

SEVENTH EDITION

MODERN  
DICTIONARY  
*of*  
ELECTRONICS

RUDOLF F. GRAF



Newnes

**MODERN  
DICTIONARY  
of  
ELECTRONICS**

**SEVENTH EDITION**

**REVISED AND UPDATED**



**Rudolf F. Graf** is an author whose name is well-known to engineers, technicians, and hobbyists around the world. He graduated as an electronics engineer from Brooklyn Polytechnic Institute and did his graduate work at New York University. Mr. Graf has been active in the electronics industry for more than fifty years in capacities ranging from design and consulting engineer, chief engineer, chief instructor at electronics and television schools, and consulting editor. He also held various sales and marketing positions. Mr. Graf is the author or co-author of more than 150 technical articles published by major magazines. He has written about 50 books on electricity and electronics, with more than 2 million copies in print, including the best-selling *Video Scrambling & Descrambling for Satellite & Cable TV, Second Edition* and the *Circuits* series of books, both published by Newnes. A number of his books have been translated into several European languages as well as Chinese, Japanese, and Russian.

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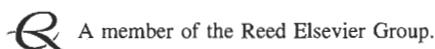
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*It gives me great pleasure to dedicate this edition to  
Allison, Sheryl, Daniel, David, Russell and Scott,  
the loveliest children this side of heaven.*



# Preface

When the first edition of this dictionary was published in 1961, today's everyday items like color TVs, VCRs, CD players, computers, FAX machines, ATMs, cordless and cell phones, pagers, tape recorders, digital watches, pocket calculators, lasers, and many others too numerous to mention, were non-existent or mere laboratory curiosities. Since then, electronics has undergone significant changes based primarily on the meteoric expansion of integrated circuits and their apparently limitless applications. Vacuum tubes were replaced by semiconductors, and numerous technologies like ferrite core or bubble memories were relegated to the electronics graveyard. No other industry has ever grown so much and matured so fast, paced by technological advances that occur at a feverish pace. The first edition of this dictionary contained about 10,000 definitions of then current terms. And now, a scant 38 years later, this seventh edition contains approximately 25,000 terms—a clear indication of the phenomenal growth of our industry.

As technologies evolve and fresh products and concepts are introduced, suitable terminology must be developed to be able to communicate. The originators of the new words give them their initial meaning, but their exact definitions change with technological advances and through actual use by others. The contents of this dictionary is thus an analysis of words and their meanings as determined by common usage, written in a modern and popular style to provide clear and concise explanations of each entry. Continual updating of a work such as this is vital, so that those involved in the world of electronics have the power to communicate with those about them and to grasp new concepts as they emerge.

All entries are allowed as much space as is necessary for complete and meaningful definitions. Terms are explained clearly and precisely without excessive technical jargon. Original entries from the previous edition have been reviewed and many were revised to keep pace with current usage. Where more than one definition exists for a term, they are arranged numerically. This method, however, does not necessarily imply a preferred order of meanings. Important words from formative technologies that are no longer in use are retained in this edition for their historical interest.

My thanks go out to Ms. Tara Troxler Thomas and to Charles Thomas whose dedication to this project and skill at the word processor made it possible to deliver the manuscript for this work to the publisher in a timely fashion.

Industry and technical sources—notably the IEEE and the ASA—generously aided in defining many terms during the preparation of earlier editions of this work.

While this volume is as up-to-date as possible at the time of writing, the field of electronics is expanding so rapidly that new terms are constantly being developed and older terms take on broader or more specialized meanings. It is the intention of the publisher to periodically issue revised editions of this dictionary; thus suggestions for new terms and definitions are always welcome.

Rudolf F. Graf  
February 1999



# A

**A**—1. Abbreviation for angstrom unit, used in expressing wavelength of light. Its length is  $10^{-8}$  centimeter. 2. Chemical symbol for argon, an inert gas used in some electron tubes. 3. Letter symbol for area of a plane surface. 4. Letter symbol for ampere.

**a**—Letter symbol for atto- ( $10^{-18}$ ).

**A0**—The Federal Communications Commission (FCC) designation for radio emission consisting solely of an unmodulated carrier.

**A1**—The FCC designation for radio emission consisting of a continuous-wave carrier keyed by telegraphy.

**A-1 or A.1**—The atomic time scale maintained by the U.S. Naval Observatory; presently it is based on weighted averages of frequencies from cesium-beam devices operated at a number of laboratories.

**A2**—The FCC designation for radio emission consisting of a tone-modulated continuous wave.

**A3**—The FCC designation for radio emission consisting of amplitude-modulated speech transmission.

**A4**—The FCC designation for radio emission consisting of amplitude-modulated facsimile signals.

**A5**—The FCC designation for radio emission consisting of amplitude-modulated television video signals.

**A—(A-minus or A-negative)**—Sometimes called F-. Negative terminal of an A battery or negative polarity of other sources of filament voltage. Denotes the terminal to which the negative side of the filament-voltage source should be connected.

**A+ (A-plus or A-positive)**—Sometimes called F+. Positive terminal of an A battery or positive polarity of other sources of filament voltage. The terminal to which the positive side of the filament voltage source should be connected.

**ab-**—The prefix attached to names of practical electric units to indicate the corresponding unit in the cgs (centimeter-gram-second) electromagnetic system, e.g., abampere, abvolt, abcoulomb.

**abac**—See alignment chart.

**abampere**—Centimeter-gram-second electromagnetic unit of current. The current that, when flowing through a wire 1 centimeter long bent into an arc with a radius of 1 centimeter, produces a magnetic field intensity of 1 oersted. One abampere is equal to 10 amperes.

**A battery**—Source of energy that heats the filaments of vacuum tubes in battery-operated equipment.

**abbreviated dialing**—1. A system using special-grade circuits that require fewer than the usual number of dial pulses to connect two or more subscribers. 2. Ability of a phone system to require only two to four digits, while the network dials the balance of the seven to fourteen digits required.

**abc**—Also ABC. See automatic bass compensation.

**abcoulomb**—Centimeter-gram-second electromagnetic unit of electrical quantity. The quantity of electricity

passing any point in an electrical circuit in 1 second when the current is 1 abampere. One abcoulomb is equal to 10 couombs.

**aberration**—1. In lenses, a defect that produces inexact focusing. Aberration may also occur in electron optical systems, causing a halo around the light spot. 2. In a cathode-ray tube, a defect in which the electron "lens" does not bring the electron beam to the same point of sharp focus at all points on the screen. 3. Failure of an optical lens to produce exact point-to-point correspondence between an object and its image. 4. Blurred focusing of light rays due to the difference in bending (refraction) imparted on different light frequencies (colors) as they pass through a lens.

**abfarad**—Centimeter-gram-second electromagnetic unit of capacitance. The capacitance of a capacitor when a charge of 1 abcoulomb produces a difference of potential of 1 abvolt between its plates. One abfarad is equal to  $10^9$  farads.

**abhenry**—Centimeter-gram-second electromagnetic unit of inductance. The inductance in a circuit in which an electromotive force of 1 abvolt is induced by a current changing at the rate of 1 abampere per second. One abhenry is equal to  $10^{-9}$  henry.

**abmho**—Centimeter-gram-second electromagnetic unit of conductance. A conductor or circuit has a conductance of 1 abmho when a difference of potential of 1 abvolt between its terminals will cause a current of 1 abampere to flow through the conductor. One abmho is equal to  $10^9$  mho. Preferred term: absiemens.

**abnormal glow**—In a glow tube, a current discharge of such magnitude that the cathode area is entirely surrounded by a glow. A further increase in current results in a rise in its density and a drop in voltage.

**abnormal propagation**—The phenomenon of unstable or changing atmospheric and/or ionospheric conditions acting on transmitted radio waves. Such waves are prevented from following their normal path through space, causing difficulties and disruptions of communications.

**abnormal reflections**—See sporadic reflections.

**abnormal termination**—The shutdown of a computer program run or other process by the detection of an error by the associated hardware, indicating that some ongoing series of actions cannot be executed correctly.

**abohm**—Centimeter-gram-second electromagnetic unit of resistance. The resistance of a conductor when, with an unvarying current of 1 abampere flowing through it, the potential difference between the ends of the conductor is 1 abvolt. One abohm is equal to  $10^{-9}$  ohm.

**abort**—1. To cut short or break off (an action, operation, or procedure) with an aircraft, guided missile, or the like, especially because of equipment failure. An abort may occur at any point from start of countdown

## AB power pack — absolute tolerance

2

or takeoff to the destination. An abort can be caused by human technical or meteorological errors, miscalculation, or malfunctions. 2. The process of halting a computer program in an orderly fashion and returning control to the operator or operating system. 3. Abnormal termination of a computer program, caused by hardware or software malfunction or operator cancellation.

**AB power pack**—Assembly in a single unit of the A and B batteries of a battery-operated circuit. Also, a unit that supplies the necessary A and B voltages from an ac source of power.

**abrasion machine**—A laboratory device for determining the abrasive resistance of wire or cable. The two standard types of machines are the squirrel cage with square steel bars and the abrasive grit types.

**abrasion resistance**—A measure of the ability of a wire or wire covering to resist damage due to mechanical causes. Usually expressed as inches of abrasive tape travel.

**abrasion soldering**—Soldering difficult metals by abrading the surface oxide film beneath a pool of molten solder.

**abrasive trimming**—Trimming a ceramic capacitor or a film resistor to its nominal value by notching the surface with a finely adjusted stream of abrasive material such as aluminum oxide.

**abscissa**—Horizontal, or  $x$ , axis on a chart or graph.

**absence-of-ground searching selector**—In dial telephone systems, an automatic switch that rotates, or rises vertically and rotates, in search of an ungrounded contact.

**absolute accuracy**—1. The tolerance of the full-scale set point referred to as the absolute voltage standard. 2. Parameter for a d/a converter. It is the overall accuracy of the converter, in which all levels are compared with an absolute standard. Absolute accuracy includes the combination of all nonlinearity and end-point errors.

**absolute address**—1. An address used to specify the location in storage of a word in a computer program, not its position in the program. 2. A binary number assigned permanently as the address of a storage location in a computer. 3. A fixed location in the memory of the CPU, as opposed to a relative address, which is specified according to its distance from another location.

**absolute altimeter**—1. Electronic instrument that furnishes altitude data with regard to the surface of the earth or any other surface immediately below the instrument, as distinguished from an aneroid altimeter, the readings of which depend on air pressure. 2. An altimeter that employs transmitted and reflected radio waves for its operation and thus does not depend on barometric pressure for its altitude indication.

**absolute code**—A code using absolute addresses and absolute operation codes; that is, a code that indicates the exact location where the reference operand is to be found or stored.

**absolute coding**—Coding written in machine language. It can be understood by the computer without processing.

**absolute delay**—The time interval between the transmission of two synchronized radio, loran, or radar signals from the same or different stations.

**absolute digital position transducer**—A digital position transducer, the output signal of which is indicative of absolute position. Also called encoder.

**absolute efficiency**—Ratio of the actual output of a transducer to that of a corresponding ideal transducer under similar conditions.

**absolute error**—1. The amounts of error expressed in the same units as the quantity containing the error.

2. Loosely, the absolute value of the error, that is, the magnitude of the error without regard to its algebraic sign.

**absolute gain of an antenna**—The gain in a given direction when the reference antenna is an isotropic antenna isolated in space.

**absolute instruction**—A computer instruction that explicitly states, and causes the execution of, a specific operation.

**absolute language**—The language in which instructions must be given to the computer. The absolute language is determined when the computer is designed. Synonyms: machine language, machine code.

**absolute loader**—Program to load a computer program at specified numerical addresses.

**absolute maximum rating**—Limiting values of operating and environmental conditions, applicable to any electron device of a specified type as defined by its published data and not to be exceeded under the worst probable conditions. Those ratings beyond which the life and reliability of a device can be expected to decline.

**absolute maximum supply voltage**—The maximum supply voltage that may be applied without the danger of causing a permanent change in the characteristics of a circuit.

**absolute minimum resistance**—The resistance between the wiper and the termination of a potentiometer, when the wiper is adjusted to minimize that resistance.

**absolute Peltier coefficient**—The product of the absolute temperature and the absolute Seebeck coefficient of a material.

**absolute power**—Power level expressed in absolute units (e.g., watts or dBm).

**absolute pressure transducer**—1. A pressure transducer that accepts two independent pressure sources simultaneously, and the output of which is proportional to the pressure difference between the sources. 2. A transducer that senses a range of pressures, which are referenced to a fixed pressure. The fixed pressure is normally total vacuum.

**absolute scale**—See Kelvin scale.

**absolute Seebeck coefficient**—The integral from absolute zero to the given temperature of the quotient of the Thomson coefficient of a material divided by its absolute temperature.

**absolute spectral response**—Output or response of a device, in terms of absolute power levels, as a function of wavelength.

**absolute system of units**—Also called coherent system of units. A system of units in which a small number of units is chosen as fundamental, e.g., units of mass, length, time, and charge. Such units are termed absolute units. All other units are derived from them by taking a definite proportional factor in each of those laws chosen as the basic laws for expressing the relationships between the physical quantities. The proportional factor is generally taken as unity.

**absolute temperature**—Temperature measured from absolute zero, a theoretical temperature level variously defined as  $-273.2^{\circ}\text{C}$ ,  $-459.7^{\circ}\text{F}$ , or  $0\text{ K}$ .

**absolute temperature scale**—Thermodynamic temperature scale, named for Lord Kelvin (1848), in which temperatures are given in kelvins (K). (In the SI system the degree sign and the word *degree* are not used for Kelvin temperatures.) The absolute zero of temperature is  $0\text{ K}$ ,  $-273.2^{\circ}\text{C}$ , or  $-459.7^{\circ}\text{F}$ . The kelvin is the same size as the Celsius degree.

**absolute tolerance**—Also called accuracy. The maximum deviation from the nominal resistance (or capacitance) value, usually given as a percentage of the nominal value.

**absolute units**—A system of units based on physical principles, in which a small number of units are chosen as fundamental and all other units are derived from them; e.g., abohm, abcoulomb, abhenry, etc.

**absolute value**—The numerical value of a number or symbol without reference to its algebraic sign. Thus, 3 is the absolute value of  $|3|$  or  $|-3|$ . An absolute value is signified by placing vertical lines around the number or symbol.

**absolute value device**—A computing element that produces an output equal to the magnitude of the input signal, but always of one polarity.

**absolute zero**—Lowest possible point on the scale of absolute temperature; the point at which all molecular activity ceases. Absolute zero is variously defined as  $-273.2^{\circ}\text{C}$ ,  $-459.7^{\circ}\text{F}$ , or 0 K.

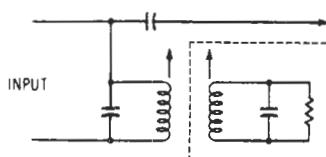
**absorbed wave**—A radio wave that becomes lost in the ionosphere due to molecular agitation and the accompanying energy loss it undergoes there. Absorption is most pronounced at low frequencies.

**absorber**—1. In a nuclear reactor, a substance that absorbs neutrons without reproducing them. Such a substance may be useful in control of a reactor or, if unavoidably present, may impair the neutron economy. 2. Any material or device that absorbs and dissipates radiated energy. 3. In microwave terminology, a material or device that takes up and dissipates radiated energy. It may be used for shielding, to prevent reflection, or to transmit one or more radiation components selectively.

**absorption**—1. Dissipation of the energy of a radio or sound wave into other forms as a result of its interaction with matter. 2. The process by which the number of particles or photons entering a body of matter is reduced by interaction of the particle or radiation with matter. Similarly, the reduction of the energy of a particle while traversing a body of matter. This term is sometimes erroneously used for capture. 3. Penetration of a substance into the body of another. 4. Conversion of radiant energy into other forms by passage through, or reflection from, matter. 5. The adhesion of a fluid in extremely thin layers to the surfaces of a solid. 6. Reduction in strength of an electromagnetic wave propagating through a medium, determined by dielectric properties of the material.

**absorption attenuation**—Loss in an optical fiber due primarily to impurities, including metals, such as cobalt, chromium, and iron, as well as OH ions.

**absorption circuit**—A tuned circuit that dissipates energy taken from another circuit or from a signal source. This effect is especially evident in a resonant circuit such as a wavemeter or wave trap.



*Absorption circuit.*

**absorption coefficient**—1. Measure of sound-absorbing characteristics of a unit area of a given material compared with the sound-absorbing characteristics of an open space (total absorption) having the same area. 2. Ratio of loss of intensity caused by absorption to the total original intensity of radiation.

**absorption current**—The current flowing into a capacitor following its initial charge, due to a gradual

penetration of the electric stress into the dielectric. Also, the current that flows out of a capacitor following its initial discharge.

**absorption dynamometer**—An instrument for measuring power, in which the energy of a revolving wheel or shaft is absorbed by the friction of a brake.

**absorption fading**—A slow type of fading, primarily caused by variations in the absorption rate along the radio path.

**absorption frequency meter**—See absorption wavemeter.

**absorption loss**—1. That part of transmission loss due to dissipation or conversion of electrical energy into other forms (e.g., heat), either within the medium or attendant upon a reflection. 2. The loss of optical flux or energy caused by impurities in the transmission medium as well as intrinsic material absorption. Expressed in decibels per kilometer.

**absorption marker**—1. A sharp dip on a frequency-response curve due to the absorption of energy by a circuit sharply tuned to the frequency at which the dip occurs. 2. A small pip or blank introduced on an oscilloscope trace to indicate a frequency point. It is so called because it is produced by a frequency-calibrated tuned trap similar to an absorption wavemeter.

**absorption modulation**—Also called loss modulation. A system for amplitude-modulating the output of a radio transmitter by means of a variable-impedance device (such as a microphone semiconductor or vacuum-tube circuit) inserted into or coupled to the output circuit.

**absorption trap**—A parallel-tuned circuit coupled either magnetically or capacitively to absorb and attenuate interfering signals.

**absorption wavemeter**—Also called absorption frequency meter. An instrument for measuring frequency. Its operation depends on the use of a tuned electrical circuit or cavity loosely coupled inductively to the source. Maximum energy will be absorbed at the resonant frequency, as indicated by a meter or other device. Frequency can then be determined by reference to a calibrated dial or chart.

**absorptivity**—A measure of the portion of incident radiation or sound energy absorbed by a material.

**abstraction**—A simplified description or specification of a system that emphasizes some of the system's details or properties while suppressing others. A high level of abstraction or a highly abstract machine is one in which very few machine details are apparent to a programmer, who sees only a broad set of machine concepts. Abstract machines are created by surrounding a primitive machine with layers of operating systems. To converse with higher levels of abstract machines, the user needs higher levels of languages.

**A/B switch**—A switch that selects one of two inputs (A or B) for routing to a common output while providing adequate isolating between the two signals.

**A-B test**—1. Direct comparison of two sounds by playing first one and then the other. May be done with two tape recorders playing identical tapes (or the same tape), two speakers playing alternately from the same tape recorder, or two amplifiers playing alternately through one speaker, etc. 2. An audio comparison test for evaluating the relative performance of two or more components or systems by quickly changing from one to the other. The left- and right-hand channels or the record and replay sound signals are often designated A and B. A and B test facilities are installed at most high-fidelity dealers.

**abvolt**—Centimeter-gram-second electromagnetic unit of potential difference. The potential difference between two points when 1 erg of work is required to

transfer 1 abcoulomb of positive electricity from a lower to a higher potential. An abvolt is equal to  $10^{-8}$  volt.

**ac**—Abbreviation for alternating current.

**ac bias**—The alternating current, usually of a frequency several times higher than the highest signal frequency, that is fed to a record head in addition to the signal current. The ac bias serves to linearize the recording process.

**accelerated aging**—A test in which certain parameters, such as voltage and temperature, are increased above normal operating values to obtain observable deterioration in a relatively short period. The plotted results give expected service life under normal conditions. Also called accelerated life test.

**accelerated graphics port**—Abbreviated AGP. A slot inside PCs for high speed video to be used instead of the standard slot type, called PCI.

**accelerated life test**—Test conditions used to bring about, in a short time, the deteriorating effect obtained under normal service conditions.

**accelerated service test**—A service or bench test in which some service condition, such as speed, temperature, or continuity of operation, is exaggerated to obtain a result in a shorter time than that which elapses in normal service.

**accelerating conductor or relay**—A conductor or relay that causes the operation of a succeeding device to begin in the starting sequence after the proper conditions have been established.

**accelerating electrode**—An electrode in a cathode-ray or other electronic tube to which a positive potential is applied to increase the velocity of electrons or ions toward the anode. A klystron tube does not have an anode but does have accelerating electrodes.

**accelerating time**—The time required for a motor to reach full speed from a standstill (zero speed) position.

**accelerating voltage**—A high positive voltage applied to the accelerating electrode of a cathode-ray tube to increase the velocity of electrons in the beam.

**acceleration**—1. The rate of change in velocity. Often expressed as a multiple of the acceleration of gravity ( $g = 32.2 \text{ ft/s}^2$ ). 2. The rate of change in velocity of a stepping motor measured in rad/s; it is the result of rotor torque divided by rotor and load inertia. 3. A vector quantity that specifies rate of change of velocity.

**acceleration at stall**—The value of servomotor angular acceleration calculated from the stall torque of the motor and the moment of inertia of the rotor. Also called torque-to-inertia ratio.

**acceleration time**—In a computer, the elapsed time between the interpretation of instructions to read or write on tape and the possibility of information transfer from the tape to the internal storage, or vice versa.

**acceleration torque**—Numerical difference between motor torque produced and load torque demanded at any given speed during the acceleration period. It is this net torque that is available to change the speed of the driven load.

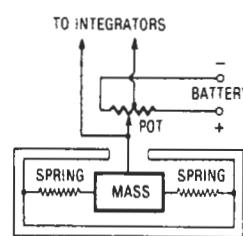
**acceleration voltage**—Potential between a cathode and anode or other accelerating element in a vacuum tube. Its value determines the average velocity of the electrons.

**accelerator**—A device for imparting a very high velocity to charged particles such as electrons or protons. Fast-moving particles of this type are used in research or in studying the structure of the atom itself. 2. A circuit that speeds up a computer or monitor. Typically a circuit card with an extra processing chip and/or additional RAM.

**accelerator board**—An adapter with a microprocessor that makes a computer run faster.

**accelerator dynamic test**—A test performed on an accelerometer by means of which information is gathered pertaining to the overall behavior frequency response and/or natural frequency of the device.

**accelerometer**—1. An instrument or device, often mounted in an aircraft, guided missile, or the like, used to sense accelerative forces and convert them into corresponding electrical quantities, usually for measuring, indicating, or recording purposes. It does not measure velocity or distance, only changes in velocity. 2. A transducer that measures acceleration and/or gravitational forces capable of imparting acceleration. 3. A sensor whose electrical output is proportional to acceleration.



Accelerometer.

**accentuation**—Also called preemphasis. The emphasizing of any certain band of frequencies, to the exclusion of all others, in an amplifier or electronic device. Applied particularly to the higher audio frequencies in frequency-modulated (FM) transmitters.

**accentuator**—1. Network or circuit used for preemphasis, that is, an increase in amplitude of a given band of usually audible frequencies. 2. A circuit or device, such as a filter, tone control, or equalizer, used to emphasize a band of frequencies, usually in the audio-frequency spectrum.

**acceptable-environmental-range test**—A test to determine the range of environmental conditions for which an apparatus maintains at least the minimum required reliability.

**acceptable quality level**—Abbreviated AQL. The maximum percentage of defective components considered to be acceptable as an average for a process or the lowest quality a supplier is permitted to present continually for acceptance. *Also see AQL.*

**acceptance angle**—1. The solid angle within which all incident light rays will enter the core of an optical fiber. Expressed in degrees. 2. In fiber optics, a measure of the maximum angle within which light may be coupled from a source or emitter. It is measured relative to the fiber's axis. 3. The critical angle, measured from the core centerline, above which light will not enter an optical fiber. It is equal to the half-angle of the acceptance cone. 4. The maximum angle within which light will be accepted by an element, such as a detector.

**acceptance cone**—1. A parameter that defines acceptable light-launching angles. Only light launched at angles within this cone will be waveguided (fiber optics). 2. A cone with an included angle twice that of the acceptance angle.

**acceptance pattern**—In fiber optics, a curve of total transmitted power plotted against the launch angle.

**acceptance sampling plan**—A plan for the inspection of samples as a basis for acceptance or rejection of a lot.

**acceptor**—Also called acceptor impurity. An impurity lacking sufficient valence electrons to complete the

bonding arrangement in the crystal structure. When added to a semiconductor crystal, it accepts an electron from a neighboring atom and thus creates a hole in the lattice structure of the crystal, making a p-type semiconductor. 2. An impurity from column III of the periodic table, which adds a mobile hole to silicon, thereby making it more p-type and accepting of electrons. Boron is the primary acceptor used to dope silicon (compare with *donor*).

**acceptor circuit**—1. A circuit that offers minimum opposition to a given signal. 2. A circuit tuned to respond to a single frequency.

**acceptor impurity**—See acceptor.

**acceptor-type semiconductor**—A p-type semiconductor.

**access**—1. To gain access to a computer's memory location in which binary information is already stored or can be stored. 2. To open up a set of connections to allow reading from or writing into this location.

**access arm**—In a computer storage unit, a mechanical device that positions the reading and writing mechanism.

**access code**—1. The preliminary digit or digits that a telephone user must dial to be connected to a particular outgoing trunk group. 2. A group of characters or numbers that identifies a user to a computer or any other secure system. 3. One or more numbers and/or symbols that are keyed into the repeater with a telephone tone pad to activate a repeater function, such as an autopatch.

**access control**—1. The control of pedestrian and vehicular traffic through entrances and exits of a protected area or premises. 2. The process of limiting access to resources of a system to only authorized users, programs, processes, or other systems.

**access grant**—Multiprocessor system response that satisfies a previous service request.

**access hole**—A hole drilled through successive layers of a multilayer board to gain access to a land or pad location on one of the inside layers.

**access method**—1. A data-management technique available for use in transferring data between the main storage and an input/output device. 2. A software component of a computer operating system that controls the flow of data between application programs and either local or remote peripheral devices.

**access mode**—1. A technique used in COBOL to obtain a specific logic record from, or to place it into, a file assigned to a mass storage device. 2. The operation of an alarm system such that no alarm signal is given when the protected area is entered; however, a signal may be given if the sensor, annunciator, or control unit is tampered with or opened.

**accessory card**—An additional circuit card that can be mounted inside a personal computer and connected to the system bus.

**access protocol**—A defined set of procedures that function as an interface between a computer user and a network, enabling the user to employ the services of that network.

**access provider**—Telecommunications company that links businesses and individuals to the Internet using modem devices, high-speed ISDN lines, or dedicated links.

**access time**—Also called waiting time. 1. The time interval (called read time) between the instant of calling for data from a storage device and the instant of completion of delivery. 2. In a memory system, the time delay, at specified thresholds, from the presentation of an enable or address input pulse until the arrival of the memory data output. 3. The time required for a computer to move data between its memory section and its

CPU. 4. A time interval that is characteristic of a storage device. Essentially, it is a measure of the time required to communicate with that device, or, more specifically, it is the time between the application of a specified input pulse (assuming that other necessary inputs are also present) and the availability of valid data signals at an output. The access time can be defined only with reference to an output signal. 5. The time required by a computer to begin delivering information after the memory or storage has been interrogated. 6. The time it takes a computer to retrieve a piece of information. With hard disks or compact discs, maximum access time is measured as the time it takes to move from one end of the disk to the other, find a piece of information, and transfer that information to RAM.

**accidental jamming**—Jamming caused by transmission from friendly equipment.

**ac circuit breaker**—A device that is used to close and interrupt an ac power circuit under normal conditions or to interrupt this circuit under faulty or emergency conditions.

**accompanying audio (sound) channel**—Also known as co-channel sound frequency. The rf carrier frequency that supplies the sound to accompany a television picture.

**ac component**—In a complex wave (i.e., one containing both ac and dc), the alternating, fluctuating, or pulsating member of the combination.

**accordion**—A type of contact used in some printed-circuit connectors. The contact spring is given a z shape to permit high deflection without excessive stress.

**ac-coupled flip-flop**—A flip-flop that changes state when triggered by the rise or fall of a clock pulse. There is a maximum allowable rise or fall time for proper triggering.

**ac coupling**—Coupling of one circuit to another circuit through a capacitor or other device that passes the varying portion but not the static (dc) characteristics of an electrical signal.

**accumulation key**—In a calculator, it automatically accumulates products and totals of successive calculations.

**accumulator**—1. In an electronic computer, a device which stores a number and which, on receipt of another number, adds the two and stores the sum. An accumulator may have properties such as shifting, sensing signals, clearing, complementing, etc. 2. A chemical cell able to store electrical energy (British). Also called secondary cell. 3. The "scratch pad" section of the computer, in which arithmetic operations are carried out. 4. A register and related circuitry that hold an operand for arithmetic and logic operations. 5. A register or latch internal to the MPU where data is stored temporarily before being sent to another location internal or external to the MPU chip.

**accuracy**—1. The maximum error in the measurement of a physical quantity in terms of the output of an instrument when referred to the individual instrument calibration. Usually given as a percentage of full scale. 2. The quality of freedom from mistake or error in an electronic computer, that is, of conformity to truth or to a rule. 3. The closeness with which a measured quantity approaches the true value of that quantity. (See true value.) 4. The degree to which a measured or calculated value conforms to the accepted standard or rule. 5. The measure of a meter's ability to indicate a value corresponding to the absolute value of electrical energy applied. Accuracy is expressed as a percentage of the meter's rated full-scale value. To be meaningful, accuracy specifications must always consider the effects of time, temperature, and humidity. 6. Confidence in the correlation between measurements in one location and another,

or between a measurement and a recognized standard. 7. The correctness or certainty of position when the rotor of a stepping motor comes to rest. It is usually expressed as a percentage of the step angle, but can also be specified in degrees or minutes of arc. In steppers, the error is not cumulative, but occurs only at the completion of the last step. 8. The degree of freedom from error, that is, the degree of conformity to some standard. Accuracy is contrasted with *precision*. For example, four-place numbers are less precise than six-place numbers; however, a properly computed four-place number might be more accurate than an improperly computed six-place number. 9. As applied to an adc, the term describes the difference between the actual input voltage and the full-scale weighted equivalent of the binary code.

**accuracy rating of an instrument** — The limit, usually expressed as a percentage of full-scale value, not exceeded by errors when the instrument is used under reference conditions.

**ACD** — Abbreviation for automatic call distributor. A switching system that automatically distributes incoming calls to a centralized group of receivers in the sequence in which the calls are received. It holds calls until a receiver is available.

**ac/dc** — Electronic equipment capable of operation from either an ac or dc primary power source. Abbreviation for alternating current/direct current.

**ac/dc receiver** — A radio receiver designed to operate directly from either an ac or a dc source.

**ac/dc ringing** — A method of telephone ringing in which alternating current is used to operate a ringing device, and direct current is used to aid the action of a relay that stops the ringing when the called party answers.

**ac directional overcurrent relay** — A device that functions on a desired value of ac overcurrent flowing in a predetermined direction.

**ac dump** — The intentional, accidental, or conditional removal of all alternating-current power from a system or component. An ac dump usually results in the removal of all power, since direct current is usually supplied through a rectifier or converter.

**ac erasing head** — In magnetic recording, a device using alternating current to produce the magnetic field necessary for removal of previously recorded information.

**acetate** — A basic chemical compound in the mixture used to coat recording discs.

**acetate base** — The transparent plastic film that forms the tough backing for acetate magnetic recording tape.

**acetate disc** — A mechanical recording disc, either solid or laminated, made mostly from cellulose nitrate lacquer plus a lubricant.

**acetate tape** — A sound-recording tape with a smooth, transparent acetate backing. One side is coated with an oxide capable of being magnetized.

**ac generator** — 1. A rotating electrical machine that converts mechanical power into alternating current. Also known as an alternator. 2. A device, usually an oscillator, designed for the purpose of producing alternating current.

**A channel** — One of two stereo channels, usually the left.

**achieved reliability** — Reliability determined on the basis of actual performance of nominally identical items under equivalent environmental conditions. Also called operational reliability.

**achromatic** — 1. In color television, a term meaning a shade of gray from black to white, or the absence of color (without color). 2. Black-and-white television, as distinguished from color television. 3. Literally, color free. In an optical system, the term is used when chromatic aberration is corrected for at least two wavelengths. A

color that is defined as being achromatic is often referred to as gray. 4. Having no color; being a neutral such as black, white, or gray.

**achromatic lens** — A lens that has been corrected for chromatic aberration. Such a lens is capable of bringing all colors of light rays to approximately the same point of focus by combining a concave lens of flint glass with a convex lens of crown glass. A lens that transmits light without separating it into its constituent colors.

**achromatic locus** — Also called achromatic region. On a chromaticity diagram, an area that contains all points representing acceptable reference white standards.

**achromatic region** — See achromatic locus.

**acicular** — Needle-shaped; descriptive of the shape of the magnetizable particles composing the coating of a recording tape. Modern tapes are premagnetized during the coating process to line the "needles" up with the direction of the tape, thus providing maximum sensitivity from the oxide.

**acid** — A chemical compound that dissociates and forms hydrogen ions when in aqueous solution.

**acid depolarizer** — An acid, such as nitric acid, sometimes introduced into a primary cell to prevent polarization.

**acid fluxes** — Fluxes consisting of inorganic acids and salts, which are used when a surface to be soldered is below the ideal for rapid wetting. Also called corrosive fluxes.

**acknowledge** — A control signal used to complete a handshaking sequence in telecommunications. The acknowledge signal indicates that the information has been accepted by the receiving computer.

**ac line** — A power line delivering alternating current only.

**ac line filter** — A filter designed to dissipate or bypass to ground any extraneous signals or electrical noise on an ac power line, while causing virtually no reduction of the power-line voltage or power. Used to keep unwanted signals and noise out of sensitive equipment.

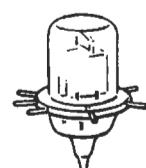
**acclinic line** — Also called isoclinic line. On a magnetic map, an imaginary line that connects points of equal magnetic inclination or dip.

**ac magnetic biasing** — In magnetic recording, the method used to remove random noise and/or previously recorded material from the wire or tape. This is done by introducing an alternating magnetic field at a substantially higher frequency than the highest frequency to be recorded.

**ac noise** — Noise that displays a rate of change that is fast relative to the response capability of the device.

**ac noise immunity** — A measure of a logic circuit's ability to maintain the prescribed logic state in the presence of such noise. It is defined in terms of the amplitude and pulse width of an input noise signal to which the element will not respond.

**acorn tube** — A button- or acorn-shaped vacuum tube with no base, designed for UHF applications. Electrodes are brought out through the glass envelope on the side, top, and bottom.



Acorn tube.

**acoustic**—Also acoustical. Pertaining to sound or the science of sound.

**acoustic absorption loss**—The energy lost by conversion into heat or other forms when sound passes through or is reflected by a medium.

**acoustic absorptivity**—The ratio of sound energy absorbed by a surface to the sound energy arriving at the surface. Equal to 1 minus the reflectivity of the surface.

**acoustical**—*See* acoustic.

**acoustical attenuation constant**—The real part of the acoustical propagation constant. The commonly used unit is the neper per section or per unit distance.

**acoustical coupler**—A device for connecting a telephone handset to a computer input port.

**acoustical-electrical transducer**—A device designed to transform sound energy into electrical energy and vice versa.

**acoustical material**—Any material considered in terms of its acoustical properties; especially, a material designed to absorb sound.

**acoustical mode**—A mode of crystal-lattice vibration that does not produce an oscillating dipole.

**acoustical ohm**—A measure of acoustic resistance, reactance, or impedance. One acoustical ohm is equal to a volume velocity of 1 cubic centimeter per second when produced by a sound pressure of 1 microbar.

**acoustical phase constant**—The imaginary part of the acoustical propagation constant. The commonly used unit is the radian per section or per unit distance.

**acoustical reflectivity**—*See* sound-reflection coefficient.

**acoustical transmittivity**—*See* sound-transmission coefficient.

**acoustic burglar alarm**—Also called acoustic intrusion detector. A burglar alarm that is responsive to sounds produced by an intruder. Concealed microphones connected to an audio amplifier trip an alarm when sounds within a predetermined range of frequencies exceed a predetermined normal level.

**acoustic capacitance**—In a sound medium, a measure of volume displacement per dyne per square centimeter. The unit is centimeter to the fifth power per dyne.

**acoustic clarifier**—A system of cones loosely attached to the baffle of a speaker and designed to vibrate and absorb energy during sudden loud sounds, thereby suppressing them.

**acoustic compliance**—1. The measure of volume displacement of a sound medium when subjected to sound waves. 2. That type of acoustic reactance which corresponds to capacitive reactance in an electrical circuit.

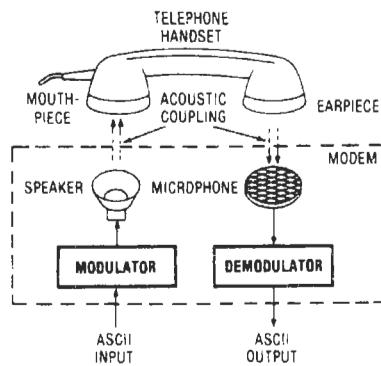
**acoustic coupler**—1. A device that converts digital signals into audio signals, enabling data to be transmitted over the telephone lines via a conventional telephone. 2. A modem device that connects a terminal or computer to the handset of a telephone.

**acoustic coupling**—Coupling resonator elements by mechanical means through the use of wires, rods, or nonelectroded sections of quartz or ceramic. The terms *acoustic* and *mechanical* can be used interchangeably.

**acoustic delay line**—A device that retards one or more signal vibrations by causing them to pass through a solid or liquid.

**acoustic dispersion**—The change of the speed of sound with frequency.

**acoustic elasticity**—1. The compressibility of the air in a speaker enclosure as the cone moves backward. 2. The compressibility of any material through which sound is passed.



*Acoustic coupler.*

**acoustic feedback**—1. Also called acoustic regeneration. The mechanical coupling of a portion of the sound waves from the output of an audio-amplifying system to a preceding part or input circuit (such as the microphone) of the system. When excessive, acoustic feedback will produce a howling sound in the speaker. 2. The pickup, by a turntable, of vibrations from the speaker. If these vibrations reach the cartridge, they will be reamplified, causing noise (usually a rumble, but in extreme cases a howl) and/or distortion. Also, feedback resulting from such sound waves setting some part of an amplifier circuit into vibration and thus modulating the currents in the circuit. Acoustic feedback usually causes howling or whistling.

**acoustic filter**—1. A sound-absorbing device that selectively suppresses certain audio frequencies while allowing others to pass. 2. Any sound-absorbing or sound-transmitting arrangement, or combination of the two, that passes sound waves of desired frequency while attenuating or eliminating others.

**acoustic frequency response**—The voltage-attenuation frequency measured into a resistive load, producing a bandwidth approaching sufficiently close to the maximum.

**acoustic generator**—A transducer, such as a speaker, headphones, or a bell, that converts electrical, mechanical, or other forms of energy into sound.

**acoustic homing system**—1. A system that uses a sound signal for guidance purposes. 2. A guidance method in which a missile homes in on noise generated by a target.

**acoustic horn**—Also called horn. 1. A tube of varying cross section having different terminal areas that change the acoustic impedance to control the directivity of the sound pattern. 2. A tapered tube (round or rectangular, but generally funnel shaped) that directs sound and, to some extent, amplifies it.

**acoustic impedance**—1. Total opposition of a medium to sound waves. Equal to the force per unit area on the surface of the medium divided by the flux (volume velocity or linear velocity multiplied by area) through that surface. Expressed in ohms and equal to the mechanical impedance divided by the square of the surface area. One unit of acoustic impedance is equal to a volume velocity of 1 cubic centimeter per second produced by a pressure of 1 microbar. Acoustic impedance contains both acoustic resistance and acoustic reactance. 2. The degree of resistance to transmitting sound imparted by the characteristic elasticity of a given substance.

**acoustic inertance**—A type of acoustic reactance that corresponds to inductive reactance in an electrical circuit. (The resistance to movement or reactance offered by

the sound medium because of the inertia of the effective mass of the medium.) Measured in acoustic ohms.

**acoustic intensity**—The limit approached by the quotient of acoustical power being transmitted at a given time through a given area divided by the area as the area approaches zero.

**acoustic interferometer**—An instrument for measuring the velocity or frequency of sound waves in a liquid or gas. This is done by observing the variations of sound pressure in a standing wave, established in the medium between a sound source and a reflector, as the reflector is moved or the frequency is varied.

**acoustic intrusion detector**—See acoustic burglar alarm.

**acoustic labyrinth**—A loudspeaker enclosure in which the rear of the loudspeaker is coupled to a tube which, at the resonant frequency of the loudspeaker, is one quarter of a wavelength long. The tube, folded upon itself in order to save space, gives the appearance of a labyrinth.

**acoustic lens**—1. An array of obstacles that refract sound waves in the same way that an optical lens refracts light waves. The dimensions of these obstacles are small compared with the wavelengths of the sounds being focused. 2. A device that produces convergence or divergence of moving sound waves. When used with a loudspeaker, the acoustic lens widens the beam of the higher-frequency sound waves.

**acoustic line**—Mechanical equivalent of an electrical transmission line. Baffles, labyrinths, or resonators are placed at the rear of a speaker to help reproduce the very low audio frequencies.

**acoustic memory**—A computer memory using an acoustic delay line. The line employs a train of pulses in a medium such as mercury or quartz.

**acoustic mine**—Also called sonic mine. An underwater mine that is detonated by sound waves, such as those from a ship's propeller or engines.

**acoustic mirage**—The distortion of a sound wave-front by a large temperature gradient in air or water. This creates the illusion of two sound sources.

**acoustic ohm**—The unit of acoustic resistance, reactance, or impedance. One acoustic ohm is present when a sound pressure of 1 dyne per square centimeter produces a volume velocity of 1 cubic centimeter per second.

**acoustic phase constant**—The imaginary part of the acoustic propagation constant. The commonly used unit is the radian per section or per unit distance.

**acoustic phonograph**—A mechanical record player (now obsolete) in which the needle sets a thin diaphragm into vibration. The diaphragm in turn causes the air in a horn to vibrate, thus reproducing the recorded sound.

**acoustic pickup**—1. In nonelectrical phonographs, the method of reproducing the material on a record by linking the needle directly to a flexible diaphragm. 2. In an acoustic phonograph, a pickup consisting of a needle, needle holder, and vibrating diaphragm.

**acoustic radiator**—In an electroacoustic transducer, the part that initiates the radiation of sound vibration. A speaker cone or headphone diaphragm is an example.

**acoustic radiometer**—An instrument for measuring sound intensity by determining the unidirectional steady-state pressure caused by the reflection or absorption of a sound wave at a boundary.

**acoustic reactance**—That part of acoustic impedance due to the effective mass of the medium, that is, to the inertia and elasticity of the medium through which

the sound travels. The imaginary component of acoustic impedance; expressed in acoustic ohms.

**acoustic reflectivity**—The ratio of the rate of flow of sound energy reflected from the surface on the side of incidence to the incident rate of flow.

**acoustic refraction**—A bending of sound waves when passing obliquely from one medium to another in which the velocity of sound is different.

**acoustic regeneration**—See acoustic feedback.

**acoustic resistance**—That component of acoustic impedance responsible for the dissipation of energy due to friction between molecules of the air or other medium through which sound travels. Measured in acoustic ohms and analogous to electrical resistance.

**acoustic resonance**—An increase in sound intensity as reflected waves and direct waves that are in phase combine. May also be due to the natural vibration of air columns or solid bodies at a particular sound frequency.

**acoustic resonator**—An enclosure that intensifies those audio frequencies at which the enclosed air is set into natural vibration.

**acoustics**—1. Science of production, transmission, reception, and effects of sound. 2. In a room or other location, those characteristics that control reflections of sound waves and thus the sound reception in it.

**acoustic scattering**—The irregular reflection, refraction, or diffraction of a sound wave in many directions.

**acoustic shock**—Physical pain, dizziness, and sometimes nausea brought on by hearing a loud, sudden sound. (The threshold of pain is about 120 dBm.)

**acoustic surface-wave component**—A passive electroacoustic device that has metallized interdigital transducer elements deposited on the surface of a piezoelectric substrate. The device allows acoustic energy to be generated, manipulated, and detected on the substrate surface. Most of the acoustic energy is confined to a region within one wavelength of the surface of the substrate. When the metallization is subjected to an alternating voltage, a strain develops between the interdigital fingers and also at the frequency of excitation. This alternating strain on the crystal surface launches a Rayleigh surface-wave front that travels in both directions and that originates from the center of the transducer. The wave exists as an electroacoustic vibration.

**acoustic suspension**—1. A loudspeaker system in which the moving cone is held by an overcompliant suspension, the stiffness required for proper operation being supplied by air that is trapped behind the cone in a sealed enclosure. While relatively inefficient, such a system permits good bass reproduction in a unit of moderate size. 2. A speaker enclosure design in which the speaker cone is suspended in an airtight box. This enables the acoustic pressure of the air enclosed therein to provide the principal restoring force for the diaphragm of the speaker. It needs somewhat more power from the amplifier than a free speaker but has better low-frequency performance.

**acoustic system**—Arrangement of components in devices designed to reproduce audio frequencies in a specified manner.

**acoustic telemetry**—The utilization of sound energy for the transmission of information. It differs from other telemetry methods in that information derived from the received signal is encoded by the transmitting source.

**acoustic transformer**—A device that transmits power along a glass or ceramic rod and isolates the power supply from the signal input.

**acoustic transmission**—Direct transmission of sound energy without the intermediary of electric currents.

**acoustic transmission system**—An assembly of elements adapted for the transmission of sound.

**acoustic treatment**—Use of certain sound-absorbing materials to control the amount of reverberation in a room, hall, or other enclosure; that is, to make the room less live.

**acoustic wave**—A traveling vibration by which sound energy is transmitted in air, water, or the earth. The characteristics of these waves may be described in terms of change of pressure, particle displacement, or density.

**acoustic wave filter**—A device designed to separate sound waves of different frequencies. (Through electroacoustic transducers, such a filter may be associated with electric circuits.)

**acoustoelectric effect**—Generation of an electric current in a crystal by a traveling longitudinal sound wave.

**acousto-optic Bragg cell**—A modulation device that impresses analog information on light beams. This transducer is composed of two sets of interleaved electrodes of alternating polarities deposited on an optical waveguide. An electrical signal applied to each pair of adjacent electrodes buckles the film between them. This distortion changes the refractive index of the waveguide and creates physical waves in the film, commonly called surface waves. These waves are generated at a rate equal to that of the applied electrical signal.

**acousto-optics**—The study of the interactions between sound waves and light in a solid medium. Sound waves can be made to modulate, deflect, and focus light waves—an important characteristic in laser and holographic applications.

**ac plate resistance**—Also called dynamic plate resistance. Internal resistance of a vacuum tube to the flow of alternating current. Expressed in ohms, the ratio of a small change in plate voltage to the resultant change in plate current, other voltages being held constant.

**ac power supply**—A power supply that provides one or more ac output voltages, e.g., ac generator, dynamotor, inverter, or transformer.

**acquisition**—1. The process of pointing an antenna or telescope so that it is properly oriented to allow gathering of tracking or telemetry data from a satellite or space probe. 2. In radar, the process between the initial location of a target and the final alignment of the tracking equipment on the target. 3. The gathering of data from transducers or a computer.

**acquisition and tracking radar**—A radar set that locks onto a strong signal and tracks the object emitting or reflecting the signal. May be airborne or on the ground. Tracking radars use a dish-type antenna reflector to produce a searchlight-type beam.

**acquisition radar**—A radar set that detects an approaching target and feeds approximate position data to a fire-control or missile-guidance radar, which then takes over the function of tracking the target.

**acquisition range**—Also called capture range. The range of input frequency about  $f_0$  under which a phase-locked loop, which is initially unlocked, will become locked. This range is narrower than the normal tracking range and is a function of the loop-filter characteristics and the input amplitude.

**acquisition time**—1. Time delay between request for data conversion and the holding of the analog value by a sample-and-hold amplifier. 2. In a sample-and-hold circuit, how long it takes after the sample command is given for the hold capacitor to be charged to a full-scale voltage change and to remain within a specified error band around its final value. 3. The time it takes for the output of a sample-and-hold circuit to change from its previous value to a new value when the circuit is switched from the hold mode to the sample mode. It includes the slew

## acoustic transmission system — activation

time and settling time to within a certain error band of the final value and is usually specified for a full-scale change.

**ac receiver**—A radio receiver designed to operate from an ac source only.

**ac reclosing relay**—A device that controls the automatic reclosing and locking out of an ac circuit interrupter.

**ac relay**—A relay designed to operate from an alternating-current source.

**ac resistance**—Total resistance of a device in an ac circuit. See also high-frequency resistance.

**acronym**—A word formed from the first letter or letters of the words describing some item, e.g., FORTRAN from formula translation.

**across-the-line starting**—Connection of a motor directly to the supply line for starting. Also called full-voltage starting.

**ac signaling**—Using ac signals or tones to transmit data and/or control signals.

**ACTCRBS**—Abbreviation for air traffic control radar beacon system. A control system in use worldwide. Air separation information exchanged between plane and air traffic controller must be sent by radio.

**ac time overcurrent relay**—A device that has either a definite or an inverse time characteristic and functions when the current in an ac circuit exceeds a predetermined value.

**actinic**—In radiation, the property of producing a chemical change, such as the photographic action of light.

**actinium**—A radioactive element discovered in pitch-blende by the French chemist Debierne in 1889. Its atomic number is 89, its atomic weight 227, and its symbol Ac.

**actinodielectric**—A photoconductive dielectric.

**actinoelectric**—Exhibiting a temporary rise in electrical conductivity during exposure to light.

**actinoelectric effect**—1. The property of some special materials whereby when an electric current is impressed on them, their resistance changes with light. 2. The property of certain materials (such as selenium, cadmium sulfide, germanium, and silicon) that causes them to change their electrical resistance or generate a voltage on exposure to light.

**actinoelectricity**—Electricity produced by the action of radiant energy on crystals.

**actinometer**—An instrument that measures the intensity of radiation by determining the amount of fluorescence produced by that radiation.

**action area**—In the rectifying junction of a metallic rectifier, that portion which carries the forward current.

**action current**—A brief and very small electric current that flows in a nerve during a nervous impulse.

**action potential**—1. The instantaneous value of the voltage between excited and resting portions of an excitable living structure. 2. The voltage variations in a nerve or muscle cell when it is excited or fired by an appropriate stimulus. After a short time, the cell recovers its normal resting potential, typically about 80 millivolts. The interior of the cell is negative relative to the outside.

**activate**—To start an operation, usually by application of an appropriate enabling signal.

**activating**—1. Chemically treating a basic metal to remove oxides and other passive films to make it more receptive to electroplating. 2. A treatment that renders nonconductive material receptive to electroless deposition. (Nonpreferred synonyms: seeding, catalyzing, and sensitizing.)

**activation**—1. Making a substance artificially radioactive by placing it in an accelerator such as a cyclotron or by bombarding it with neutrons. 2. To treat the cathode or target of an electron tube in order to create or increase its

emission. 3. The process of adding electrolytes to a cell to make it ready for operation. 4. Causing the acceleration of a chemical reaction.

**activation time**—In a cell or battery, the time interval from the moment activation is initiated to the moment the desired operating voltage is obtained.

**activator**—An additive that improves the action of an accelerator.

**active**—1. Controlling power from a separate supply. 2. Requiring a power supply separate from the controls. 3. Containing, or connected to and using, a source of energy.

**active area**—The portion of the rectifying junction of a metallic rectifier that carries forward current.

**active balance**—In operation of a telephone repeater, the summation of all return currents at a terminal network balanced against the local circuit or drop impedance.

**active circuit**—A circuit that contains active elements such as transistors, diodes, or integrated circuits.

**active communications satellite**—A communications satellite in which on-board receivers and transmitters receive signals beamed at them from a ground terminal, amplify them greatly, and retransmit them to another ground terminal. Less sensitive receivers and less powerful transmitters can be used on the ground than are needed for passive satellites. Also called active comsat.

**active component**—1. Those components in a circuit that have gain, or direct current flow, such as SCRs, transistors, thyristors, or tunnel diodes. They change the basic character of an applied electrical signal by rectification, amplification, switching, and so forth. (Passive elements like inductors, capacitors, and resistors have no gain characteristics.) 2. A device, the output of which is dependent on a source of power other than the main input signal. 3. A device capable of some dynamic function (such as amplification, oscillation, signal control) and which usually requires an external power supply for its operation. 4. Broadly, any device (including electromechanical relays) that can switch (or amplify) by application of low-level signals.

**active computer**—The one of two or more computers in an installation that is online and processing data.

**active comsat**—*See* active communications satellite.

**active current**—In an alternating current, a component in phase with the voltage. The working component as distinguished from the idle or wattless component.

**active decoder**—A device that is associated with a ground station and automatically indicates the radar beacon reply code that is received in terms of its number or letter designation.

**active delay line**—A digital delay module that incorporates a passive delay line and a series of logical gate circuits. These modules are used specifically with digital or logic signals. Also called digital delay line, digital delay unit, digital delay module, and digital programmable delay line.

**active device**—*See* active component.

**active display**—A display, such as a cathode-ray tube, electroluminescent display, or plasma panel, that presents information by emitting light.

**active ECM**—*See* jamming.

**active electric network**—An electric network containing one or more sources of energy.

**active element**—1. The driven or self-excited element in a multielement antenna or antenna array. 2. Also known as the responsive element. That part of a detector on which the infrared energy is projected and which, when radiation falls on it, undergoes a physical change that results in an electrical signal. *See* active component.

**active equalizer**—An equalizer designed to correct deficiencies in a speaker system's response. Such equalizers, which are designed to precisely match specific speaker systems, usually connect between the amplifier and preamplifier, or in one of the amplifier's tape-monitor circuits.

**active filter**—1. A device employing passive network elements and amplifiers. It is used for transmitting or rejecting signals in certain frequency ranges or for controlling the relative output of signals as a function of frequency. 2. A high-pass, low-pass, bandpass, or band-elimination filter that uses an active element, such as an operational amplifier, and relatively small capacitors, rather than the larger inductors and capacitors that would be required in a conventional passive filter. 3. A circuit whose gain depends on the frequency of the input signal. 4. A filter, consisting of an amplifier and suitable tuning elements, usually inserted in a feedback path. 5. A filter that uses active devices such as operational amplifiers to synthesize the filter response function. This technique has an advantage at high speeds because the need for inductors (with their poor high-frequency characteristics) is eliminated.

**active guidance**—*See* active homing.

**active homing**—A system whereby a missile homes in on a target by means of a radar aboard the missile. Also called active guidance.

**active infrared detection**—An infrared detection system in which a beam of infrared rays is transmitted toward one or more possible targets, and the rays reflected from the target are detected.

**active infrared system**—A system in which the object is irradiated by a source of infrared energy, which, in turn, is reflected by the object onto a detector. A snooper scope is an active infrared system.

**active intrusion sensor**—An active sensor that detects the presence of an intruder within the range of the sensor. Examples are an ultrasonic motion detector, a radio-frequency motion detector, and a photoelectric alarm system. *See also* passive intrusion sensor.

**active jamming**—1. Intentional radiation or reradiation of electromagnetic waves to impair the use of a specific portion of the electromagnetic-wave spectrum. 2. Transmission or retransmission of signals for the express purpose of disrupting communications.

**active junction**—In a semiconductor, a change in n-type to p-type doping, or vice versa, by a diffusion step. On discrete transistors there are two active junctions, the collector-base junction and the emitter-base junction.

**active leg**—Within a transducer, an electrical element that changes its electrical characteristics as a function of the applied stimulus.

**active line**—In a U.S. television picture, one of the lines (approximately 488) that make up the picture. The remaining 37 of the 525 available lines are blanked; they are called inactive lines.

**active maintenance downtime**—The time during which work is actually being done on an item, from the recognition of an occurrence of failure to the time of restoration to normal operation. This includes both preventive and corrective maintenance.

**active material**—1. In the plates of a storage battery, lead oxide or some other active substance that reacts chemically to produce electrical energy. 2. The fluorescent material, such as calcium tungstate, used on the screen of a cathode-ray tube.

**active matrix**—A display matrix with a transistor at each pixel location to individually store its state (on or off). Pixels in active matrix panels only need to be addressed when they are being turned on or off.

**active mixer and modulator**—A device requiring a source of electrical power and using nonlinear network elements to heterodyne or combine two or more electrical signals.

**active network**—1. A network containing passive and active (gain) elements. 2. An electrical network that includes a source of energy.

**active pressure**—In an ac circuit, the pressure that produces a current, as distinguished from the voltage impressed on the circuit.

**active probe**—A test probe, generally used with an oscilloscope, that is so named because of the active components used within probe circuitry. These components consist of one or all of the following: transistors, diodes, integrated circuits, or FETs. If FETs are used, these probes are often referred to as FET probes.

**active pull-up**—An arrangement in which a transistor is used to replace the pull-up resistor in an integrated circuit in order to provide low output impedance without high power consumption.

**active RC network**—A network formed by resistors, capacitors, and active elements.

**active redundancy**—That redundancy wherein all redundant items are operating simultaneously rather than being switched on when needed.

**active repair time**—That portion of corrective maintenance downtime during which repair work is being done on the item, including preparation, fault location, part replacement, adjustment and recalibration, and final test time. It may also include part procurement time under shipboard or field conditions.

**active satellite**—A satellite that receives, regenerates, and retransmits signals between stations. *See also* communications satellite.

**active sensor**—A sensor that detects the disturbance of a radiation field that is generated by the sensor. *See also* passive sensor.

**active sonar**—*See* sonar.

**active splitter**—*See* line splitter.

**active substrate**—1. A substrate in which active elements are formed to provide discrete or integrated devices. Examples of active substrates are single crystals of semiconductor materials within which are transistors, resistors, and diodes, or combinations of these elements. Another example is ferrite substrates within which electromagnetic fields are used to perform logical, gating, or memory functions. 2. A substrate for an integrated component in which parts display transistors. 3. A working part of the electronic circuit, which it supports physically. 4. In an integrated circuit, a substrate consisting of single-crystal semiconductor material into which the various IC components are formed; it acts as some or all of the components. This is in contrast to a substrate consisting of a dielectric, on whose surface the various components are deposited.

**active swept-frequency interferometer radar**—A dual radar system for air surveillance. It provides angle and range information of high precision for pinpointing target locations by trigonometric techniques.

**active systems**—In radio and radar, systems that require transmitting equipment, such as a beacon or transponder, to be carried in the vehicle.

**active tracking system**—Usually, a system that requires the addition of a transponder or responder on board the vehicle to repeat or retransmit information to the tracking equipment; e.g., dovap, secor, azusa.

**active transducer**—1. A type of transducer in which its output waves depend on one or more sources of power, apart from the actuating waves. 2. A transducer that requires energy from local sources in addition to that which is received.

## active mixer and modulator — adaptive control

**active trim**—Trimming of a circuit element (usually resistors) in a circuit that is electrically activated and operating to obtain a specified functional output for the circuit. *See* functional trimming.

**active wire**—The wire of an armature winding that produces useful voltage. That portion of the winding in which induction takes place.

**activity**—1. In a piezoelectric crystal, the magnitude of oscillation relative to the exciting voltage. 2. The intensity of a radioactive source. 3. Operations that result in the use or modification of the information in a computer file.

**activity curve**—A graph showing how the activity of a radioactive source varies with time.

**activity ratio**—The ratio of the number of records in a computer file that have activity to the total number of records in the file.

**ac transducer**—A transducer that, for proper operation, must be excited with alternating currents only. Also a device, the output of which appears in the form of an alternating current.

**actual height**—The highest altitude at which refraction of radio waves actually occurs.

**actual power**—The average of values of instantaneous power taken over one cycle.

**actuating device**—A mechanical or electrical device, either manual or automatic, that operates electrical contacts to bring about signal transmission.

**actuating system**—1. In a device or vehicle, a system that supplies and transmits energy for the operation of a mechanism or other device. 2. A manually or automatically operated mechanical or electrical device that operates electrical contacts to effect signal transmission.

**actuating time**—The time at which a specified contact functions.

**actuator**—1. In a servo system, the device that moves the load. 2. The part of a relay that converts electrical energy into mechanical motion. 3. Switch part to which an external force is applied to operate the switch. 4. A manual or automatic switch or sensor, such as a holdup button, magnetic switch, or thermostat, that causes a system to transmit an alarm signal when manually activated or when the device automatically senses an intruder or other unwanted condition. 5. A motorized arm that moves a satellite dish into position under the control of a receiver.

**ACU**—Abbreviation for automatic calling unit.

**ac voltage**—*See* alternating voltage.

**acyclic machine**—A direct-current machine in which the voltage generated in the active conductors maintains the same direction with respect to those conductors at all times.

**a/d**—Abbreviation for analog-to-digital. Also a-d, A-D, or A/D.

**adapter**—1. A fitting designed to change the terminal arrangement of a jack, plug, socket, or other receptacle, so that other than the original electrical connections are possible. 2. An intermediate device that permits attachment of special accessories or provides special means for mounting. 3. A device for connecting two parts of an apparatus that would not be directly connectable because of incompatible dimensions, terminations, currents, voltages, frequencies, etc.

**adaptive communication**—A method in which automatic changes in the communications system allow for changing inputs or changing characteristics of the device or process being controlled. Also called self-adjusting communication or self-optimizing communication.

**adaptive control**—1. A control method that uses sensors for real-time measurement of process variables

with calculation and adjustment of control parameters as a method of achieving near-optimum process performance.

2. A method of control in which actions are continuously adjusted in response to feedback.

**adaptive control system**—A device whose parameters are automatically adjusted to compensate for changes in the dynamics of the process to be controlled. An AFC circuit utilizing temperature-compensating capacitors to correct for temperature changes is an example.

**adaptive telemetry**—Telemetry having the ability to select certain vital information or any change in a given signal.

**adaptor**—A device that locates and supports products to be tested. Generally, it is made of an insulating material with locator pins mounted to precisely position the product to a spring contact probe test pattern. Also, an adaptor serves as an intermediate between the circuit verifier and the interchangeable test head that contains the test pattern.

**adc**—Abbreviation for analog-to-digital converter. Also ADC.

**Adcock antenna**—A pair of vertical antennas separated by one-half wavelength or less and connected in phase opposition to produce a figure-8 directional pattern.

**Adcock direction finder**—A radio direction finder using one or more pairs of Adcock antennas for directional reception of vertically polarized radio waves.

**Adcock radio range**—A type of radio range utilizing four vertical antennas (Adcock antennas) placed at the corners of a square, with a fifth antenna in the center.

**a/d converter**—Abbreviation for analog-to-digital converter. Also a-d, A-D, or A/D converter. 1. A unit or device that converts an analog signal, that is, a signal in the form of a continuously variable voltage or current, to a digital signal. 2. A circuit that accepts information in a continuously varying ac or dc current or voltage and whose output is the same information in digital form. 3. A circuit or device for producing a set of digital output signals representing the magnitude of a voltage applied to its input.

**add-and-subtract relay**—A stepping relay capable of being operated so as to rotate the movable contact arm in either direction.

**addend**—A quantity that, when added to another quantity (called the augend), produces a result called the sum.

**adder**—1. A device that forms the sum of two or more numbers or quantities impressed on it. 2. In a color TV receiver, a circuit that amplifies the receiver primary signal coming from the matrix. Usually there is one adder circuit for each receiver primary channel. 3. An arrangement of logic gates that adds two binary digits and produces sum and carry outputs.

**add-in**—Components (expansion boards, cartridges, or chips) that can increase a computer's capabilities, such as memory, graphics, and communications. Add-ins usually refer to an entire circuit board. *See also add-on.*

**add-in memory**—Additional computer memory that is added to a computer system within the computer's physical housing. Typically the add-in memory is inserted, in board form, into an available card slot on the assembly, the connections for which have already been placed on the existing computer. Additional memory may be in the form of semiconductor RAM, CCD, bubble memory, disk, or tape.

**additional station**—Any amateur radio station licensed to an amateur radio operator, normally for a specific land location other than the primary station.

**addition record**—A new record created during the processing of a file in a computer.

**additive**—Sometimes referred to as the key. A number, series of numbers, or alphabetical intervals added to a code to put it in a cipher.

**additive color**—A system that combines two colored lights to form a third.

**additive primaries**—Primary colors that can be mixed to form other colors, but which cannot themselves be produced by mixing other primaries. Red, green, and blue are the primaries in television because, when added in various proportions, they produce a wide range of other colors.

**additive process**—A printed-circuit manufacturing process in which a conductive pattern is formed on an insulating base by electrolytic chemical deposition.

**additive synthesis**—A technique for creating musical notes whereby sine waves are added together to create new waveforms. Frequently used in electric organs rather than in synthesizers.

**additron**—An electrostatically focused, beam-switching tube used as a binary adder in high-speed digital computers. (No longer used.)

**add mode**—Allows entry of numbers in a calculator to two decimal places without the need to enter the decimal point.

**add-on**—Circuitry or system that can be attached to a computer to increase memory or performance. *See also add-in.*

**add-on component or add-on device**—A discrete or integrated prepackaged or chip component that is attached to a film circuit to complete the circuit functions.

**add-on memory**—Additional computer memory that is added externally and is plug compatible with the computer system. The add-on memory is connected with an external connector cable to the computer, where provision has been made for memory expansion. Such a memory device is also available in its own housing, in which case it is physically placed beside the computer's main cabinet. Additional memory may be in the form of semiconductor RAM, CCD, bubble memory, disk, or tape.

**address**—1. An expression, usually numerical, that designates a specific location in a storage or memory device or other source or destination of information in a computer. 2. An identification, as represented by a name, label, or number, for a register, location in storage, or any other data source or destination, such as the location of a station in a communications network. 3. Loosely, any part of an instruction that specifies the location of an operand for the instruction. 4. To select the location of a stored information set for access. 5. In computer technology, a number used by the central processing unit (CPU) to specify a location in memory. 6. Element(s) of a packet frame that identifies the source and/or destination stations by means of an agreed bit pattern. 7. A unique sequence of letters or numbers for the location of data or the identity of an intelligent device.

**address bus**—1. A unidirectional bus over which digital information appears to identify either a particular memory location or a particular device. 2. The set of output pins from a microprocessor chip and the associated circuitry linking them to other devices for the purpose of addressing those chips or parts of them. *See also bus system.*

**address characters**—Blocks of alphanumeric characters that identify users or stations uniquely.

**address comparator**—In a computer, a device that ensures that an address being read is the right one.

**address computation**—The process by which the address part of an instruction in a digital computer is produced or modified.

**address constant**—*See base address.*

**addressed memory**—In a computer, memory sections containing each individual register.

**address field**—The portion of an instruction that specifies the location of a particular piece of information in a computer memory.

**addressing mode**—An addressing method. One of several different addressing methods possible in microprocessors.

**address modification**—In a computer, a change in the address portion of an instruction or command such that, if the routine which contains that instruction or command is repeated, the computer will go to a new address or location for data or instructions.

**address part**—In an electronic computer instruction, a portion of an expression designating location. *See also* instruction code.

**address-routing indicator**—Group of characters contained in a message heading that designates the destination of the message.

**add-subtract time**—The time required by a digital computer to perform addition or subtraction. It does not include the time required to obtain the quantities from storage and put the result back into storage.

**add time**—The time required in a digital computer to perform addition. It does not include the time required to obtain the quantities from storage and put the result back into storage.

**a/d encoder**—Analog-to-digital encoder. A device that changes an analog quantity into an equivalent digital representation. Also referred to as an a-d, A-D, or A/D encoder.

**adf**—*See* automatic direction finder. Also referred to as ADF.

**adiabatic damping**—A reduction in the size of an accelerator beam as the energy of the beam is increased.

**adiabatic demagnetization**—A technique used to obtain temperatures within thousandths of a degree of absolute zero. It consists of applying a magnetic field to a substance at a low temperature and in good thermal contact with its surroundings, insulating the substance thermally, and then removing the magnetic field.

**A-display**—Also called A-scan. A radarscope presentation in which time (distance or range) is one coordinate (usually horizontal) and the target appears displaced perpendicular to the time base.

**adjacency**—In character recognition, a condition in which the character-spacing reference lines of two characters printed consecutively on the same line are less than a specified distance apart.

**adjacent- and alternate-channel selectivity**—A measure of the ability of a receiver to differentiate between a desired signal and signals that differ in frequency from the desired signal by the width of one channel or two channels, respectively.

**adjacent audio (sound) channel**—The rf carrier frequency that contains the sound modulation associated with the next-lower-frequency television channel.

**adjacent channel**—That frequency band immediately above or below the one being considered.

**adjacent-channel attenuation**—*See* selectance.

**adjacent-channel interference**—Undesired signals received on one communication channel from a transmitter operating on a channel immediately above or below.

**adjacent-channel selectivity**—The ability of a receiver to reject signals on channels adjacent to the channel of the desired station.

**adjacent conductor**—Any conductor next to another conductor, either in the same multiconductor cable layer or in adjacent layers.

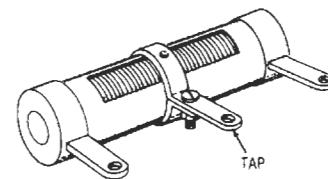
## addressed memory — advanced license

**adjacent sound channel**—In television, the rf channel containing the sound signal modulation of the next lower channel.

**adjacent video carrier**—The rf carrier that carries the picture modulation for the television channel immediately above the channel to which the viewer is tuned.

**adjustable component**—Any circuit component whose electrical value may be varied at will, e.g., adjustable capacitor, inductor, resistor, or load.

**adjustable resistor**—1. A resistor that has the resistance wire partly exposed to enable the amount of resistance in use to be adjusted occasionally by the user. Adjustment requires the loosening of a screw, the subsequent moving of the lug, and retightening of the screw. 2. A fixed resistor with a movable contact (or tap) that can be positioned along the length of the resistive path.



*Adjustable resistor.*

**adjustable voltage divider**—A wirewound resistor with one or more movable terminals that can be slid along the length of the exposed resistance wire until the desired voltage values are obtained.

**adjusted circuit**—Also called bolted-fault level. In a circuit, the current measured under short-circuit conditions with the leads that are normally connected to the circuit breaker bolted together.

**adjusted decibels**—An expression of the ratio of the noise level to a reference noise at any point in a transmission system, when the noise meter has been adjusted to allow for the interfering effect under specified conditions.

**admittance**—1. The ease with which an alternating current flows in a circuit. The reciprocal of impedance; usually expressed in siemens. Symbol is  $Y$  or  $y$ . 2. The (sinusoidal) current in a circuit divided by the terminal voltage. 3. The vector sum of a resistive component of conductance and a reactive component of susceptance.

**ADP**—Abbreviation for automatic data processing.

**ADSL**—Abbreviation for Asymmetric Digital Subscriber Line. A video display terminal distribution video system delivering video over existing (i.e., copper) telephone lines.

**adsorption**—The deposition of a thin layer of gas or vapor particles onto the surface of a solid. The process is known as chemisorption if the deposited material is bound to the surface by a simple chemical bond.

**ADU**—Abbreviation for automatic dialing unit.

**advance ball**—In mechanical recording, a rounded support (often sapphire) that is attached to a cutter and rides on the surface of the recording medium. Its purpose is to maintain a uniform mean depth of cut and to correct for small irregularities on the surface of the disc.

**advance calling**—A telecommunications feature in which voice messages can be spoken into the telephone for automatic delivery at a prearranged time to any other telephone or telephones.

**advanced license**—A license issued by the FCC to amateur radio operators who are capable of sending

and receiving Morse code at the rate of 13 words per minute and are familiar with general and intermediate radio theory and practice. Its privileges include exclusive use of certain frequencies.

**advance wire** — An alloy of copper and nickel, used in the manufacture of electric heating units and some wirewound resistors.

**aeolight** — A glow lamp that uses a cold cathode and a mixture of inert gases. Its illumination can be regulated with an applied signal voltage and it is often used as a modulation indicator for motion picture sound recording.

**aerial** — *See* antenna.

**aerial cable** — A cable installed on a pole line or similar overhead structure.

**aerodiscone antenna** — An aircraft antenna that is aerodynamically shaped and is physically small compared with other antennas having similar electrical characteristics. Its radiation pattern is omnidirectional and linearly polarized.

**aerodrome control radio station** — A radio station providing communications between an airport control tower and aircraft or mobile aeronautical radio stations.

**aerodynamics** — The science of the motion of air and other gases. Also, the forces acting on bodies such as aircraft when they move through such gases, or when such gases move against or around the bodies.

**aeromagnetic** — Pertaining to the magnetic field of the earth as surveyed from the air.

**aeronautical advisory station** — A station used for civil defense and advisory communications with private aircraft stations.

**aeronautical broadcasting service** — The broadcasting service intended for the transmission of information related to air navigation.

**aeronautical broadcast station** — A station that broadcasts information regarding air navigation and meteorological data pertinent to aircraft operation.

**aeronautical fixed service** — A fixed service intended for the transmission of information relating to air navigation and preparation for and safety of flight.

**aeronautical fixed station** — A station operating in the aeronautical fixed service.

**aeronautical ground station** — A radio station operated for the purpose of providing air-to-ground communications in connection with the operation of aircraft.

**aeronautical marker-beacon station** — A land station operating in the aeronautical radionavigation service and providing a signal to designate a small area above the station.

**aeronautical mobile service** — A radio service between aircraft and land stations or between aircraft stations.

**aeronautical radio-beacon station** — An aeronautical radionavigation land station transmitting signals that are used by aircraft and other vehicles to determine their position bearing or position in relation to the aeronautical radio beacon station.

**aeronautical radionavigation service** — A radionavigation service intended for use in the operation of aircraft.

**aeronautical radio service** — 1. Service carried on between aircraft stations and/or land stations. 2. Special radio for air navigation. 3. Service that includes aircraft-to-aircraft, aircraft-to-ground, and ground-to-aircraft communications important to the operation of aircraft.

**aeronautical station** — A land station (or in certain instances a shipboard station) in the aeronautical mobile service that carries on communications with aircraft stations.

**aeronautical telecommunication** — Electronic and nonelectronic communications used in the aeronautical service.

**aeronautical telecommunication agency** — An agency to which is assigned the responsibility for operating a station or stations in the aeronautical telecommunication service.

**aeronautical telecommunication log** — A record of the activities of an aeronautical telecommunication station.

**aeronautical telecommunications** — Any telegraph or telephone communications of signals, writing, images, and sounds of any nature by wire, radio, or other system or process of signaling, used in the aeronautical service.

**aeronautical telecommunication service** — Telecommunication service provided for aeronautical purposes.

**aeronautical telecommunication station** — A station in the aeronautical telecommunication service.

**aeronautical utility land station** — A land station located at an airport control tower and used for communications connected with the control of ground vehicles and aircraft on the ground.

**aeronautical utility mobile station** — A mobile station used at an airport for communications with aeronautical utility land stations, ground vehicles, and aircraft on the ground.

**aeophare** — *See* radio beacon.

**AES** — Abbreviation for Audio Engineering Society. A professional group; the official association of technical personnel, scientists, engineers, and executives in the audio field.

**AF** — *See* audio frequency.

**AFC** — *See* automatic frequency control.

**afocal** — An optical system with one set of object and image points at infinity. Literally, "without a focal length." An afocal system receives its input image from infinity and projects its output image to infinity.

**AFSK** — Abbreviation for audio-frequency shift keying. With this method of modulation, two tones (mark = 2125 Hz, space = 2295 Hz) are fed directly into the microphone jack of the transmitter.

**afterglow** — Also called phosphorescence. 1. The light that remains in a gas-discharge tube after the voltage has been removed, or on the phosphorescent screen of a cathode-ray tube after the exciting electron beam has been removed. 2. The luminosity that remains in a rarefied gas after an electrodeless discharge has traversed the gas.

**afterpulse** — In a photomultiplier, a spurious pulse induced by a preceding pulse.

**AGC** — *See* automatic gain control.

**age** — To maintain an electrical component in a specified environment, as with respect to pressure, temperature, applied voltage, etc., until its characteristics stabilize.

**aggregate function** — A command that performs calculations based on a set of values rather than on a single value.

**agile receiver** — A satellite receiver that can be tuned to any desired channel.

**aging** — 1. Storing a permanent magnet, capacitor, semiconductor, meter, or other device, sometimes with voltage applied, until its desired characteristics become essentially constant. 2. The change of a component or a material with time under defined environmental conditions, leading to improvement or deterioration of properties.

**agonic line** — An imaginary line on the earth's surface, all points of which have zero magnetic declination.

**AGP** — Abbreviation for accelerated graphics port.

**AGREE** — Advisory Group on Reliability of Electronics Equipment.

**AI** — *See* artificial intelligence.

**aided tracking** — A system of tracking a target signal in bearing, elevation, or range (or any combination of these variables) in which manual correction of the tracking error automatically corrects the rate at which the tracking mechanism moves.

**AIEE** — Abbreviation for American Institute of Electrical Engineers. Now merged with IRE to form IEEE.

**air bearing** — A means of supporting magnetic tape on an air film rather than by means of a sliding or rolling contact. Usually, an air bearing is a perforated cylinder; pressurized air flows through the perforations and forms a film that prevents the tape from contacting the cylinder.

**airborne intercept radar** — Short-range airborne radar employed by fighter and interceptor planes to track down their targets.

**airborne long-range input** — Airborne equipment designed to extend air-surveillance coverage seaward so that long-range interceptors may be used.

**airborne moving-target indicator** — A type of airborne-radar display that does not present essentially stationary objects.

**airborne noise** — Undesired sound in the form of fluctuations of air pressure about the atmospheric pressure as a mean.

**airborne radar platform** — Airborne surveillance and height-finding radar for early warning and control.

**air capacitor** — A capacitor in which air is the only dielectric material between its plates.

**aircarrier aircraft station** — A radio station aboard an aircraft that is engaged in or essential to the transportation of passengers or cargo for hire.

**air cell** — A primary cell in which depolarization at the positive electrode is accomplished chemically by reduction of the oxygen in the air.

**air column** — The air space within a horn of an acoustic chamber.

**air condenser** — *See* air capacitor.

**air-cooled tube** — An electron tube in which the generated heat is dissipated to the surrounding air directly, through metal heat-radiating fins, or with the aid of channels or chimneys that increase the air flow.

**air-core cable** — A telephone cable in which the interstices in the cable core are not filled with a moisture barrier.

**air-core coil** — A number of turns of spiral wire in which no metal is used in the center.

**air-core transformer** — A transformer (usually rf) having two or more coils wound around a nonmetallic core. Transformers wound around a solid insulating substance or on an insulating coil form are included in this category.

**aircraft bonding** — Electrically connecting together all the metal structure of the aircraft, including the engine and metal covering of the wiring.

**aircraft flutter** — Flickering (repetitive fading and intensifying) in a TV picture as the signal is reflected from flying aircraft. The reflected signal arrives in or out of phase with the normal signal and thus strengthens or weakens the latter.

**aircraft station** — A radio station installed on aircraft and continuously subject to human control.

**air defense control center** — Principal information, communications, and operations center from which all aircraft, antiaircraft operations, air-defense artillery, guided missiles, and air-raid warning functions of a

specific area of air defense responsibility are supervised and coordinated.

**air defense identification zone** — Airspace of defined dimensions within which the ready identification, location, and control of aircraft is required.

**air dielectric capacitor** — A capacitor with a dielectric consisting of air.

**airdrome control station** — A station used for communication between an airport control tower and aircraft.

**air environment** — In communications electronics, all airborne equipment that is part of the communications-electronics system, as distinguished from the equipment on the ground, which belongs to the ground environment.

**air gap** — 1. A nonmagnetic discontinuity in a ferromagnetic circuit. For example, the space between the poles of a magnet—although filled with brass, wood, or any other nonmagnetic material—is nevertheless called an air gap. This gap increases magnetic reluctance and prevents saturation of the core. 2. The air space between two magnetically or electrically related objects.

**air/ground control radio station** — An aeronautical telecommunication station with the primary responsibility of handling communications related to the operation and control of aircraft in a given area.

**air/ground liaison code** — Set of symbols for a limited number of words, phrases, and sentences used for communications between air and ground forces.

**air-motion transformer** — A type of speaker in which the air is not pushed into vibration by a piston, but rather squeezed by the contractions of a folded diaphragm.

**air navigation radio aids** — Aeronautical ground stations, radio beacons, direction finders, and similar facilities.

**airplane flutter rejection** — The measure of a receiver's immunity to the effects of wavering signals produced by aircraft in the reception path.

**airport beacon** — A beacon (light or radio) to indicate the location of an airport.

**airport control station** — A station that furnishes communications between an airport control tower and aircraft in the immediate vicinity; messages are limited to those related to actual aviation needs.

**airport radar control** — The surveillance-radar portion of radar approach control.

**airport runway beacon** — A radio-range beacon that defines one or more approaches to an airport.

**airport surface detection equipment** — Abbreviated ASDE. 1. Radar that shows the movement of aircraft and other vehicles on the ground at an airport. Valuable tool at night and during low visibility. 2. A digital radar system used to track planes and vehicles on airport runways and up to 200 feet in altitude. Unlike previous surface radar systems, ASDE provides clear images in bad weather.

**airport surveillance radar** — 1. Abbreviated ASR. A short-range radar system that maintains constant surveillance over aircraft at the lower levels of flight. Distinct from air route surveillance radar (ARSR), which is long-range radar—150-mile (241-km) radius—to control traffic between terminals. 2. An air-traffic-control radar that scans the airspace 30 to 60 miles (48 to 98 km) around an airport and displays the location of all aircraft below a certain altitude and all obstructions near the control tower.

**air-position indicator** — Airborne computing system that presents a continuous indication of aircraft position on the basis of aircraft heading, air speed, and elapsed time.

**air-spaced coax**—A coaxial cable in which air is basically the dielectric material. The conductor may be centered by means of a spirally wound synthetic filament, by beads, or by braided filaments. This construction is also referred to as an air dielectric.

**air surveillance**—Systematic observation of airspace by electronic, visual, or other means, primarily to identify and determine the movements of aircraft and missiles, friendly and enemy, in the airspace under observation.

**airstime**—Time spent on a cellular phone, which is usually billed to the subscriber on a per-minute basis.

**air-to-ground communication**—Transmission of radio signals from an aircraft to stations or other locations on the earth's surface, as differentiated from ground-to-air, air-to-air, or ground-to-ground communications.

**air-to-ground radio frequency**—The frequency or band of frequencies agreed upon for transmission from an aircraft to an aeronautical ground station.

**air-to-surface missile**—A missile designed to be dropped from an aircraft. An internal homing device or the aircraft's radio guides it to a surface target.

**airwaves**—Slang expression for radio waves used in radio and television broadcasting.

**alacritized switch**—1. A mercury switch treated to yield a low adhesional force between the rolling surface and mercury pool, resulting in a decreased differential angle. 2. A mercury switch in which the tendency of the mercury to stick to the mating parts has been reduced.

**alarm**—A device that signals the existence of an abnormal condition by means of an audible or visible discrete change, or both, intended to attract attention. An alarm circuit produces or transmits an alarm signal.

**alarm condition**—A threatening condition, such as an intrusion, fire, or holdup, sensed by a detector.

**alarm device**—A device that signals a warning in response to an alarm condition, such as a bell, siren, or annunciator.

**alarm discrimination**—The ability of an alarm system to distinguish between those stimuli caused by an intrusion and those which are a part of the environment.

**alarm hold**—A means of holding an alarm once sensed. The typical magnetic trap does not hold or latch, and thus the reclosing of a trapped door resets the typical magnetic trap. A hold circuit applied to such a device indicates that the door has been opened and continues to so indicate until reset.

**alarm line**—A wired electrical circuit used for the transmission of alarm signals from the protected premises to a monitoring station.

**alarm relay**—A relay, other than an annunciator, used to operate, or to operate in connection with, a visual or audible alarm.

**alarm state**—The condition of a detector that causes a control unit in the secure mode to transmit an alarm signal.

**alarm system**—An assembly of equipment and devices designated and arranged to signal the presence of an alarm condition requiring urgent attention, such as unauthorized entry, fire, temperature rise, etc. The system may sound a local warning or alert the police, a central station, or a proprietary service.

**albedo**—The reflecting ability of an object. It is the ratio of the amount of light reflected compared with the amount received.

**ALC**—Abbreviation for automatic level (volume) control. 1. A special compressor circuit included in some tape recorders for automatically maintaining the recording volume within the required limits regardless of changes in the volume of the sound. 2. A circuit that automatically maintains recording levels within permissible limits, so that, no matter how loud or soft the sound being recorded,

the signal on the tape will not get strong enough to overmodulate and distort or soft enough to be lost in noise. Also known as automatic volume control (AVC).

**Alexanderson alternator**—An early mechanical generator used as a source of low-frequency power for transmission or induction heating. It is capable of generating frequencies as high as 200,000 hertz.

**Alexanderson antenna**—A vlf antenna consisting of a horizontal wire connected to ground at equally spaced points by vertical wires with base-loading coils; the transmitter is coupled to an end coil.

**Alford antenna**—A square loop antenna comprising four linear sides with their ends bent inward so that capacitive loading is provided to equalize the current around the loop.

**algebraic adder**—In a computer, an adder that provides the algebraic rather than arithmetic sum of the entered quantities.

**algebraic logic**—A calculator mode that permits all calculations to be done in the order in which they are written.

**algebraic sum**—The sum of two or more quantities combined according to their signs. (Compare with *arithmetic sum*.)

**ALGOL**—1. An international problem language designed for the concise, efficient expression of arithmetic and logical processes and the control (iterative, etc.) of these processes. From *algorithmic language*. 2. A high-level language that has a context-free structure.

**algorithm**—1. A set of rules or processes for solving a problem in a finite number of steps (for example, a full statement of an arithmetic procedure for finding the value of  $\sin x$  with a stated precision). See also procedure. 2. A series of equations, some of which may state inequalities, that cause decisions to be made and the computational process to be altered based on these decisions. 3. A set of rules or directions for getting a specific output from a specific input. The distinguishing feature of an algorithm is that all vagueness must be eliminated; the rules must describe operations that are so simple and well defined they can be executed by a machine. Furthermore, an algorithm must always terminate after a finite number of steps. 4. An ordered sequence of mathematical steps that always produces the correct answer to a problem, though the solution may be more lengthy than necessary. 5. A set of well-defined procedures for the solution of a problem in a limited number of steps. Algorithms are implemented in a computer by a programmed sequence of instructions.

**algorithmically generated pattern**—An array of digital data automatically generated by a predetermined software routine or program.

**algorithmic language**—An arithmetic language by which a numerical procedure may be presented to a computer precisely and in a standard form.

**algorithmic pattern generation**—Real-time generation of input test patterns during test execution according to specified procedures, formulas, or algorithms. Also refers to procedures or algorithms used in automatic-test-generation software for specific fault sets.

**alias**—An alternate label. For instance, a label and one or more aliases may be used to identify the same data element or point in a computer program.

**aliasing**—1. The introduction of error into the Fourier analysis of a discrete sampling of continuous data when components with frequencies too great to be analyzed with the sampling interval being used contribute to the amplitudes of lower-frequency components. 2. A phenomenon arising as a result of the sampling process in which high-frequency components of the original analog signal (whether information or noise) appear as lower frequencies in the sampled signal. Aliasing occurs when the

sampling rate is less than twice the highest frequency existing in the original analog signal. 3. Undesirable distortion component that can arise in digital audio equipment when the input signal's frequency exceeds one-half of the digital circuitry's sampling rate. 4. The mistaking of some object or situation for another, especially because of the way data is examined. Examples: movies of propellers and wagon wheels that seem to turn backward, musical notes that are wrongly analyzed by sequential measurement (for instance, thought to be an octave too low), and, especially, "jaggies." 5. Undesirable staircase distortions in computer-generated images caused by improper sampling techniques. The most common effect is a jagged edge along object boundaries.

**aliasing noise**—A distortion component that will be created if a sampled signal bandwidth is effectively greater than one-half the sampling rate.

**align**—1. To adjust the tuned circuits of a receiver or transmitter for maximum signal response. 2. To put into proper relative position, agreement, or coordination when placing parts of a photomask together or placing a photomask over an etched pattern in the oxide on a semiconductor wafer. 3. To adjust the tuning of a multistage device so that all stages are adjusted to the same frequency or so that they work together properly.

**aligned bundle**—See coherent bundle.

**aligned-grid tube**—A multigrid vacuum tube in which at least two of the grids are aligned one behind the other to give such effects as beam formation and noise suppression.

**alignment**—1. The process of adjusting components of a system for proper interrelationship. The term is applied especially to (a) the adjustment of tuned circuits in a receiver to obtain the desired frequency response and (b) the synchronization of components in a system. 2. In a tape recorder, the physical positioning of a tape head relative to the tape itself. Alignment in all respects must conform to rigid requirements in order for a recorder to function properly. 3. The accuracy or proper relative position of an image on a photomask with respect to an existing image on a substrate, as in a photoresist coating, or etched in the oxide of an oxidized silicon wafer. 4. A technique in the fabrication process of semiconductors by which a series of six to eight masks are successively registered to build up the various layers of a monolithic device. Each mask pattern must be accurately referenced to or aligned to all preceding mask patterns. 5. The accuracy of coordination or relative position of images on a semiconductor oxide coating and on the photomask, or any other images placed in relation to those.

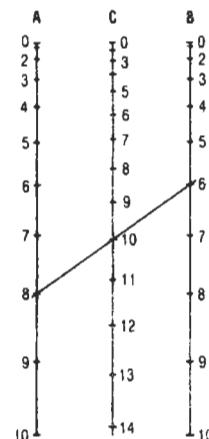
**alignment chart**—Also called nomograph, nomogram, or abac. Chart or diagram consisting of two or more lines on which equations can be solved graphically. This is done by laying a straightedge on the two known values and reading the answer at the point where the straightedge intersects the scale for the value sought.

**alignment pin**—1. A pin in the center of the base of a tube. A projecting rib on the pin ensures that the tube is correctly inserted into its socket. 2. Any pin or device that will ensure the correct mating of two components designed to be connected.

**alignment protractor**—An instrument that indicates error in a pickup's lateral alignment. It fits on the center spindle of the turntable, and the pickup stylus fits into a small hole on the device. The correct indication is shown when the angle of lateral movement of the pickup head is at 90° to the tangent of the groove at any point, although minimal tracking error is expected with most pickup arms.

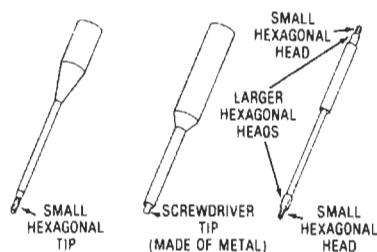
**alignment tool**—A special screwdriver or socket wrench used for adjusting trimmer or padder capacitors

## aliasing noise — alkaline cell



Alignment chart.

or cores in tuning inductances. It is usually constructed partly or entirely of nonmagnetic material. See also neutralizing tool.



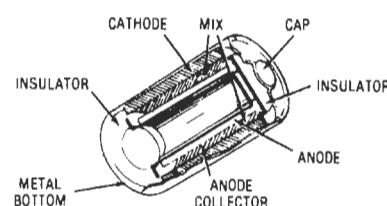
Alignment tools.

**alive**—1. Electrically connected to a source of potential difference, or electrically charged to have a potential different from that of the earth. 2. Energized. 3. Reverberant, as a room in which sound reflects and echoes.

**alive circuit**—A circuit that is energized.

**alkali**—A compound that forms hydroxyl ions when in aqueous solution. Also called a base.

**alkaline cell**—1. A primary cell, similar to the zinc-carbon cell, in which the negative electrode is granular zinc mixed with a potassium hydroxide (alkaline) electrolyte; the positive electrode is a polarizer in electrical contact with the outer metal can of the cell. A porous separator divides the electrodes. This type of cell delivers a terminal potential of 1.5 volts and has a 50 percent to 100 percent higher capacity than does a 1.5-volt zinc-carbon cell. Also called an alkaline-manganese cell. 2. A primary dry cell that has a very low internal resistance and high



Alkaline cell.

service capacity. It is characterized by a relatively flat discharge curve under load.

**all-channel tuning** — Ability of a television set to receive all assigned channels, VHF and UHF, channels 2 through 83, as well as cable channels.

**all-diffused monolithic integrated circuit** — Also called compatible monolithic integrated circuit. A microcircuit consisting of a silicon substrate into which all the circuit parts (both active and passive elements) are fabricated by diffusion and related processes.

**Allen screw** — A screw having a hexagonal hole or socket in its head. Often used as a setscrew.

**Allen wrench** — A straight or bent hexagonal rod used to turn an Allen screw.

**alligator clip** — A spring-loaded metal clip with long, narrow meshing jaws similar to the jaws of an alligator; it is used for making temporary electrical connections, generally at the end of a test lead on interconnection wire.



Alligator clip.

**allocate** — In a computer, to assign storage locations to main routines and subroutines, thus fixing the absolute values of symbolic addresses.

**allocated channel** — A channel assigned to a specific user.

**allocated frequency band** — A segment of the radio-frequency spectrum established by a competent authority that designates the use that may be made of the frequencies contained therein.

**allocated-use circuit** — 1. A circuit in which one or more channels have been allocated for the exclusive use of one or more services by a proprietary service; may be a unilateral or joint circuit. 2. Communication link specifically assigned to user(s) warranting such facilities.

**allocation technique** — The method of providing a process access to a shared resource.

**allochromatic** — Exhibiting photoelectric effects due to the inclusion of microscopic impurities or as a result of exposure to various types of radiation.

**allophone** — A variation in the pronunciation of a phoneme. An allophone can be regarded as the sound that results when a phoneme is placed in its environment.

**allotter** — In a telephone system, a distributor, associated with the finder control group relay assembly, that allots an idle linefinder in preparation for an additional call.

**allotter relay** — In a telephone system, a relay of the linefinder circuit, the functions of which are to preallot an idle linefinder to the next incoming call from the line and to guard relays.

**allowable deviation** — The permissible difference between any range of conditions and a reference condition.

**alloy** — 1. A composition of two or more elements, of which at least one is a metal. It may be a solid solution, a heterogeneous mixture, or a combination of both. 2. Method of making pn junctions by melting a metallic dopant so that it dissolves some of the semiconductor material and then hardens to produce a doped alloy.

**alloy deposition** — The process of depositing an alloy on a substrate during manufacturing.

**alloy-diffused transistor** — A transistor in which the base is diffused and the emitter is alloyed. The

collector is the semiconductor substrate into which alloying and diffusion are effected.

**alloyed contact** — An ohmic contact formed by an alloy process.

**alloy junction** — Also called fused junction. A junction produced by alloying one or more impurity metals to a semiconductor. A small button of impurity metal is placed at each desired location on the semiconductor wafer, heated to its melting point, and cooled rapidly. The impurity metal alloys with the semiconductor material to form a p or n region, depending on the impurity used.

**alloy-junction photocell** — A photodiode in which an alloy junction is produced by alloying (mixing) an indium disc with a thin wafer of n-type germanium.

**alloy-junction transistor** — Also called fused-junction transistor. A semiconductor wafer of p- or n-type impurities fused, or alloyed, into opposite sides of the wafer to provide emitter and base junctions. The base region comprises the original semiconductor wafer.

**alloy process** — A fabrication technique in which a small part of the semiconductor material is melted together with the desired metal and allowed to recrystallize. The alloy developed is usually intended to form a pn junction or an ohmic contact.

**alloy transistor** — A transistor in which the emitter and collector junctions are both alloy junctions.

**all-pass filter** — A network designed to produce a delay (phase shift) and an attenuation that is the same at all frequencies; a lumped-parameter delay line. Also called all-pass network.

**all-pass network** — A network designed to introduce phase shift or delay but not appreciable attenuation at any frequency.

**all-relay central office** — An automatic central-office dial switchboard in which relay circuits are used to make the line interconnections.

**all-wave antenna** — A receiving antenna suitable for use over a wide range of frequencies.

**all-wave receiver** — A receiver capable of receiving stations on all the commonly used wavelengths in shortwave bands as well as in the broadcast band.

**alnico** — An alloy consisting mainly of aluminum, nickel, and cobalt plus iron. Various subscripts and combinations of letters are available. Material can be found both in cast and sintered form, including isotropic and anisotropic alloys. Capable of very high flux density and magnetic retentivity, the alloy is used in permanent magnets for speakers, magnetrons, etc.

**alpha** — 1. Emitter-to-collector current gain of a transistor connected as a common-base amplifier. For a junction transistor, alpha is less than unity, or 1. Alpha is usually defined as the ratio of a small change in collector current to the corresponding change in emitter current, when the collector-base voltage is kept constant. 2. Brain wave signals whose frequency is approximately 8 to 12 Hz. The associated mental state is relaxation, heightened awareness, elation, and in some cases, dreamlike.

**alphabet** — An ordered set of all the letters and associated marks used in a language, for example, the Morse code alphabet, the 128 characters of the U.S. ASCII alphabet.

**alphabetic coding** — A system of abbreviation used in preparing information for input into a computer. Information may then be reported in the form of letters and words as well as in numbers.

**alphabetic-numeric** — Having to do with the alphabetic letters, numerical digits, and special characters used in electronic data processing work.

**alphabetic string** — A character string containing only letters and special characters.

**alpha cutoff frequency**—The frequency at which the current gain of a common-base transistor stage has decreased to 0.707 of its low-frequency value. Gives a rough indication of the useful frequency range of the device.

**alphameric (alphanumeric)**—Generic term for alphabetic letters, numerical digits, and special characters that are machine processable.

**alphameric characters**—1. A character set that mixes alphabetic characters, numeric characters, and usually punctuation characters. The alphabetic characters may be uppercase and/or lowercase or even in Japanese or Arabic script. 2. Consisting of letters and numbers. Also called alphanumeric or alphanumeric.

**alphanumeric**—1. A generic term for alphabetic letters, numerical digits, and special ASCII characters that can be processed by a computer. A character set containing any combination of the above. 2. Consisting of letters and numbers. 3. All letters in the alphabet, the numbers 0 through 9, and special characters—such as -, /, \*, \$, (), +, and #- that are machine processable.

**alphanumeric code**—In computer practice or in communications, a code in which the letters of the alphabet are represented by numbers.

**alphanumeric display**—Device consisting of a typewriter-style keyboard and a display (CRT) screen on which text is viewed.

**alphanumeric keys**—Keys on a data entry device that resemble those on a standard keyboard. Usually they are used to manually input or edit text for the display system, although they can also be used in a function key mode.

**alphanumeric reader**—An instrument that reads alphabetic, numeric, and special characters by means of a photosensor that measures the varying intensity of the characters reflected from a light source.

**alphanumeric readout**—A type of digital readout that displays both letters and numerals.

**alpha particle**—A small, electrically charged particle thrown off at very high velocity by many radioactive materials, including uranium and radium. Identical to the nucleus of a helium atom, it is made up of two neutrons and two protons. Its electrical charge is positive and is equal in magnitude to twice that of an electron.

**alpha ray**—A stream of fast-moving alpha particles that produce intense ionization in gases through which they pass, are easily absorbed by matter, and produce a glow on a fluorescent screen. The lowest-frequency radioactive emissions.

**alpha system**—A signaling system in which the signaling code to be used is designated by alphabetic characters.

**alpha-wave detector**—A device that detects and displays alpha-wave segments of brain wave output. Used in biofeedback. Also called alpha-wave meter or sensor.

**alpha-wave meter**—See alpha-wave detector.

**ALS**—Abbreviation for advanced low-power Schotky (Texas Instruments). A low-power, high-speed transistor-transistor logic (TTL) family.

**alterable memory**—A storage medium that may be written into.

**alteration switch**—A manual switch on a computer console or a program-simulated switch that can be set on or off to control coded machine instructions.

**alternate channel**—A channel located two channels above or below the reference channel.

**alternate-channel interference**—Interference caused in one communication channel by a transmitter operating in the channel after an adjacent channel. See also second-channel interference.

**alternate facility**—A communications-electronics facility that is established for the purpose of replacing or supplementing another facility or facilities under real or simulated emergency conditions.

**alternate frequency**—The frequency assigned for use at a certain time, or for a certain purpose, to replace or supplement the frequency normally used.

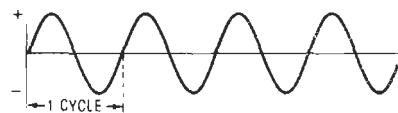
**alternate mode**—A means of displaying on an oscilloscope the output signals of two or more channels by switching the channels, in sequence, after each sweep.

**alternate route or routing**—A secondary or backup communications path to be used if the normal (primary) routing is not possible.

**alternate voice/data operation**—Modem operations coordinated by voice over the same line that accommodates transmission. The modem is patched out of the circuit to allow this. A special switch, called an exclusion key, converts the line from voice to data.

**alternating-charge characteristic**—The function relating, under steady-state conditions, the instantaneous values of the alternating component of transferred charge to the corresponding instantaneous values of a specified periodic voltage applied to a nonlinear capacitor.

**alternating current**—Abbreviated ac. 1. A flow of electricity that reaches maximum in one direction, decreases to zero, then reverses itself and reaches maximum in the opposite direction. The cycle is repeated continuously. The number of such cycles per second is the frequency. The average value of voltage during any cycle is zero. 2. Any signal that varies with time. It usually means that the current actually changes polarity with time. The plot of current versus time usually is a sine wave that comprises a succession of instantaneous values, the greatest of which is the amplitude or peak value. The time taken by one complete cyclic repetition is the period, and the number of periods in one second is the frequency.



Alternating current.

**alternating current/direct current**—A term applied to electronic equipment indicating it is capable of operation from either an alternating-current or direct-current primary power source.

**alternating-current erasing head**—An erasing head used in magnetic recording, in which alternating current produces the magnetic field necessary for erasing. Alternating-current erasing is achieved by subjecting the medium to a number of cycles of a magnetic field of a decreasing magnitude. The medium is, therefore, essentially magnetically neutralized.

**alternating-current generator**—A rotary machine that generates alternating current when its rotor, which may be either the armature or the field, is rotated by an engine or a motor. Also called an alternator.

**alternating-current pulse**—An alternating-current wave of brief duration.

**alternating-current transmission**—In television, that form of transmission in which a fixed setting of the controls makes any instantaneous value of signal correspond to the same value of brightness only for a short time.

**alternating flasher**—A control that provides voltage first to one load and then to another load. This cycle repeats normally at a fixed rate per minute.

**alternating quantity**—A periodic quantity that has alternately positive and negative values, the average value of which is zero over a complete cycle.

**alternating voltage**—Also called ac voltage. Voltage that is continually varying in value and reverses its direction at regular intervals, such as that generated by an alternator or developed across a resistance or impedance through which alternating current is flowing.

**alternation**—One-half of a cycle—either when an alternating current goes positive and returns to zero, or when it goes negative and returns to zero. Two alternations make one cycle. The complete rise and fall of a current traveling in one direction, or one-half of an alternating-current cycle.

**alternator**—A device for converting mechanical energy into electrical energy in the form of an alternating current.

**alternator transmitter**—A radio transmitter that generates power by means of a radio-frequency alternator.

**altimeter**—An instrument that indicates the altitude of an aircraft above a specific reference level, usually sea level or the ground below the aircraft. It may be similar to an aneroid barometer, which utilizes the change of atmospheric pressure with altitude, or it may be electronic.

**altimeter station**—An airborne transmitter, the emissions from which are used to determine the altitude of an aircraft above the surface of the earth.

**altitude delay**—The synchronization delay introduced between the time of transmission of the radar pulse and the start of the trace on the indicator. This is done to eliminate the altitude circle on the plan-position-indicator display.

**ALU**—Abbreviation for arithmetic and logic unit. 1. A device that performs the basic mathematical operations such as addition, subtraction, multiplication, and division of numbers (usually binary) presented to its inputs and provides an output that is an appropriate function of the inputs. 2. The arithmetic and logic unit internal to the microprocessor chip. This register handles all arithmetic and logical operations carried out as part of a microprocessor instruction. 3. The part of a CPU that executes adds, subtracts, shifts, AND logic operations, OR logic operations, etc. 4. A complex array of gates that can be used to perform binary arithmetic, logic operations, shifts and rotates, and complementing. 5. One of the three essential components of a microprocessor, the other two being data registers and control. The ALU performs addition and subtraction, logic operations, masking, and shifting (multiplication and division).

**alumina**—1. A ceramic used for insulators in electron tubes or substrates in thin-film circuits. It can withstand continuously high temperatures and has a low dielectric loss over a wide frequency range. Aluminum oxide ( $\text{Al}_2\text{O}_3$ ). 2. The substrate material on which are deposited thin conductive and resistive layers for thin-film microwave integrated circuits.

**aluminized-screen picture tube**—A cathode-ray picture tube that has a thin layer of aluminum deposited on the back of its fluorescent surface to improve the brilliance of the image and also prevent ion-spot formation.

**aluminizing**—The process of applying a film of aluminum to a surface, usually by evaporation in a vacuum.

**aluminum-electrolytic capacitor**—A capacitor with two aluminum electrodes (the anode has the oxide film) separated by layers of absorbent paper saturated with the operating electrolyte. The aluminum-oxide film

or dielectric is repairable in the presence of an operating electrolyte.

**aluminum-steel conductor**—A composite conductor made up of a combination of aluminum and steel wires. In the usual construction, the aluminum wires surround the steel.

**alumoweld**—A thin coating of aluminum fused to a steel core. Used in line wire and cable messengers.

**AM**—*See* amplitude modulation.

**amateur**—Also called a ham. 1. A person licensed to operate radio transmitters as a hobby. Any amateur radio operator. 2. A nonprofessional, usually noncommercial, devotee of any technology (as a hobby).

**amateur band**—Any one of several radio frequency bands assigned for noncommercial use by licensed radio amateurs. In the United States, there are twelve such bands between 1.80 MHz and 1.3 GHz. Assignments are made by the Federal Communications Commission.

**amateur call letters**—Call letters and numbers assigned to amateur stations by the licensing authority. Call-letter combinations consist of a letter prefix denoting the country in which the station is situated, plus a number designating the location within the country, and two or more letters identifying the particular station. Example: K2ABC (K or W = United States, 2 = New York, and ABC = identification of individual licensee issued alphabetically except for special circumstances).

**amateur extra license**—A license issued by the FCC to amateur radio operators who are able to send and receive Morse code at the rate of 20 words per minute and who are familiar with general, intermediate, and advanced radio theory and practice. Its privileges include all authorized amateur rights and the exclusive rights to operate on certain frequencies.

**amateur radio**—The practice of operating electronic communications equipment as a hobby in the amateur service. Also refers to the equipment used for this purpose.

**amateur radiocommunication**—Noncommercial radiocommunication by or among radio stations solely with a personal aim and without pecuniary or business interest.

**amateur radio license**—The instrument of authorization issued by the Federal Communications Commission, comprised of a station license and, in the case of the primary station, incorporating an operator license.

**amateur radio operation**—Radiocommunication conducted by an amateur radio operator from an amateur radio station.

**amateur radio operator**—1. A person interested in radio technique solely with a personal aim and without pecuniary interest, and holding a valid Federal Communications Commission license to operate amateur radio stations. 2. A private citizen who operates electronic communications equipment as a hobby.

**amateur radio service**—A radiocommunication service of self-training, intercommunication, and technical investigation carried on by amateur radio operators.

**amateur service**—A radiocommunication service that licensed operators with no pecuniary interest use for self-training, communication, and technical investigations.

**amateur station**—A radio transmitting station operated by one or more licensed amateur operators.

**amateur-station call letters**—*See* amateur call letters.

**ambience**—1. Reverberant or reflected sound that reaches a listener's ear from all directions as sound waves "bounce" successively off the various surfaces of a listening area—the walls, ceiling, etc. The term is usually reserved for large areas such as auditoriums and

concert halls, though home listening-rooms have their own ambience effects. 2. The indirect sounds heard in a concert hall or other large listening area that contribute to the overall auditory effect obtained when listening to live performances.

**ambient**—Surrounding. The surrounding environment coming into contact with the system or component in question. *See also* ambient noise; ambient temperature.

**ambient level**—The level of interference emanating from sources other than the test sample, such as inherent noise of the measuring device and extraneous radiated fields.

**ambient light**—Normal room light. Light existing in a room or other location that is characteristic of the environment.

**ambient-light filter**—A filter used in front of a television picture-tube screen to reduce the amount of ambient light reaching the screen and to minimize the reflections of light from the glass face of the tube.

**ambient lighting**—Lighting designed to provide a substantially uniform level of illumination throughout an area, exclusive of any provision for special local requirements.

**ambient noise**—1. Acoustic noise in a room or other location. Usually measured with a sound-level meter. The term *room noise* commonly designates ambient noise at a telephone station. 2. Unwanted background noise picked up by a microphone, that is, any extraneous clatter in a room. Also any acoustic coloration that influences sounds, brought about by the acoustic properties of a room in which a recording is being made or replayed. 3. Interference present (in a communication line) at all times. 4. Background electrical noise in electrical measurements and operation.

**ambient operating temperature**—The temperature of the air surrounding an object, neglecting small localized variations.

**ambient pressure**—The general surrounding atmospheric pressure.

**ambient temperature**—1. Temperature of air or liquid surrounding any electrical part or device. Usually refers to the effect of such temperature in aiding or retarding removal of heat by radiation and convection from the part or device in question. 2. The prevailing temperature in the immediate vicinity of an object; the temperature of its environment. 3. A temperature within a given volume, e.g., a room or building.

**ambient temperature range**—The range of environmental temperatures in the vicinity of a component or device over which it may be operated safely and within specifications. For forced-air cooled operation, the ambient temperature is measured at the air intake.

**ambiguity**—1. An undesirable tendency of a synchro or servo system to seek a false null position in addition to the proper null position. 2. Inherent error resulting from multiple-bit changes in a polystrophic code. (Proper logic design prevents such errors.)

**ambiguous count**—A count on an electronic scaler that is obviously impossible.

**ambisonic reproduction**—The recreation of the ambience of an original recording situation with associated directionality. Sound from every direction is picked up by a tetrahedral microphone array and is then encoded onto two channels, which, upon decoding, produce sound through several speakers in a continuous range of directions around the listener, thus approximating the original. It can be subdivided into periphonic and pantophonic systems, the former concerning a complete sphere of information, the latter relating to a horizontal circle. Pantophonic reproduction does not distinguish vertical directionality, but still achieves remarkable realism.

**AM broadcast channel**—Any of the 10-kHz wide bands of radio frequencies, which extend from 530 to 1710 kHz and are used for standard amplitude-modulated radio broadcasts.

**American Institute of Electrical Engineers (AIEE)**—Now merged with IRE to form the IEEE.

**American Morse code**—A system of dot-and-dash signals originated by Samuel F. B. Morse and still used to a limited extent for wire telegraphy in North America. It differs from the international Morse code used in radiotelegraph transmission.

**American National Standards Institute, Inc.**—Abbreviated ANSI. An independent, industry-wide association that establishes standards for the purpose of promoting consistency and interchangeability among the products of different manufacturers. Formerly United States of America Standards Institute (USASI) and American Standards Association (ASA).

**American Radio Relay League (ARRL)**—An organization of amateur radio operators.

**American Standards Association**—Abbreviated ASA. *See* American National Standards Institute, Inc.

**American wire gage (AWG)**—The standard system used for designating wire diameter. Gage sizes range from No. 40, the smallest diameter wire, to No. 4/0, the largest. AWG sizes are used for specifying both solid and stranded wire. Gage numbers have an inverse relationship to size, i.e., larger numbers have smaller diameter.

#### American wire gage (AWG)

AWG	Diameter (mm)	AWG	Diameter (mm)
1	7.35	21	0.723
2	6.54	22	0.644
3	5.83	23	0.573
4	5.19	24	0.511
5	4.62	25	0.455
6	4.12	26	0.405
7	3.67	27	0.361
8	3.26	28	0.321
9	2.91	29	0.286
10	2.59	30	0.255
11	2.31	31	0.227
12	2.05	32	0.202
13	1.83	33	0.180
14	1.63	34	0.160
15	1.45	35	0.143
16	1.29	36	0.127
17	1.15	37	0.113
18	1.02	38	0.101
19	0.912	39	0.090
20	0.812	40	0.080

**AM/FM receiver**—A device capable of converting either amplitude- or frequency-modulated signals into audio frequencies.

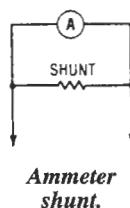
**AM/FM tuner**—A device capable of converting either amplitude- or frequency-modulated signals into low-level audio frequencies.

**AML**—Abbreviation for automatic modulation limiting. A circuit that uses an agc (automatic gain control) effect to prevent overmodulation. As a stronger voice signal is applied, this stage reduces the gain of the

audio amplifier(s), keeping the modulation level below 100 percent.

**ammeter**—An instrument for measuring either direct or alternating electric current. Its scale is usually graduated in amperes, milliamperes, microamperes, or kiloamperes.

**ammeter shunt**—A low-resistance conductor placed in parallel with the meter movement so that most of the current flows through this conductor and only a small part passes through the movement itself. This arrangement extends the usable range of the meter.



Ammeter shunt.

**amorphous**—A characteristic, particularly of a crystal, determining that it has no regular structure.

**amorphous silicon**—A noncrystalline form of silicon used to fabricate transistors on large-area flat displays. Although it is not as good a semiconductor as crystalline silicon, amorphous silicon is much easier to lay down.

**amorphous silicon cell**—A photovoltaic cell made of silicon and hydrogen atoms deposited in an irregular atomic structure on substrate.

**amortisseur winding**—See damper winding.

**amp**—Abbreviation for ampere.

**ampacity**—The maximum current an insulated wire or cable can safely carry without exceeding either the insulation or jacket material limitations. Expressed in amperes. See also current-carrying capacity.

**amperage**—The number of amperes flowing in an electrical conductor or circuit.

**ampere**—Letter symbol: A. 1. A unit of electrical current or rate of flow of electrons. One volt across 1 ohm of resistance causes a current flow of 1 ampere. A flow of 1 coulomb per second equals 1 ampere. An unvarying current is passed through a solution of silver nitrate of standard concentration at a fixed temperature. A current that deposits silver at the rate of 0.001118 gram per second is equal to 1 ampere, or  $6.25 \times 10^{18}$  electrons per second passing a given point in a circuit. 2. The constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular sections, and placed 1 meter apart in a vacuum will produce between these conductors a force equal to  $2 \times 10^{-7}$  newtons per meter of length.

**ampere-hour**—A current of 1 ampere flowing for 1 hour. Multiplying the current in amperes by the time of flow in hours gives the total number of ampere-hours. Used mostly to indicate the amount of energy a storage battery can deliver before it needs recharging, or the energy a primary battery can deliver before it needs replacing. One ampere-hour equals 3600 coulombs.

**ampere-hour capacity**—The amount of current a battery can deliver in a specified length of time under specified conditions. For example, a 100-ampere-hour battery can supply 20 amperes for 5 hours.

**ampere-hour efficiency**—The number of ampere-hours obtained from a storage battery divided by the number of ampere-hours required to recharge the storage battery to its original condition.

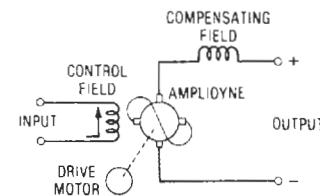
**ampere-hour meter**—An electrical meter that measures and registers the amount or the integral, with respect to time, of the current that passes through it and is consumed in the circuit.

**Ampère's rule**—Current in a certain direction is equivalent to the motion of positive charges in that direction. The magnetic flux generated by a current in a wire encircles the current in the counterclockwise direction when the current is approaching the observer.

**ampere-turn**—A measure of magnetomotive force, especially as developed by an electric current, defined as the magnetomotive force developed by a coil of one turn through which a current of 1 ampere flows; that is, 1.26 gilberts.

**amp-hr**—Abbreviation for ampere-hour or ampere-hours.

**amplidyne**—A special direct-current generator used extensively in servo systems as a power amplifier. The response of its output voltage to changes in field excitation is very rapid, and its amplification factor is high.



Amplidyne.

**amplification**—1. Increase in size of a medium in its transmission from one point to another. May be expressed as a ratio or, by extension of the term, in decibels. 2. An increase in the magnitude of a signal brought about by passing through an amplifier.

**amplification factor ( $\lambda$ )**—1. In a vacuum tube, the ratio of a small change in plate voltage to a small change in grid voltage required to produce the same change in plate current (all other electrode voltages and currents being held constant). 2. In any device, the ratio of output magnitude to input magnitude.

**amplified AGC**—An automatic gain-control (AGC) circuit in which the control voltage is amplified before being applied to the tube or transistor, the gain of which is to be controlled in accordance with the strength of the incoming signal.

**amplified back bias**—Degenerative voltage developed across a fast time-constant circuit within a stage of an amplifier and fed back into a preceding stage.

**amplifier**—1. A device that draws power from a source other than the input signal and that produces as an output an enlarged reproduction of the essential features of its input. The amplifying element may be an electron tube, transistor, magnetic circuit, or any of various devices. 2. A device for increasing the magnitude of a signal by means of a varying control voltage, maintaining the signal's characteristic form as closely as possible to the original. 3. An electronic device for magnifying (and usually controlling) electrical signals. High-fidelity amplifiers consist of a preamplifier equalizer section, plus a power or basic amplifier section. In an integrated amplifier, both sections are built on one chassis and made available as a single unit. Alternately, the two sections are available as separate units. 4. Device for increasing power associated with a signal (voltage or

current). Basic types include dc, ac, audio, linear, radio, video, differential, pulse, logarithmic.

**amplifier noise** — All spurious or unwanted signals, random or otherwise, that can be observed in a completely isolated amplifier in the absence of a genuine input signal.

**amplifier nonlinearity** — 1. The inability of an amplifier to produce an output at all times proportionate to its input. 2. Gain deviation from a straight line on a plot of amplifier output versus input (the transfer curve).

**amplify** — To increase in magnitude or strength, usually said of a current or voltage.

**amplifying delay line** — A delay line used in pulse-compression systems to amplify delayed superhigh-frequency signals.

**amplistat** — A self-saturating type of magnetic amplifier.

**Amplitron** — (Raytheon) A broadband crossed-field amplifier with a reentrant electron stream. The electron stream interacts with the backward wave of a nonreentrant rf structure.

**amplitude** — 1. The magnitude of variation in a changing quantity from its zero value. The word must be modified with an adjective such as peak, rms, maximum, etc., which designates the specific amplitude in question. 2. The level of an audio or other signal in voltage or current terms. 3. The extent to which an alternating or pulsating current or voltage swings from zero or from a mean value.

**amplitude-controlled rectifier** — A rectifier circuit in which a thyratron is the rectifying element.

**amplitude density distribution** — A function that gives the fraction of time that a voltage is within a narrow range.

**amplitude distortion** — Distortion that is present in an amplifier when the amplitude of the output signal fails to follow exactly any increase or decrease in the amplitude of the input signal. It results from nonlinearity of the transfer function and gives rise to harmonic and intermodulation distortion. No amplifier is completely free from the effect because its transfer function is slightly curved. The nature of the curvature determines the order of the distortion produced, but negative feedback and other circuit configurations help minimize the curvature within the dynamic range and hence keep the distortion at a very low level.

**amplitude distribution function** — A function that gives the fraction of time that a time-varying voltage is below a given level.

**amplitude fading** — Fading in which the amplitudes of all frequency components of a modulated carrier wave are uniformly attenuated.

**amplitude-frequency distortion** — The distortion that occurs when the various frequency components of a complex wave are not amplified, attenuated, or transmitted equally well.

**amplitude-frequency response** — The variation of gain, loss, amplification, or attenuation of a device or system as a function of frequency. Usually measured in the region where the transfer characteristic is essentially linear.

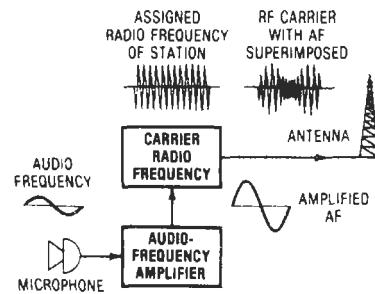
**amplitude gate** — See slicer.

**amplitude-level selection** — The choice of the voltage level at which an oscilloscope sweep is triggered.

**amplitude limiter** — A circuit or stage that automatically reduces the amplification to prevent signal peaks from exceeding a predetermined level.

**amplitude-modulated transmitter** — A transmitter in which the amplitude of its radio-frequency wave is varied at a low frequency rate—usually in the audio or video range. This low frequency is the intelligence (information) to be conveyed.

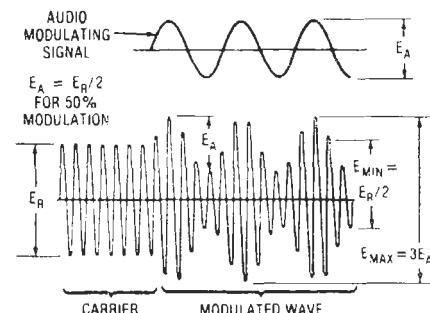
## amplifier noise — amplitude of noise



Amplitude-modulated transmitter.

**amplitude-modulated wave** — A constant-frequency waveform in which the amplitude varies in step with the frequency of an impressed signal.

**amplitude modulation** — Abbreviated AM. 1. Modulation in which the amplitude of a wave is the characteristic subject to variation. Those systems of modulation in which each component frequency ( $f$ ) of the transmitted intelligence produces a pair of sideband frequencies at carrier frequency plus  $f$  and carrier frequency minus  $f$ . In special cases, the carrier may be suppressed; either the lower or upper sets of sideband frequencies may be suppressed; the lower set of sideband frequencies may be produced by one or more channels of information. The carrier may be transmitted without intelligence-carrying sideband frequencies. The resulting emission bandwidth is proportional to the highest frequency component of the intelligence transmitted. 2. A process in which the program information is imposed on a carrier signal of constant frequency by varying its amplitude in proportion to program level. Used on the standard broadcast band (530 to 1710 kHz) and on long-wave and shortwave bands.



Amplitude modulation.

**amplitude-modulation noise level** — Undesired amplitude variations of a constant radio-frequency signal, especially in the absence of any intended modulation.

**amplitude noise** — The effect on radar accuracy of the fluctuations in amplitude of the signal returned by the target. These fluctuations are caused by any change in aspect if the target is not a point source.

**amplitude of noise** — When impulse-type noise is of random occurrence and so closely spaced that the individual waveshapes are not separated by the receiving equipment, then the noise has the waveshape and characteristics of random noise. Random-noise amplitude is proportional to the square root of the bandwidth. If the impulses are separated, the noise no longer has the

waveshape of random noise and its amplitude is directly proportional to the bandwidth of the transmission system.

**amplitude permeability** — The relative permeability at a stated value of field strength and understated conditions, the field strength varying periodically with time and no direct magnetic-field component being present.

**amplitude range** — The ratio, usually expressed in decibels, between the upper and lower limits of program amplitudes that contain all significant energy contributions.

**amplitude resonance** — The condition that exists when any change in the period or frequency of the periodic agency (but not its amplitude) decreases the amplitude of the oscillation or vibration of the system.

**amplitude response** — The maximum output amplitude that can be obtained at various points over the frequency range of an instrument operated under rated conditions.

**amplitude selection** — The process of selecting that portion of a waveform which lies above or below a given value or between two given values.

**amplitude separator** — A television-receiver circuit that separates the control impulses from the video signal.

**amplitude-shift keying** — Abbreviated ask. The modulation of digital information on a carrier by changing the amplitude of the carrier.

**amplitude-suppression ratio** — In frequency modulation, the ratio of the magnitude of the undesired output to the magnitude of the desired output of an FM receiver when the applied signal is simultaneously amplitude and frequency modulated. Generally measured with an applied signal that is amplitude modulated 30 percent at a 400-hertz rate and is frequency modulated 30 percent of the maximum system deviation at a 1000-hertz rate.

**amplitude versus frequency distortion** — Distortion caused by the nonuniform attenuation or gain of the system, with respect to frequency under specified terminal conditions.

**AM rejection ratio** — The ratio of the recovered audio output produced by a desired FM signal with specified modulation, amplitude, and frequency to that produced by an AM signal, on the same carrier, with specified modulation index.

**AM suppression** — The ability of an FM tuner to reject AM signals. Expressed in decibels, it is the ratio between the tuner output with a 100-percent modulation FM signal to its output with a 30-percent modulated AM signal.

**AM tuner** — A device capable of converting amplitude-modulated signals into low-level audio frequencies.

**amu** — Abbreviation for atomic mass unit.

**analog** — 1. In electronic computers, a physical system in which the performance of measurements yields information concerning a class of mathematical problems. 2. Of or pertaining to the general class of devices or circuits in which the output varies as a continuous function of the input. 3. The representation of numerical quantities by means of physical variables, e.g., translation, rotation, voltage, resistance; contrasted with *digital*. 4. A continuous representation of phenomena in terms of points along a scale, each point merging imperceptibly into the next. An analog voltage, for example, may take any value. Real-world phenomena, such as heat and pressure, are analog (compare with *digital*).

**analog adder** — An analog circuit or device that receives two or more inputs and delivers an output that is equal to their sum.

**analog amplifier** — A device whose output is continuously proportional to the input stimulus.

**analog channel** — A computer channel in which the transmitted information can have any value between the defined limits of the channel.

**analog circuit** — A circuit in which the output varies as a continuous function of the input, as contrasted with digital circuits.

**analog communications** — A system of telecommunications employing a nominally continuous electrical signal that varies in frequency, amplitude, etc., in some direct correlation to nonelectrical information (sound, light, etc.) impressed on a transducer.

**analog computer** — 1. A computer operating on the principle of creating a physical (often electrical) analogy of the mathematical problem to be solved. Variables such as temperature, light, pressure, distance, angle, shaft speed, or flow are represented by the magnitude of a physical phenomenon such as voltage or current. The computer manipulates these variables in accordance with the mathematical formulas "analogue" on it. 2. A computer system in which both the input and output are continuously varying signals. 3. A computing machine that works on the principle of measuring, as distinguished from counting. 4. A computer that solves problems by setting up equivalent electric circuits and making measurements as the variables are changed in accordance with the corresponding physical phenomena. An analog computer gives approximate solutions, whereas a digital computer gives exact solutions. 5. A nondigital computer that manipulates linear (continuous) data to measure the effect of a change in one variable on all other variables in a particular problem. (Compare: *digital computer*.)

**analog computing** — Computing system in which continuous signals represent mechanical (or other) parameters.

**analog data** — 1. A physical representation of information such that the representation bears an exact relationship to the original information. The electrical signals on a telephone channel are an analog data representation of the original voice. 2. Data represented in a continuous form, as contrasted with digital data represented in a discrete (discontinuous) form. Analog data is usually represented by physical variables, such as voltage, resistance, rotation, etc.

**analog input module** — An I/O rack module that converts an analog signal from a user device to a digital signal that may be processed by the processor.

**analog meter** — An indicating instrument that employs a movable coil and pointer arrangement (or equivalent) to display values along a graduated scale.

**analog multiplexer** — 1. Circuit used for time-sharing of analog-to-digital converters between a number of different analog information channels. Consists of a group of analog switches arranged with inputs connected to the individual analog channels and outputs connected in common. 2. Two or more analog switches with separate inputs and a common output, with each gate separately controllable. Multiplexing is performed by sequentially turning on each switch one at a time, switching each individual input to a common output. 3. A device that selects one of several analog signals according to a digital code. Analog multiplexers (amux) are available in many forms; their chief application is as a front end in data-acquisition systems, enabling a single analog-to-digital converter to monitor more than one information channel.

**analog network** — A circuit or circuits that represent physical variables in such a manner as to permit the expression and solution of mathematical relationships between the variables, or to permit the solution directly by electric or electronic means.

**analog output**—1. A signal (voltage) whose amplitude is continuously proportionate to the stimulus, the proportionality being limited by the resolution of the device. 2. An output quantity that varies smoothly over a continuous range of values rather than in discrete steps.

**analog panel meter**—See APM.

**analog recording**—A method of recording in which some characteristic of the record current, such as amplitude or frequency, is continuously varied in a manner analogous to the time variations of the original signal.

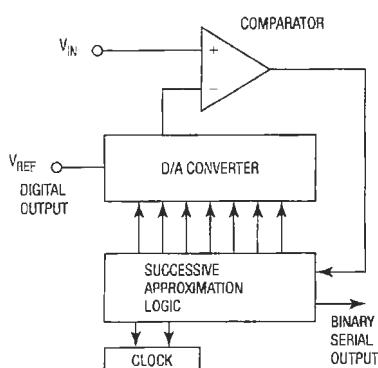
**analog representation**—A representation that does not have discrete values, but is continuously variable.

**analog signal**—1. An electrical signal that varies continuously in both time and amplitude, as obtained from temperature or pressure, or speed transducers. A voltage level that changes in proportion to the change in a physical variable. 2. A signal representing a variable that may be continuously observed and continuously represented.

**analog switch**—1. A device that either transmits an analog signal without distortion or completely blocks it. 2. Any solid-state device, with or without a driver, capable of bilaterally switching voltages or current. It has an input terminal, output terminal, and, ideally, no offset voltage, low *on* resistance, and extreme isolation between the signal being gated and control signals. 3. A means to interconnect two or more circuits whose information is represented in analog form using a network that may or may not be time divided and may or may not consist of linear elements.

**analog-to-digital conversion**—1. The process of converting a continuously variable (analog) signal to a digital signal (binary code) that is a close approximation of the original signal. 2. The process of quantizing a continuous function.

**analog-to-digital converter**—Abbreviated a-d converter, adc, or ADC. 1. A circuit that changes a continuously varying voltage or current (analog) into a digital output. The input may be ac or dc, and the output may be serial or parallel, binary or decimal. 2. Device that translates analog signals (voltages, pressures, etc.) from sensors into numerical digital form (binary, decimal, etc.).



Analog-to-digital converter.

**analog transmission**—Transmission of a continuously variable signal as opposed to a discretely variable one.

**analog value**—A continuously variable value, such as a current or voltage.

## analog output — AND/NOR gate

**Analytical Engine**—An early form of general-purpose digital computer invented in 1833 by Charles Babbage.

**analyzer**—1. An instrument or other device designed to examine the functions of components, circuits, or systems and their relations to each other, as contrasted with an instrument designed to measure some specific parameter of such a system or circuit. 2. Of computers, a routine the purpose of which is to analyze a program written for the same or a different computer. This analysis may consist of summarizing instruction references to storage and tracing sequences of jumps. 3. An instrument that evaluates and/or measures one or more specific parameters (e.g., voltage, current, frequency, logic level, bit time, distortion). 4. A test assembly that checks the performance of, or locates trouble in, electronic equipment. Also called test set and tester.

**anastigmat**—A lens system designed so as to be free from the aberration called astigmatism.

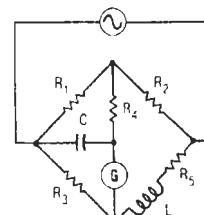
**anchor**—An object, such as a metal rod, set into the ground to hold the end of a guy wire.

**ancillary equipment**—Equipment not directly employed in the operation of a system but necessary for logistic support, preparation for flight, or assessment of target damage; e.g., test equipment, vehicle transport.

**AND circuit**—Synonym for AND gate.

**AND device**—A device that has its output in the logic 1 state if and only if all the control signals are in the logic 1 state.

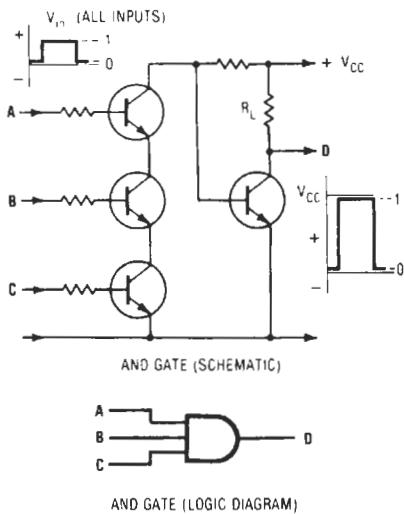
**Anderson bridge**—A bridge normally used for the comparison of self-inductance with capacitance. It is a six-branch network in which an outer loop of four arms is formed by four nonreactive resistors and the unknown inductor. An inner loop of three arms is formed by a capacitor and a fifth resistor in series with each other and in parallel with the arm opposite the unknown inductor. The detector is connected between the junction of the capacitor and the fifth resistor and at that end of the unknown inductor separated from a terminal of the capacitor by only one resistor. The source is connected to the other end of the unknown inductor and to the junction of the capacitor with two resistors of the outer loop. The balance is independent of frequency.



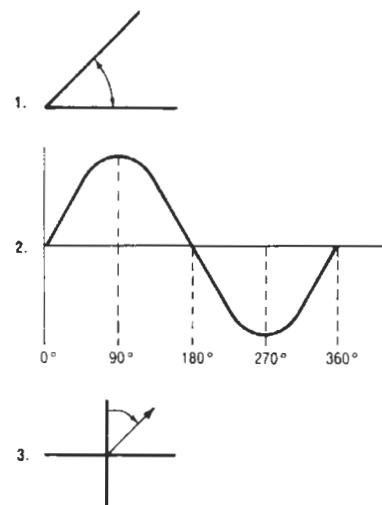
Anderson bridge.

**AND gate**—1. In an electronic computer, a gate circuit with more than one control (input) terminal. No output signal will be produced unless a pulse is applied to all inputs simultaneously. 2. A binary circuit, with two or more inputs and a single output, in which the output is logic 1 only when all inputs are logic 1, and the output is logic 0 if any one of the inputs is logic 0.

**AND/NOR gate**—A single logic element that performs the operation of two AND gates with outputs feeding a NOR gate. No access to the internal logic elements is provided (i.e., no connection is available at the outputs of the AND gates).



AND gate with three inputs.



Angle.

**AND/OR circuit**—A gating circuit that produces a prescribed output condition when several possible combinations of input signals are applied. It exhibits the characteristics of the AND gate and the OR gate.

**android**—1. A mobile mechanism possessing the ability to manipulate objects external to itself under the constant control of its own resident intelligence, operating within guidelines initially established and occasionally updated by a human being, a computer, or some other external intelligence. 2. Automaton of manlike form.

**anechoic**—Nonreflective, producing no echoes.

**anechoic chamber**—1. A room or chamber specially designed to absorb all sound within, thus preventing sound reflections or reverberation. Such rooms are used for evaluation of microphones and speakers. 2. A room lined with material that traps sound waves so the sound is perfectly absorbed and the room is acoustically dead. Such a chamber is used for testing microphones and speakers. 3. A derived term for a room or enclosure that is designed to be echo free over a specified frequency range. Any sound reflections within this frequency range must be less than 10 percent of the source sound pressure.

**anechoic enclosure**—A special echo-free enclosure used for testing audio transducers, in which all wall surfaces have been covered with acoustically absorptive materials so that reflections of the sound waves are eliminated. Also known as a dead room or an anechoic room.

**anechoic room**—A room whose walls have been treated so as to make them absorb a particular kind of radiation almost completely; used for testing components of sound systems, radar systems, etc., in an environment free of reflections.

**anelectronic**—See anelectrotonus.

**anelectrotonus**—The reduced sensitivity produced in a nerve or muscle in the region of contact with the anode when an electric current is passed through it.

**anemometer**—An instrument used for measuring the force or speed of wind.

**angels**—Short-duration radar reflections in the lower atmosphere. Most often caused by birds, insects, organic particles, tropospheric layers, or water vapor.

**angle**—1. A fundamental mathematical concept formed when two straight lines meet at a point. The lines are the sides of the angle, and the point of intersection

is the vertex. 2. A measure of the distance along a wave or part of a cycle, measured in degrees. 3. The distance through which a rotating vector has progressed.

**angle jamming**—An electronic countermeasures technique in which azimuth and elevation information present in the modulation components of the returning echo pulse of a scanning fire-control radar is jammed by transmitting a pulse similar to the radar pulse but with angle information of erroneous phase.

**angle modulation**—Modulation in which the angle of a sine-wave carrier is the characteristic varied from its normal value by modulation. Phase and frequency modulation are particular forms of angle modulation.

**angle noise**—Tracking error introduced into radar by variations in the apparent angle of arrival of the echo from a target due to finite target size. (This effect is caused by variations in the phase front of the radiation from a multiple-point target as the target changes its aspect with respect to the observer.)

**angle of arrival**—Angle made between the line of propagation of a radio wave and the earth's surface at the receiving antenna.

**angle of azimuth**—The angle measured clockwise in a horizontal plane, usually from the north. The north used may be true north, Y-north, or magnetic north.

**angle of beam**—The angle that encloses most of the transmitted energy from a directional-antenna system.

**angle of convergence**—Angle formed by the lines of sight of both eyes when focusing on an object.

**angle of deflection**—The angle formed between the new position of the electron beam in a cathode-ray tube and the normal position before deflection.

**angle of departure**—The angle of the line of propagation of a radio wave with respect to a horizontal plane at the transmitting antenna.

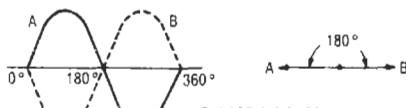
**angle of divergence**—In cathode-ray tubes, a measure of its spread as the electron beam travels from the cathode to the screen. The angle formed by an imaginary center line and the border line of the electron beam. In good tubes, this angle is less than 2°.

**angle of elevation**—The angle between the horizontal plane and the line ascending to the object.

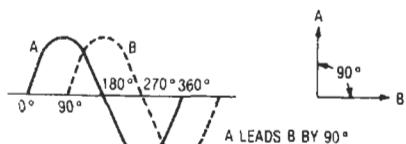
**angle of incidence**—The angle between a wave or beam striking a surface and a line perpendicular to that surface.

**angle of lag — anneal**

**angle of lag**—The angular phase difference between one sinusoidal function and a second having the same frequency. Expressed in degrees, the amount the second function must be retarded to coincide with the first.

*Angle of lag.*

**angle of lead**—1. The time or angle by which one alternating electrical quantity leads another of the same cyclic period. 2. The angle through which the commutator brushes of a generator or motor must be moved from the normal position to prevent sparking.

*Angle of lead, I.*

**angle of radiation**—The angle between the surface of the earth and the center of the beam of energy radiated upward into the sky from a transmitting antenna.

**angle of reflection**—The angle between a wave or beam reflected from a surface and a line perpendicular to that surface. This angle lies in a common plane with the angle of incidence and is equal to it.

**angle of refraction**—The angle between a wave or beam as it passes through a medium and a line perpendicular to the surface of that medium. This angle lies in a common plane with the angle of incidence.

**angle tracking noise**—Any deviation of the tracking axis from the center of reflectivity of a target. The resultant of servo noise, receiver noise, angle noise, and amplitude noise.

**angstrom unit**—A unit of measurement of wavelength of light and other radiation. Equal to one ten-thousandth ( $10^{-4}$ ) of a micrometer or one hundred-millionth of a centimeter ( $10^{-8}$  cm). The visible spectrum extends from about 4000 to 8000 angstrom units. Blue light has a wavelength in the region of 4700 angstroms; yellow, 5800; and red, 6500. A measure of wavelength equal to  $10^{-10}$  meter, or 0.1 nanometer, the preferred term.

**angular acceleration**—The rate at which angular velocity changes with respect to time, generally expressed in radians per second.

**angular accelerometer**—A device capable of measuring the magnitude of, and/or variations in, angular acceleration.

**angular aperture**—The largest angular extent of wave surface that an objective can transmit.

**angular deviation loss**—The ratio of the response of a microphone or speaker on its principal axis to the response at a specified angle from the principal axis (expressed in decibels).

**angular distance**—The angle subtended by two bodies at the point of observation. It is equal to the

distance of wavelengths multiplied by  $2\pi$  radians or by  $360^\circ$ .

**angular frequency**—Frequency expressed in radians per second. It is equal to the number of hertz (cycles per second) multiplied by  $2\pi$ .

**angular length**—Length expressed in radians or equivalent angular measure equal to  $2\pi$  radians, or  $360^\circ$ , multiplied by the length in wavelengths.

**angular momentum**—The momentum that a body has by virtue of its rotational movement.

**angular phase difference**—Phase difference between two sinusoidal functions expressed as an angle.

**angular rate**—The rate of change of bearing.

**angular resolution**—The ability of a radar to distinguish between two targets solely on the basis of angular separation.

**angular velocity**—The rate at which an angle changes. Expressed in radians per second, the angular velocity of a periodic quantity is the frequency multiplied by  $2\pi$ . If the periodic quantity results from uniform rotation of a vector, the angular velocity is the number of radians per second passed over by the rotating vector. Generally designated by the Greek letter omega ( $\omega$ ).

**anharmonic oscillator**—An oscillating system in which the restoring force is a nonlinear function of the displacement from equilibrium.

**anhysteresis**—The process whereby a material is magnetized by applying a unidirectional field upon which is superimposed an alternating field of gradually decreasing amplitude.

**ANIK**—The Canadian domestic satellite system used to transmit the network television feeds of the Canadian Broadcasting Corporation. All ANIK satellites are operated by Telesat Canada of Ottawa. ANIK satellites have both 4-GHz C-band and 12-GHz Ku-band transponders. ANIK means *brother* in Inuit (Eskimo).

**animation**—A moving on-screen representation of the activities taking place in a simulation.

**anion**—1. A negatively charged ion which, during electrolysis, is attracted toward the anode. A corresponding positive ion is called a cation. 2. A negative ion that moves toward the anode in a discharge tube, electrolytic cell, or similar device.

**anisotropic**—1. Describing a substance that exhibits different magnetic, electrical, optical, and other physical properties when measured along axes in different directions. 2. A material that has characteristics such as wave propagation constant, magnetic permeability, conductivity, etc., that vary with direction; that is, not isotropic.

**anisotropic body**—A body in which the value of any given property depends on the direction of measurement, as opposed to a body that is isotropic.

**anisotropic magnet**—A magnetic material having a better magnetic characteristic along the preferred axis than along any other.

**anisotropic material**—A material having preferred orientation so that the magnetic characteristics are superior along a particular axis. This may be as a result of rolling, heat treatment in a magnetic field, or, in the case of some of the sintered magnets, the direction of press.

**anisotropy**—Directional dependence of magnetic properties, leading to the existence of easy or preferred directions of magnetization. Anisotropy of a particle may be related to its shape, to its crystalline structure, or to the existence of strains within it.

**anneal**—1. To heat a metal to a predetermined temperature and then let it cool slowly. This process prevents brittleness and often stabilizes electrical characteristics.

2. To heat and then gradually cool in order to relieve mechanical stresses. Annealing copper makes it softer and less brittle.

**annealed laminations** — Laminations that have been annealed for transformers or choke coils.

**annealed wire** — Wire that has been softened by heating and gradual cooling to remove mechanical stresses.

**annotation** — An added descriptive comment or explanatory note.

**annular** — Ringed; ring-shaped.

**annular conductor** — A conductor consisting of a number of wires stranded in three reversed concentric layers surrounding a saturated hemp core. The core is usually made wholly or mostly of nonconducting material. This construction has the advantage of lower total ac resistance for a given cross-sectional area of conducting material by eliminating the greater skin effect at the center.

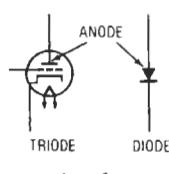
**annular transistor** — A mesa transistor in which the semiconductor regions are arranged in concentric circles about the emitter.

**annulling network** — An arrangement of impedance elements connected in parallel with filters to annul or cancel capacitive or inductive impedance at the extremes of the passband of a filter.

**annunciation relay** — 1. An electromagnetically operated signaling apparatus that indicates whether a current is flowing or has flowed in one or more circuits. 2. A nonautomatic reset device that gives a number of separate visual indications upon the functioning of protective devices, and which may also be arranged to perform a lockout function.

**annunciator** — 1. A visual device consisting of a number of pilot lights or drops. Each light or drop indicates the condition that exists or has existed in an associated circuit and is labeled accordingly. 2. A device for sounding an alarm or attracting attention. The indication is usually aural, but occasionally may be visual or both aural and visual. 3. An alarm-monitoring device that consists of a number of visible signals, such as flags or lamps indicating the status of the detectors in an alarm system or systems. Each circuit in the device is usually labeled to identify the location and condition being monitored. In addition to the visible signal, an audible signal is usually associated with the device. When an alarm condition is reported, a signal is indicated — visible, audible, or both. The visible signal is generally maintained until reset either manually or automatically.

**anode** — 1. The positive electrode, such as the plate of a vacuum tube; the element to which the principal stream of electrons flows. 2. In a cathode-ray tube, the electrodes connected to a source of positive potential. These anodes are used to concentrate and accelerate the electron beam for focusing. 3. The less noble and/or higher-potential electrode of an electrolytic cell, at which corrosion occurs. This may be an area on the surface of a metal or alloy, the more active metal in a cell composed of two dissimilar metals, or the positive electrode of an impressed-current system.



Anode.

**anode-balancing coil** — A set of mutually coupled windings used to maintain approximately equal currents in anodes operating in parallel from the same transformer terminal.

**anode breakdown voltage** — The potential required to cause conduction across the main gap of a gas tube when the starter gap is not conducting and all other tube elements are held at cathode potential.

**anode-bypass capacitor** — Also called plate-bypass capacitor. A capacitor connected between the anode and ground in an electron-tube circuit. Its purpose is to bypass high-frequency currents and keep them out of the load.

**anode characteristic curve** — A graph that shows how the anode current of an electron tube is affected by changes in the anode voltage.

**anode circuit breaker** — A device used in the anode circuits of a power rectifier for the primary purpose of interrupting the rectifier circuit if an arcback should occur.

**anode current** — The electron flow in the element designated as the anode. Usually signifies plate current.

**anode dark space** — In a gas tube, a narrow, dark zone next to the surface of the anode.

**anode dissipation** — The power dissipated as heat in the anode of an electron tube because of the bombardment by electrons and ions.

**anode efficiency** — See plate efficiency.

**anode-load impedance** — See plate-load impedance.

**anode modulation** — See plate modulation.

**anode neutralization** — Also called plate neutralization. A method of neutralization in which a portion of the anode-cathode ac voltage is shifted 180° and applied to the grid-cathode circuit through a neutralizing capacitor.

**anode power input** — See plate power input.

**anode power supply** — The means for supplying power to the plate of an electron tube at a more positive voltage than that of the cathode. Also called plate power supply.

**anode pulse modulation** — See plate pulse modulation.

**anode rays** — Positive ions coming from the anode of an electron tube; these ions are generally due to impurities in the metal of the anode.

**anode saturation** — See plate saturation.

**anode sheath** — A layer of electrons surrounding the anode in mercury-pool arc tubes.

**anode strap** — A metallic connector between selected anode segments of a multicavity magnetron, used principally for mode separation.

**anode supply** — Also called plate supply. The dc voltage source used in an electron-tube circuit to place the anode at a high positive potential with respect to the cathode.

**anode terminal** — 1. In a diode (semiconductor or tube), that terminal to which a positive dc voltage must be applied to forward-bias the diode. Compare with *cathode terminal*. 2. In a diode (semiconductor or tube), that terminal at which a negative dc voltage appears when the diode is employed as an ac rectifier (blocking). 3. That terminal which is internally connected to the anodic element of any device.

**anode voltage** — The potential difference existing between the anode and cathode.

**anode voltage drop (of a glow-discharge, cold cathode tube)** — Difference in potential between cathode and anode during conduction, caused by the electron flow through the tube resistance ( $IR$  drop).

**anodic protection** — Corrosion inhibition based on the electrolytic formation of a protective passive film on

**anodic silver — antenna bandwidth**

metals by applying to them a positive (anodic) potential; e.g., aluminum is anodized (oxidized) by a positive charge in a sulfuric acid solution.

**anodic silver**—A precious metal used in plating; fine silver in different configurations, such as shot, cones, bars, etc., is sacrificed during the silver-plating process.

**anodization**—The formation of an insulating oxide over certain elements, usually metals, by electrolytic action. The most commonly anodized materials are tantalum, aluminum, titanium, and niobium. Anodization is particularly useful where protection of a conductor is required. The base metal can form the conductor and the anodized surface layer can form the insulator.

**anodize**—To deposit a protective coating of oxide on a metal by means of an electrolytic process in which it is used as the anode.

**anodizing**—An electrochemical oxidation process used to improve the corrosion resistance or to enhance the appearance of a metal surface. Aluminum and magnesium parts are frequently anodized.

**anomalous displacement current**—Also called dielectric absorption. The current in addition to the normal leakage current in a circuit containing a capacitor with an imperfect dielectric after the normal charging or discharging current has become negligibly small.

**anomalous photoconductivity**—A spectral phenomenon in which the degree of the photoresponse of an illuminated semiconductor is determined by the wavelength composition of the incident light.

**anomalous propagation**—1. Propagation that is unusual or abnormal. 2. The conduction of UHF signals through atmospheric ducts or layers in a manner similar to that of a waveguide. These atmospheric ducts carry the signals with less than normal attenuation over distances far beyond the optical path taken by UHF signals. Also called superrefraction. 3. In sonar, pronounced and rapid variations in the strength of the echo due to large, rapid focal fluctuations in propagation conditions.

**anonymous FTP (File Transfer Protocol)**—The procedure of connecting to a remote computer as an anonymous or guest user in order to transfer public files back to a local computer. *See also* FTP; protocol.

**A-N radio range**—A navigational aid that provides four equisignal zones for aircraft guidance. Deviation from the assigned course is indicated aurally by the Morse code letters A (--) or N (---). On-course position is indicated by an audible merging of the A and N code signals into a continuous tone.

**ANSI**—American National Standards Institute. The U.S. government organization with responsibility for the development and promulgation of (among others) data processing standards.

**A-N signal**—A radio-range, quadrant-designation signal that indicates to the pilot whether he or she is on course or to the right or left.

**ANSI keyboard**—Abbreviation for American National Standards Institute keyboard. A typewriter standard unit that offers a choice of uppercase characters only or uppercase and lowercase combined.

**ANSI standards**—A series of standards recommended by the American National Standards Institute.

**answerback**—1. The response of a terminal to remote-control signals. 2. A signal sent by a data receiver to a data transmitter indicating that it is ready to receive data or is acknowledging the receipt of data. *See also* handshaking. 3. A reply message from a terminal, manually or automatically initiated, to verify that the right terminal has been accessed and is in operation.

**answerback (W-R-U) system**—A system capable of being remotely controlled by another station. When

tripped by a unique access code, a short predetermined message is broadcast.

**answerback unit**—An electromechanical device used with a teletypewriter set to transmit a predetermined message of not more than 21 characters in response to a request signal. It can transmit either a five-level 7.42 unit code or an eight-level 11.0 unit code at speeds of up to 100 words per minute.

**answering cord**—The cord nearest the face of a telephone switchboard. It is used for answering subscriber's calls and calls on incoming trunks.

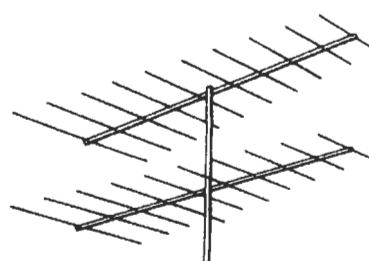
**answering service**—A business that contracts with subscribers to answer incoming telephone calls after a specified delay or when scheduled to do so. It may also provide other services, such as relaying fire or intrusion alarm signals to proper authorities.

**answer lamp**—In a telephone switchboard, a lamp that lights when an answer cord is plugged into a line jack; it extinguishes when the telephone answers and lights when the call is complete.

**answer tone**—Tone signal, with a frequency between 2025 and 2225 Hz and a duration of at least 1.5 s, used by an answering modem to indicate its ready condition to an originating modem.

**antenna**—Also called aerial. 1. That portion, usually wires or rods, of a radio transmitter or receiver station used for radiating waves into or receiving them from space. It changes electrical currents into electromagnetic radio waves, and vice versa. 2. A section of wire or a metallic device designed to intercept radio waves in the air and convert them to an electrical signal for feeding to a receiver. Under relatively difficult reception conditions, such as created by location, terrain, obstructions, etc., an antenna becomes fairly critical and should be one especially designed for its intended purposes. 3. A device for transmitting and receiving radio waves. Depending on their use and operating frequency, antennas can take the form of a single piece of wire, a dipole, a grid such as a yagi array, a horn, a helix, a sophisticated parabolic-shaped dish, or a phase array of active electronic elements of virtually any flat or convoluted surface. 4. A device that collects and focuses electromagnetic energy, i.e., contributes an energy gain. Gain is proportional to surface area for a microwave dish.

**antenna array**—1. A combination of antennas assembled to obtain a desired pickup or rejection pattern. 2. An arrangement of two or more directional antennas, spaced and connected so that they are in phase and their effects are electrically additive.



Antenna array.

**antenna bandwidth**—1. The range of frequencies over which the impedance characteristics of the antenna are sufficiently uniform that the quality of the radiated signal is not significantly impaired. 2. The frequency range

over which a certain antenna characteristic falls within acceptable limits. For instance, an antenna may have a bandwidth of 1 MHz over which the standing-wave ratio is 2:1 or less. 3. The frequency range throughout which an antenna will operate at a specified efficiency without the need for alteration or adjustment.

**antenna beam width**—The angle, in degrees, between two opposite half-power points of an antenna beam.

**antenna coil**—In a radio receiver or transmitter, the inductance through which antenna current flows.

**antenna coincidence**—That instance when two rotating, highly directional antennas are pointed toward each other.

**antenna-conducted interference**—Any signal that is generated within a transmitter or receiver and appears as an undesired signal at the antenna terminals of the device, e.g., harmonics of a transmitter signal, or the local-oscillator signal of the receiver.

**antenna cores**—Ferrite cores of various cross sections for use in radio antennas.



Antenna core.

**antenna coupler**—1. A radio-frequency transformer used to connect an antenna to a transmission line or to connect a transmission line to a radio receiver. 2. A radio-frequency transformer, link circuit, or tuned line used to transfer radio-frequency energy from the final plate-tank circuit of a transmitter to the transmission line feeding the antenna.

**antenna crosstalk**—A measure of undesired power transfer through space from one antenna to another. Usually expressed in decibels, the ratio of power received by one antenna to the power transmitted by the other.

**antenna current**—The radio-frequency current that flows in an antenna.

**antenna detector**—A device consisting of an antenna and electronic equipment to warn aircraft crew members of their being observed by radar sets. The device is usually located in the nose or tail of the aircraft and illuminates a light on one or more panels when radar signals are detected.

**antenna diplexer**—A coupling device that permits several transmitters to share one antenna without troublesome interaction.

**antenna-directivity diagram**—A curve representing, in polar or Cartesian coordinates, a quantity proportional to the gain of an antenna in the various directions in a particular plane or cone.

**antenna disconnect switch**—A safety switch or interlock plug used to remove driving power from the antenna to prevent rotation while work is being performed.

**antenna duplexer**—A circuit or device that permits one antenna to be shared by two transmitters without undesirable interaction.

**antenna effect**—1. Cause of error in a loop antenna due to the capacitance to ground. 2. In a navigational system, any undesirable output signal that results when a directional antenna acts as a nondirectional antenna. 3. The tendency of wires or metallic bodies to act as antennas, i.e., to radiate or pick up radio signals.

**antenna effective area**—In any specified direction, the square of the wavelength multiplied by the power gain (or directional gain) in that direction, and divided by  $4\pi$ . (When power gain is used, the effective area is that for power reception; when directive gain is used, the effective area is that for directivity.)

**antenna efficiency**—The relative ability of an antenna to convert rf energy from a transmitter into electromagnetic waves. If the gain rating of a directional antenna is 10 dB, for example, it is often assumed that the effective radiated power will be 10 times greater than the rf power fed to it. However, if the antenna efficiency is, say, 50 percent, a loss of 3 dB, the true gain will be only 7 dB ( $10 - 3 = 7$  dB).

**antenna elevation**—The physical height of an antenna above the earth.

**antenna factor**—The value of decibel that must be added to a two-terminal voltmeter reading to obtain the actual induced antenna open-circuit voltage or the electric-field strength.

**antenna farm**—A large plot of ground (5 to 2000 acres) surrounding a radio transmitting or receiving station that provides space and adequate clearance for the installation of several large antennas, such as rhombic antennas.

**antenna field**—1. The region defined by a group of antennas. 2. A group of antennas placed in a geometric configuration that is specific for a particular trajectory measuring system. 3. The effective free-space energy distribution produced by an antenna or group of antennas.

**antennafier**—An integrated low-profile antenna and amplifier for use with compact, portable communications systems.

**antenna front-to-back ratio**—The ratio of field strength in front of a directional antenna (i.e., directly forward in the line of maximum directivity) to the field strength in back of the antenna (i.e.,  $180^\circ$  from the front). Measured at a fixed distance from the radiator.

**antenna gain**—1. The effectiveness of a directional antenna in a particular direction, compared against a standard (usually an isotropic antenna). The ratio of standard antenna power to the directional antenna power that will produce the same field strength in the desired direction. 2. The increase in signal level at the antenna terminals with reference to the level at the terminals of a half-wave dipole antenna, expressed in decibels. 3. For a given antenna, the ratio of signal strength (received or transmitted) to that obtained with a simple dipole antenna.

**antenna ground system**—That portion of an antenna closely associated with the earth and including an extensive conducting surface, which may be the earth itself.

**antenna height**—The average height above the terrain from 2 to 10 miles (3.2 to 16 km) from the antenna. In general, the antenna height will be different in each direction from the antenna. The average of these various heights is considered the antenna height above average terrain.

**antenna height above average terrain**—The height of the center of radiation of an antenna above an averaged value of the elevation above sea level for the surrounding terrain.

**antenna illumination**—Describes how a feedhorn “sees” the surface of a dish as well as the surrounding terrain.

**antenna impedance**—The impedance an antenna presents to a transmitter or receiver at the attachment point of the transmission line or feeder. It varies from about 50 to 600 ohms, depending on antenna type and installation.

**antenna induced microvolts**—The voltage that exists across the open-circuited antenna terminals, as calculated from a measurement.

**antenna lens**—An arrangement of metal vanes or dielectric material used to focus a microwave beam in a manner similar to an optical lens.

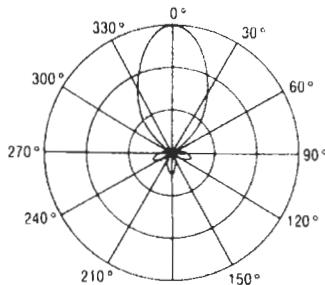
**antenna lobe**—*See* lobe.

**antenna matching**—Selection of components to make the impedance of an antenna equal to the characteristic impedance of its transmission line.

**antennamitter**—An integrated low-profile antenna and oscillator for use with compact, portable communications systems.

**antenna pair**—Two antennas located on a base line of accurately surveyed length. The signals received by these antennas are used to determine quantities related to a target position.

**antenna pattern**—Also called antenna polar diagram. A plot of angle versus free-space field intensity at a fixed distance in the horizontal plane passing through the center of the antenna.



Antenna pattern.

#### antenna-pattern measuring equipment

Devices used to measure the relative field strength or intensity existing at any point or points in the space immediately surrounding an antenna.

**antenna pedestal**—A structure that supports an antenna assembly (motors, gears, synchros, rotating joints, etc.).

**antenna polar diagram**—*See* antenna pattern.

**antenna polarization**—The position of an antenna, with respect to the surface of the earth, that determines the wave polarization for which the antenna is most efficient. A vertical antenna radiates and receives vertically polarized waves; a horizontal antenna radiates and receives horizontally polarized waves broadside to itself and vertically polarized waves at high angles off its ends.

**antenna power**—The square of the antenna current of a transmitter, multiplied by the antenna resistance at the point where the current is measured.

**antenna power gain**—The power gain of an antenna in a given direction is four times the ratio of the radiation intensity in that direction to the total power delivered to the antenna. (The term is also applied to receiving antennas.)

**antenna preamplifier**—A low-noise rf amplifier, usually mast-mounted near the terminals of the receiving antennas, used to compensate for transmission-line loss and thereby improve the overall noise figure.

**antenna reflector**—In a directional-antenna array, an element that modifies the field pattern in order to reduce the field intensity behind the array and increase

it in front. In a receiving antenna, the reflector reduces interference from stations behind the antenna.

**antenna relay**—A relay used in radio stations to automatically switch the antenna to the receiver or transmitter and thus protect the receiver circuits from the rf power of the transmitter.

**antenna resistance**—The total resistance of a transmitting antenna system at the operating frequency. The power supplied to the entire antenna circuit, divided by the square of the effective antenna current referred to the feed point. Antenna resistance is made up of such components as radiation resistance, ground resistance, radio-frequency resistance of conductors in the antenna circuit, and equivalent resistance due to corona, eddy currents, insulator leakage, and dielectric power loss.

**antenna resonant frequency**—The frequency (or frequencies) at which an antenna appears to be a pure resistance.

**antenna stabilization**—A system for holding a radar beam steady despite the roll and pitch of a ship or airplane.

**antenna structure**—A structure that includes the radiating system, its supporting structures, and appurtenances mounted thereon.

**antenna switch**—Switch used for connecting an antenna to or disconnecting it from a circuit.

**antenna system**—An assembly consisting of the antenna and the necessary electrical and mechanical devices for insulating, supporting, and/or rotating it.

**antenna terminals**—On an antenna, the points to which the lead-in (transmission line) is attached.

**antenna tilt error**—The angular difference between the antenna tilt angle shown on the mechanical indicator and the electrical center of the radar beam.

**antennavertor**—A receiving antenna and converter combined in a single unit that feeds directly into the receiver IF amplifier.

**antenna wire**—A wire, usually of high tensile strength, such as copperweld, bronze, etc., with or without insulation, used as an antenna for radio and electronic equipment.

**antiaircraft missile**—A guided missile launched from the surface against an airborne target.

**anti-aliasing**—The smoothing or removal of diagonal lines in digitized images at low resolutions that appear as stair-steps in order to recreate smoother diagonal lines.

**anti-aliasing filter**—A filter (normally low pass) that band-limits the input signal before sampling to less than half the sampling rate to prevent aliasing noise.

**anticapacitance switch**—A switch with widely separated legs, designed to keep capacitance at a minimum in the circuits being switched.

**anticathode**—Also called target. The target of an X-ray tube on which the stream of electrons from the cathode is focused and from which the X-rays are radiated.

**anticlutter circuit**—In a radar receiver, an auxiliary circuit that reduces undesired reflection in order to permit the detection of targets that otherwise would be obscured by such reflections.

**anticlutter gain control**—A device that automatically and gradually increases the gain of a radar receiver from low to maximum within a specified period after each transmitter pulse. In this way, short-range echoes producing clutter are amplified less than long-range echoes.

**anticoincidence**—A nonsimultaneous occurrence of two or more events (usually, ionizing events).

**anticoincidence circuit**—1. A counter circuit that produces an output pulse when either of two input circuits receives a pulse, but not when the two inputs receive

pulses simultaneously. 2. A circuit that provides an output only when all inputs are absent; a NAND circuit.

**anticollision radar** — A radar system used in an aircraft or ship to warn of possible collision.

**antiferroelectricity** — The property of a class of crystals that also undergo phase transitions from a higher to a lower symmetry. They differ from the ferroelectrics in having no electric dipole moment.

**antiferroelectric materials** — Those materials in which spontaneous electric polarization occurs in lines of ions; adjacent lines are polarized in an antiparallel arrangement.

**antiferromagnetic materials** — Those materials in which spontaneous magnetic polarization occurs in equivalent sublattices; the polarization in one sublattice is aligned antiparallel to the other.

**antiferromagnetic resonance** — The absorption of energy from an oscillating electromagnetic field by a system of processing spins located on two sublattices, with the spins on one sublattice going in one direction and the spins on the other sublattice in the opposite direction.

**antiferromagnetism** — A phenomenon of magnetism characterized by the elimination of magnetic moments and decrease in magnetic susceptibility with a decrease in temperature due to the equal power of atomic magnets.

**antihunt** — A stabilizing signal or equalizing circuit used in a closed-loop feedback system of a servomechanism to prevent the system from hunting, or oscillating. Special types of antihunt circuits are the anticipator, derivative, velocity feedback, and damper.

**antihunt circuit** — A circuit used to prevent excessive correction in a control system.

**antihunt device** — A device used in positioning systems to prevent hunting, or oscillation, of the load around an ordered position. The device may be mechanical or electrical. It usually involves some form of feedback.

**antijamming** — 1. Minimizing the effect of enemy electronic countermeasures to permit echoes from targets detected by radar to be visible on the indicator. 2. Controls or circuit features incorporated to minimize jamming.

**antijamming radar data processing** — Use of data from one or more radar sources to determine target range in the presence of jamming.

**antilogarithm** — The number from which a given logarithm is derived. For example, the logarithm of 4261 is 3.6295. Therefore the antilogarithm of 3.6295 is 4261.

**antimagnetic** — Made of alloys that will not remain in a magnetized state.

**antimicrophonic** — Specifically designed to prevent microphonics. Possessing the characteristic of not introducing undesirable noise or howling into a system.

**antimissile missile** — A missile that is launched to intercept and destroy another missile in flight.

**antinode** — The point on a transmission line at which the current is maximum and the voltage is minimum.

**antinodes** — Also called loops. The points of maximum displacement in a series of standing waves. Two similar and equal wave trains traveling at the same velocity in opposite directions along a straight line result in alternate antinodes and nodes along the line. Antinodes are separated from their adjacent nodes by half the wavelength of the wave motion.

**antinoise carrier-operated device** — A device commonly used to mute the audio output of a receiver during standby or no-carrier periods. Usually the automatic volume control voltage is used to control a squelch tube which, in turn, controls the bias applied to the first audio tube so that it is permitted to operate only when a

carrier is present at the receiver input. Thus, the receiver output is heard when a signal is received, and is muted when no signal is present.

**antinoise microphone** — A microphone that discriminates against acoustic noise. A lip or throat microphone is an example.

**antiphase** — Two identical signals disposed in 180° phase opposition. When superimposed, they tend to cancel each other because their waveform patterns are of equal magnitude but opposite polarity.

**antiproton** — An elementary atomic particle that has the same mass as a proton but is negatively charged.

**antirad** — A material that inhibits damage caused by radiation.

**antiresonance** — A type of resonance in which a system offers maximum impedance at its resonant frequency.

**antiresonant circuit** — A parallel resonant circuit offering maximum impedance to the series passage of the resonant frequency.

**antiresonant frequency** — 1. The frequency at which the impedance of a system is very high. 2. Of a crystal unit, the frequency for a particular mode of vibration at which, neglecting dissipation, the effective impedance of the crystal unit is infinite.

**antisidetone** — 1. In a telephone circuit, special circuits and equipment that are so arranged that only a negligible amount of the power generated in the transmitter reaches the associated receiver. 2. Pertaining to the reduction or elimination of interference in telephone circuits between the microphone and earphone of the same telephone.

**antisidetone circuit** — A telephone circuit that prevents sound, introduced in the local transmitter, from being reproduced in the local receiver. (Reduces sidetones.)

**antisidetone induction coil** — An induction coil designed for use in an antisidetone telephone set.

**antisidetone telephone set** — A telephone set with an antisidetone circuit.

**antiskating bias** — A bias force applied to a pivoted pickup arm to counteract the inward force (toward the center of the record) resulting from the drag of the stylus in the groove and the offset angle of the head.

**antiskating device** — A mechanism found on modern phonograph pickups that provides a small outward force on a pickup arm. This counteracts the arm's tendency to move toward the turntable center (inward) due to offset geometry, and reduces stylus/groove friction.

**antistatic agents** — Methods employed to minimize static electricity in plastic materials. Such agents are of two basic types. Metallic devices that come into contact with the plastics and conduct the static to earth give complete neutralization initially, but because it is not modified, the surface of the material can become prone to further static accumulation during subsequent handling. Chemical additives, which are mixed with the compound during processing, give a reasonable degree of protection to the finished products.

**antistatic cleaner** — Substance used on phonograph records that helps to prevent the buildup of a static charge that attracts dust.

**antistatic coating** — 1. An electrically conductive layer for carrying off static charges that could accumulate on a surface. 2. A conductive coating applied to a TV or monitor screen (or on a glass panel immediately in front of the screen) that conducts away any static charge and prevents dust from adhering to the surface of the television.

**antistatic sprays** — Chemical agents which, when applied to circuits and plastic surfaces, leave a conductive

coating that acts to repel dust and dirt and changes surface characteristics. Good antistatic sprays will leave a resistivity reading of 20 to 100 megohms per square inch ( $3\text{--}15 \text{ M}\Omega/\text{cm}^2$ ) on plastics and 100 megohms or more per square inch on glass surfaces. *See* static eliminators.

**antistickoff voltage** — A small voltage, usually applied to the rotor winding of the coarse synchro control transformer in a two-speed system. The antistickoff voltage acts to eliminate the possibility of ambiguous behavior in the system.

**antitransmit-receive box** — A second transmit-receive switch used in a radar antenna system to minimize absorption of the echo signal in the transmitter circuit during the interval between transmitted pulses.

**antitransmit-receive switch** — Abbreviated atr switch. An automatic device employed in a radar system to prevent received energy from being absorbed in the transmitter.

**antitransmit-receive tube** — *See* atr tube.

**antivoice-operated transmission** — A method of radiocommunication in which a voice-activated circuit prevents the operation of the transmitter during reception of messages on an associated receiver.

**aperiodic** — 1. Having no fixed resonant frequency or repetitive characteristics or no tendency to vibrate. A circuit that will not resonate within its tuning range is often called aperiodic. 2. Not characterized by predictable periods or steps.

**aperiodic antenna** — An antenna designed to have a constant impedance over a wide frequency range (for example, a terminated rhombic antenna) due to the suppression of reflections within the antenna system.

**aperiodic damping** — Also called overdamping. The condition of a system when the amount of damping is so large that when the system is subjected to a single disturbance, either constant or instantaneous, the system comes to a position of rest without passing through that position. Although an aperiodically damped system is not strictly an oscillating system, it has such properties that it would become an oscillating system if the damping were sufficiently reduced.

**aperiodic function** — A function having no repetitive characteristics and not repeatable within a specified period.

**aperiodic waveform** — A nonrepeating, random, one-shot waveform.

**aperture** — 1. In a unidirectional antenna, that portion of the plane surface which is perpendicular to the direction of maximum radiation and through which the major part of the radiation passes. 2. In an opaque disc, the hole or window placed on either side of a lens to control the amount of light passing through. 3. Also called aperture time. The amount of certainty about the exact time when the encoder input was at the value represented by a given output code. In general, the aperture is equal to the conversion time; it may be reduced by the use of sample-and-hold circuits. 4. In an electron gun, the opening that determines the size of, and has an effect on, the shape of the electron beam. In television optics, it is the effective diameter of the lens that controls the amount of light reaching the photoconductive or photoemitting image pickup tube. 5. An opening that will pass light, electrons, or other forms of radiation.

**aperture antenna** — A type of antenna whose beam width is determined by the dimensions of a horn, lens, or reflector.

**aperture compensation** — Reduction of aperture distortion by boosting the high-frequency response of a television-camera video amplifier.

**aperture correction** — Compensation for the loss in sharpness of detail because of the finite dimensions of a scanning beam in the horizontal dimension.

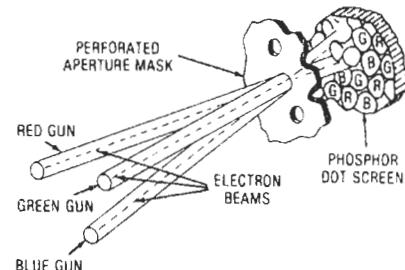
**aperture delay time** — The time elapsed from the application of the hold (or encode) command until the sampling switch in a sample-and-hold circuit opens fully and the device actually takes the sample. Aperture delay time is a fixed delay time and is normally not an error source since the hold clock edge can be advanced to compensate for it.

**aperture distortion** — In a television signal, the distortion due to the finite dimension of the camera-tube scanning beam. The beam covers several mosaic globules simultaneously, resulting in a loss of picture detail.

**aperture illumination** — The field distribution in amplitude and phase through the aperture.

**aperture jitter** — Also called aperture uncertainty time. 1. In a sample-and-hold circuit, the time variation or uncertainty with which the switch opens, or the time variation in aperture delay. 2. A source of error in a sampling system, which determines the maximum slew rate limitation of the sampled analog input signal for a given system resolution.

**aperture mask** — Also called shadow mask. A thin sheet of perforated material placed directly behind the viewing screen in a three-gun color picture tube to prevent the excitation of any one color phosphor by either of the two electron beams not associated with that color.



Aperture mask.

**aperture plate** — A ferrite memory plate containing a large number of uniformly spaced holes arranged in parallel rows and interconnected by plated conductors to provide a magnetic memory plate.

**aperture time** — 1. In a sample-and-hold circuit, the averaging time of a sample-hold during the sample-to-hold transition. 2. The time required by a sample-and-hold device to go from the sample mode into the hold mode, once the hold command has been received. The aperture time is generally a few nanoseconds, measured from the 50-percent point of the mode-control transition to the time when the output stops tracking the input. *See* aperture, 3.

**aperture-time uncertainty** — The possible variation in aperture time from one sample-to-hold transition to the next.

**APL** — Abbreviation for average picture level. The average luminance level of the part of a television line between blanking pulses.

**APM** — Abbreviation for analog panel meter. A scale-and-pointer meter capable of indicating a continuous, rather than incremental, range of values from zero to the rated full-scale value.

**apogee** — The point in an elliptical satellite orbit that is farthest from the surface of the earth. Geosynchronous satellites that maintain circular orbits around the earth are

first launched into highly elliptical orbits with apogees of 22,237 miles. When the communication satellite reaches the appropriate apogee, a rocket motor is fired to place the satellite into its permanent circular orbit of 22,237 miles. *Also see perigee.*

**A positive (A+ or A plus)**—1. Positive terminal of a battery or positive polarity of any other sources of voltage. 2. The terminal to which the positive side of the filament-voltage source of a vacuum tube should be connected.

**A power supply**—A power supply used as a source of heating current for the cathode or filament of a vacuum tube.

**apparatus**—1. Any complex device. 2. Equipment or instruments used for a specific purpose.

**apparatus wire and cable**—Insulated wire and cable used in connecting electrical apparatus to a power source, also including wire and cable used in the apparatus itself.

**apparent bearing**—The direction from which the signal arrives with respect to some reference direction.

**apparent power**—In an ac circuit, the power value obtained by simple multiplication of current by voltage with no consideration of the effect of phase angle. (Compare with *true power*.)

**apparent power loss**—For voltage-measuring instruments, the product of nominal end-scale voltage and the resulting current. For current-measuring instruments, the product of the nominal end-scale current and the resulting voltage. For other types of instruments (for example, wattmeters), the apparent power loss is expressed for a stated value of current or voltage. Also called volt-ampere loss.

**apparent source**—*See effective acoustic center.*

**Applegate diagram**—A graphical representation of electron bunching in a velocity-modulated tube, showing their positions along the drift space. This bunching is plotted on the vertical coordinate, against time along the horizontal axis.

**applet**—A small computer program that performs a simple task.

**AppleTalk**—A networking protocol developed by Apple Computer for communication between Apple Computer products and other computers. This protocol is independent of what network it is layered on.

**Appleton layer**—In the ionosphere, a region of highly ionized air capable of reflecting or refracting radio waves back to earth. It is made up of the F<sub>1</sub> and F<sub>2</sub> layers.

**apple tube**—A color-television picture tube in which the three colors of phosphors are laid in fine vertical strips along the screen. The intensity of the electron beam is modulated as it sweeps over them so that each color is produced with appropriate brightness.

**appliance**—Any electrical equipment used in the home and capable of being operated by a nontechnical person. Included are units that perform some task that could be accomplished by other, more difficult means, but usually not those used for entertainment (radios, TVs, hi-fi sets, etc.).

**appliance wire and cable**—A classification of Underwriters' Laboratories, Inc., covering insulated wire and cable intended for internal wiring of appliances and equipment. Each construction satisfies the requirements for use in particular applications.

**application**—1. The use of a computer for a specific purpose, e.g., designing a brochure or writing a letter. 2. System or problem to which a computer is applied. An application may be of the computational type, in which arithmetic computations predominate, or of the data-processing type, in which data-handling operations predominate. *See also application program.*

**application factor**—A modifier of the failure rate. It is based on deviations from rated operating stress (usually temperature and one electrical parameter).

**application-oriented language**—1. A programming language that is primarily useful in some specialized area. 2. A problem-oriented programming language whose statements resemble or contain the terminology of the computer user.

**application program**—1. A computer program intended to solve a problem or do a job, as distinct from systems programs, which control the operations of the computer system. 2. A computer program that performs a data-processing function rather than a control operation. 3. A program used to perform some logical or computational task that is important to the user rather than some internal computer function. 4. Software designed for a specific purpose, such as accounts payable, inventory, payroll, and word processing. 5. A computer program that accomplishes specific tasks, such as word processing.

**application schematic diagram**—Pictorial representation using symbols and lines to illustrate the interrelation of a number of circuits.

**application-specific integrated circuit**—*See ASIC.*

**applications software**—1. A program that depends on the specific end application and is used to do the real work or apparent work that is visible to the user. Generally this is the software that is used for dedicated computer-based systems (systems designed to perform a single or specific set of functions). Typical applications include food and chemical processing, production control, automotive electronics, computer-controlled sewing machines, photographic equipment (both for computer-controlled cameras and for darkroom computerized processing), energy distribution systems, word processing, mailing lists, payrolls, and inventory. 2. Computer programs that perform specific tasks, such as word processing or database management.

**applicators (applicator electrodes)**—1. In dielectric heating, the electrodes between which the dielectric item is placed and the electrostatic field developed. 2. Appropriately shaped conducting surfaces between which an alternating electric field is established for the purpose of producing dielectric heating. 3. In medical electronics, the electrodes applied to a patient undergoing diathermy or ultrasonic therapy.

**applied voltage**—1. The potential between a terminal and a reference point in any circuit or device. 2. The voltage obtained when measuring between two given points in a circuit with voltage applied to the complete circuit. 3. The voltage presented to a circuit point or system input, as opposed to the voltage drop resulting from current through an element that results from the applied voltage.

**applique circuit**—A special circuit provided to modify existing equipment in order to allow for some special usage.

**approach-control radar**—Any radar set or system used in a ground-controlled approach system, e.g., an airport-surveillance radar, precision approach radar, etc.

**approach path**—In radio aircraft navigation, that portion of the flight path in the immediate vicinity of a landing area where such a flight path terminates at the touchdown point.

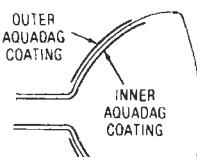
**approved circuit**—*See protected wireline distribution system.*

**APT**—Abbreviation for automatically programmed tool. A high-level or simplified programming language.

**AQL**—Abbreviation for acceptable quality level. A statistically defined quality level, in terms of percent defective accepted on an average of 95 percent of the

time. In other words, a sampling plan with 1 percent AQL passes (accepts) lots 1 percent defective 95 percent of the time.

**aquadag layer**—Trademark of Acheson Industries, Inc. A conductive graphite coating on the inner side walls of some cathode-ray tubes. It serves as an electrostatic shield or as a postdeflection and an accelerating anode. Also applied to outer walls and grounded; here it serves, with the inner coating, as a capacitor to filter the applied high voltage.



Aquadag coating.

**arbiter**—The section of a multiprocessor network's operating system that resolves simultaneous system-resource requests.

**arbitrary function fitter**—A circuit having an output voltage or current that is a presettable, adjustable, usually nonlinear function of the input voltage(s) or current(s) fed to it.

**arbitrary waveform generator**—See waveform generator.

**arbor**—See mandrel.

**arc**—1. A luminous discharge of electricity through a gas. Characterized by a change in space potential in the immediate vicinity of the cathode; this change is approximately equal to the ionization potential of the gas. 2. A prolonged electrical discharge, or series of prolonged discharges, between two electrodes. (Both produce a bright-colored flame, as contrasted with a dim corona-glow discharge). 3. To form an arc. 4. The electric current in a flamelike stream of incandescent gas particles. 5. An electric current through air or across the surface of an insulator associated with high voltage; usually occurs when a contact is opened, or when deenergizing an inductive load.

**arcback**—Also called backfire. Failure of the rectifying action in a tube, resulting from the flow of a principal electron stream in the reverse direction due to the formation of a cathode spot on the anode. This action limits the peak inverse voltage that may be applied to a particular rectifier tube.

**arc converter**—A form of oscillator utilizing an electric arc to generate an alternating or pulsating current.

**arc discharge**—1. A discharge between electrodes in gas or vapor. Characterized by a relatively low voltage drop and a high current density. 2. The sustained, luminous thermionic discharge between anode and cathode in a gas-filled tube.

**arc-discharge tube**—A gas-filled or mercury-vapor tube that utilizes ionic phenomena for switching, voltage regulation, or rectification.

**arc drop**—The voltage drop between the anode and cathode of a gas rectifier tube during conduction.

**arc-drop loss**—In a gas tube, the product of the instantaneous values of arc-drop voltage and current averaged over a complete cycle of operation.

**arc-drop voltage**—The voltage drop between the anode and cathode of a gas rectifier tube during conduction.

## aquadag layer — arc-through

**arc failure**—1. A flashover in the air near an insulation surface. 2. An electrical failure in the surface heated by a flashover arc. 3. An electrical failure in the surface damaged by the flashover arc.

**arc function**—An inverse trigonometric function.

**arc furnace**—An electric furnace heated by arcs between two or more electrodes.

**architecture**—1. Organizational structure of a computing system, mainly referring to the CPU or microprocessor. 2. The manner in which the basic computer functions are organized and partitioned on the silicon chips. 3. The manner in which a system (such as a network or a computer) or program is structured.

**archival**—Pertaining to long-term storage of data.

**archival backup**—Backing up only files that have been changed since the last backup.

**archive**—1. A procedure for transferring information from an online storage diskette or memory area to an offline storage medium. 2. To copy computer programs and data onto an auxiliary storage medium, such as a disk or tape, for long-term retention.

**arcing**—The production of an arc, e.g., at the brushes of a motor or at the contact of a switch.

**arcing contacts**—Special contacts on which the arc is drawn after the main contacts of a switch or circuit breaker have opened.

**arcing time**—1. The interval between the parting, in a switch or circuit breaker, of the arcing contacts and the extension of the arc. 2. The time elapsing, in a fuse, from the severance of the fuse link to the final interruption of the circuit under the specified condition.

**arc lamp**—Source of brilliant artificial light obtained by an electric arc passing between two carbon rods. The arc is struck by bringing the two rods together and then rapidly separating them. As the arc burns, the carbon rods are vaporized away. A mechanism is employed to keep the space between the two rods constant. This type of lamp is used extensively in motion picture projectors and spotlights. The illumination of the arc lamp is derived from the incandescence of the positive electrode and from the heated, luminous, ionized gases or vapor that surround the arc.

**arc oscillator**—A negative-resistance oscillator comprising a sustained dc arc and a resonant circuit.

**arcovet**—The (usually abrupt) creation of an arc between electrodes, contacts, or plates of a capacitor.

**arcovet resistance**—The resistance of a material to the effects of a high-voltage, low-current arc (under prescribed conditions) passing across the surface of the material. The resistance is stated as a measure of total elapsed time required to form a conductive path on the surface (material carbonized by the arc).

**arcovet voltage**—Under specified conditions, the minimum voltage required to create an arc between electrodes separated by a gas or liquid insulation.

**arc percussive welding**—A type of welding in which the materials to be welded are separated by a gap, across which an arc is struck; the arc melts the surfaces of the materials, and the materials are simultaneously brought together. See also pulse arc welding.

**arc resistance**—The length of time that a material can resist the formation of a conductive path by an arc adjacent to the surface of the material. Also called tracking resistance.

**arc suppressor**—A device, or combination of devices, used for arc suppression. See spark suppressor.

**arc-through**—In a gas tube, a loss of control with the result that a principal electron stream flows in the normal direction during what should be a nonconducting period.

**area code**—A three-digit number code identifying one of the geographic areas of the United States, Canada, and Mexico to permit direct distance dialing on the telephone system. The area code precedes the central office code in the complete 10-digit telephone number, and must be used when the called telephone is in a numbering plan area different from that of the calling telephone. The first digit of the area code is never a 1 or 0. *See also* direct distance dialing.

**area protection**—Protection of the inner space or volume of a secured area by means of a volumetric sensor.

**area redistribution**—A method of measuring the duration of irregularly shaped pulses. A rectangle is drawn having the same peak amplitude and the same area as the original pulse under consideration. Because the same time units are used in measuring the original and the new pulse, the width of the rectangle is considered the duration of the pulse.

**area sensor**—A sensor with a detection zone that approximates an area, such as a wall surface or the exterior of a safe.

**A register**—The accumulator for all arithmetical operations in a computer. Also called A accumulator.

**argon**—An inert gas used in discharge tubes and some electric lamps. It gives off a purple glow when ionized; its symbol is Ar.

**argon glow lamp**—A glow lamp containing argon gas that produces a pale blue violet light.

**argument**—1. A variable upon which the value of a function depends. The arguments of a function are listed in parentheses after the function name. The computations specified by the function definition are made with the variables specified as arguments. 2. The number that a function works on to produce its results. 3. The independent variable of a function. Arguments can be passed as part of a subroutine call where they would be used in that subroutine.

**arithmetic and logic unit**—Computer element that can perform the basic data manipulations in the central processor. Usually it can add, subtract, complement, negate, rotate, AND, and OR. Abbreviated ALU.

**arithmetic capability**—The ability to do addition, subtraction, and in some cases multiplication and division.

**arithmetic check**—A check of a computation making use of the arithmetical properties of the computation.

**arithmetic element**—Synonym for arithmetic unit.

**arithmetic mean**—1. Usually, the same as *average*. It is obtained by first adding quantities together and then dividing by the number of quantities involved. 2. A figure midway between two extremes and is found by adding the minimum and maximum together and dividing by two.

**arithmetic operation**—1. In an electronic computer, the operations in which numerical quantities form the elements of the calculation, including the fundamental operations of arithmetic (addition, subtraction, multiplication, comparison, and division). 2. Adding, subtracting, incrementing, or decrementing data in registers or memory.

**arithmetic organ**—*See* arithmetic unit.

**arithmetic shift**—In a digital computer, the multiplication or division of a quantity by a power of the base used in the notation.

**arithmetic statement**—1. An expression and a variable separated by an equals sign. The expression is evaluated and the resulting value is assigned to the variable. 2. Instruction specifying an arithmetic operation.

**arithmetic sum**—The sum of two or more quantities regardless of their signs. Compare with *algebraic sum*.

**arithmetic symmetry**—Filter response showing mirror-image symmetry about the center frequency when frequency is displayed on an arithmetic scale. Constant

envelope delay in bandpass filters usually is accompanied by arithmetic symmetry in the phase and amplitude responses and generally requires a computer design. *See also* geometric symmetry.

**arithmetic unit**—Also called arithmetic element or arithmetic organ. In an automatic digital computer, that portion in which arithmetical and logical operations are performed on elements of information.

**armature**—The moving element in an electromechanical device, such as the rotating part of a generator or motor, the movable part of a relay, or the spring-mounted, iron portion of a bell or buzzer.

**armature contacts**—1. Contacts mounted directly on the armature. 2. Sometimes used for movable contacts.

**armature control of speed**—The varying of voltage applied to the armature of a shunt-wound motor to control the motor's speed over the basic speed range.

**armature core**—An assembly of laminations forming the magnetic circuit of an armature.

**armature gap**—The space between the armature and pole face.

**armature hesitation**—A delay or momentary reversal of the motion of the armature.

**armature-hesitation contact chatter**—Chatter caused by delay or momentary reversal in direction of the armature motion of a relay during either the operate or the release stroke.

**armature-impact contact chatter**—Chatter caused by impact of the armature of a relay on the pole piece in operation, or on the backstop in release.

**armature overtravel**—That portion of the available stroke occurring after the contacts of a relay have touched.

**armature reaction**—In an armature, the reaction of the magnetic field produced by the current on the magnetic lines of force produced by the field coil of an electric motor or generator.

**armature rebound**—Return motion of a relay armature after striking the backstop.

**armature-rebound contact chatter**—Chatter caused by the partial return of the armature of a relay to its operated position as a result of rebound from the backstop in release.

**armature relay**—A relay operated by an electromagnet that, when energized, causes an armature to be attracted to a fixed pole or poles.

**armature slot**—In the core of an armature, a slot or groove into which the coils or windings are placed.

**armature stud**—In a relay, an insulating member that transmits the motion of the armature to an adjacent contact member.

**armature travel**—The distance traveled during operation by a specified point on the armature of a relay.

**armature voltage control**—A means of controlling the speed of a motor by changing the voltage applied to its armature windings.

**armature wire**—Stranded annealed copper wire, straight lay, soft loose white cotton braid. It is used for low-voltage, high-current rotor winding motors and generators. Straight lay permits forming in armature slots, and compressibility.

**armchair copy**—Amateur term for clear, static-free signals.

**armed sweep**—*See* single sweep.

**arming the oscilloscope sweep**—Closing a switch that enables the oscilloscope to trigger on the next pulse.

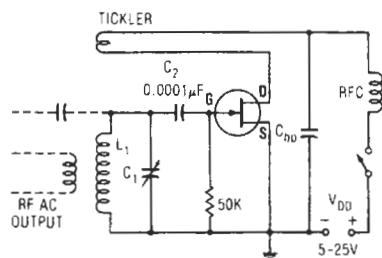
**armor**—A braid or wrapping of metal, usually steel, placed over the insulation of wire or cable to protect it from abrasion or crushing.

**armor clamp**—A fitting for gripping the armor of a cable at the point where the armor terminates or where the cable enters a junction box.

**armored cable**—Two or more insulated wires collectively provided with a metallic covering, primarily to protect the insulated wires from damage.

**Armstrong frequency-modulation system**—A phase-shift modulation system originally proposed by E. H. Armstrong.

**Armstrong oscillator**—An inductive feedback oscillator that consists of a tuned gate circuit and an untuned tickler coil in the drain circuit. Feedback is controlled by varying the coupling between the tickler and the gate circuit.



Armstrong oscillator.

**arr**—See automatic repeat request.

**array**—1. In an antenna, a group of elements arranged to provide the desired directional characteristics. These elements may be antennas, reflectors, directors, etc. 2. A series of items, not necessarily arranged in a meaningful pattern. 3. The group of patterns on a wafer or in the artwork or photomask for semiconductor processing. See random-access memory.

**array antenna**—An antenna comprising a number of radiating elements, generally similar, arranged and excited to obtain directional effects.

**array device**—A group of many similar, basic, complex, or integrated devices without separate enclosures. Each has at least one of its electrodes connected to a common conductor, or all are connected in series.

**array noise**—Unwanted disturbance in a memory integrated circuit generated by the normal movement of data within the array.

**array processor**—1. A computer optimized in architecture and instruction set to handle programs involving computations on large batches of data, such as fast Fourier transforms and large matrix computations. An array processor takes blocks of data and instructions from a host mini or large computer and performs the computations at speeds many times as high as those that are possible through the host computer alone. The host may be considered the data-organizing front end; the array processor is the processing unit. 2. A computer dedicated by its design to performing repetitive arithmetical calculations on large arrays of data with high precision, wide dynamic range, and high throughput. Usually most input/output operations and file management chores are left to the host computer in order to free the peripheral array processor to concentrate on its calculations. 3. A single computer that operates on one piece of data at a time. 4. A processor in a computer that performs matrix arithmetic much faster than is done in a standard computer. Capable of performing operations on all the elements in large matrices at one time. Also called a vector processor.

## armor clamp — artificial intelligence

**arrester**—Also called a lightning arrester. 1. A protective device used to provide a bypass path directly to ground for lightning discharges that strike an antenna or other conductor. 2. A power-line device capable of reducing the voltage of a surge applied to its terminals, interrupting current, if present, and restoring itself to original operating conditions. 3. Device that diverts high voltages to ground and away from the equipment it protects.

**ARRL**—Abbreviation for American Radio Relay League.

**arrowhead**—A linearly polarized, frequency-independent, log-periodic antenna.

**ARSR**—Abbreviation for air route surveillance radar.

**ARTCC**—Abbreviation for air route traffic control center. A complex data-handling facility designed by Burroughs, IBM, and Raytheon to computerize as much in-route air traffic control as possible.

**articulation**—Sometimes called intelligibility. 1. In a communications system, the percentage of speech units understood by a listener. The word *articulation* is customarily used when the contextual relationships among the units of speech material are thought to play an unimportant role; the word *intelligibility* is used when the context is thought to play an important role in determining the listener's perception. 2. A quantitative measurement of the intelligibility of human speech, where 100 percent is completely understandable. For the typical sound reinforcement or other communications system, no more than a 15-percent articulation loss is acceptable. 3. The ability of a mechanism to pivot, grasp, or extend.

**articulation equivalent**—The articulation of speech reproduced over a complete telephone connection, expressed numerically in terms of the trunk loss of a working reference system that is adjusted to give equal articulation.

**artificial antenna**—Also called dummy antenna. A device that simulates a real antenna in its essential impedance characteristics and has the necessary power-handling capabilities, but which does not radiate or receive radio waves. Used mainly for testing and adjusting transmitters.

**artificial ear**—A microphone-equipped device for measuring the sound pressures developed by an earphone. To the earphone it presents an acoustic impedance equivalent to the impedance presented by the human ear.

**artificial echo**—1. Received reflections of a transmitted pulse from an artificial target, such as an echo box, corner reflector, or other metallic reflecting surface. 2. A delayed signal from a pulsed radio-frequency signal generator.

**artificial horizon**—A gyroscopically operated instrument that shows, within limited degrees, the pitching and banking of an aircraft with respect to the horizon. Lines or marks on the face of the instrument represent the aircraft and the horizon. The relative positions of the two are then easily discernible.

**artificial intelligence**—Abbreviated AI. 1. The design of computer and other data-processing machinery to perform increasingly higher-level cybernetic functions. 2. The capability of a device to perform functions that are normally associated with human intelligence, such as reasoning, learning, and self-improvement. Related to machine learning. 3. The imitation by artificial systems of characteristics described as intelligent when observed in humans. Artificial intelligence embraces concepts and theories from many different disciplines, including mathematics, cybernetics, computer science, psychology, biology, and others. 4. Overlapping subsets called expert systems, knowledge representations, inference schemes, program synthesis, scene analysis, and robotics. 5. The ability of a machine to perform certain complex functions

normally associated with human intelligence, such as judgment, pattern recognition, understanding, learning, planning, and problem solving. 6. Computer programs developed to mimic human intelligence, such as reasoning, learning, problem solving, and making decisions. Artificial intelligence programs enable computers to perform tasks such as playing chess, proving mathematical theorems, etc. 7. An area of computer science dedicated to the development of machines that can learn, understand, interpret, and arrive at conclusions in a manner that would be considered intelligent if a person were doing it.

**artificial ionization**—Introduction of an artificial reflecting or scattering layer into the atmosphere to permit beyond-the-horizon communications.

**artificial language**—In computer terminology, a language designed for ease of communication in a particular area of activity, but one that is not yet natural to that area (as contrasted with a natural language evolved through long usage).

**artificial line**—A lumped-constant network designed to simulate some or all the characteristics of a transmission line over a desired frequency range.

**artificial line duct**—A balancing network simulating the impedance of the real line and distant terminal apparatus. It is employed in a duplex circuit to make the receiving device unresponsive to outgoing signal currents.

**artificial load**—Also called dummy load. A dissipative but essentially nonradiating device having the impedance characteristics of an antenna, transmission line, or other practical utilization circuit. Energy is dissipated in the form of heat. Used to test radio transmitters, engine generators, etc. Permits testing under load conditions without the creation of any standing waves or radiating a signal.

**artificial radioactivity**—Radioactivity induced in stable elements under controlled conditions by bombarding them with neutrons or high-energy, charged particles. Artificially radioactive elements emit beta and/or gamma rays.

**artificial voice**—A small speaker mounted in a specially shaped baffle that is proportioned to simulate the acoustical constants of the human head. It is used for calibrating and testing close-talking microphones.

**Artos stripper**—A machine that, when properly adjusted, will automatically measure to a predetermined length, cut, strip, count, and tie wire in bundles.

**ARTS**—Abbreviation for Automated Radar Terminal System. A multiprocessor computing system used at terminal radar approach controls (tracons) and airport towers, based on Sperry Univac 1140 computers. Various configurations, differing in size of memory and number of processors, exist at different facilities; the largest, ARTS IIIE, is installed at the New York tracon.

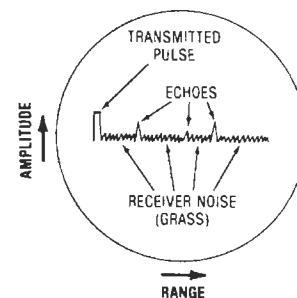
**artwork**—1. A topological pattern of an integrated circuit, made with accurate dimensions so that it can be used in mask making. Generally, it is a large multiple of the final mask size, and final reduction is accomplished through the use of a step-and-repeat camera. 2. Detailed, original drawing (often developed with the aid of a computer) showing layout of an integrated circuit. 3. The images formed by drawing, scribing, or by cutting and stripping on a film or glass support, which are reduced, contact-printed, or stepped and repeated to make a photomask or intermediate. 4. Layouts and photographic films created to produce thick-film screens and thin-film masks.

**ASA**—Abbreviation for American Standards Association. See American National Standards Institute.

**ASA code**—A code that was recommended by the American Standards Association for industry-wide use in the transmission of information. Now ANSI code.

**asbestos**—A nonflammable material generally used for heat insulation, such as in a line-cord resistor. No longer used on new equipment.

**A-scan**—Also called A-display. On a cathode-ray indicator, a presentation in which time (range or distance) is one coordinate (horizontal) and signals appear as perpendicular deflections to the time scale (vertical).



*A-scan on a CRT.*

**ASCII**—Acronym for American Standard Code for Information Interchange (pronounced "ask-ee"). 1. A standard code used extensively in data transmission, in which 128 numerals, letters, symbols, and special control codes are each represented by a seven-bit binary number 0000000 through 1111111. For example, numeral 5 is represented by 011 0101, letter K by 100 1011, percent symbol (%) by 010 0101, and start of text (STX) control code by 000 0010. 2. A standard code used by many computers, video-display terminals, teleprinters, and computer peripherals. A full eight-bit ASCII word may be transmitted in parallel or serial form, with the eighth bit often providing parity information. Keyboard encoders convert a single switch closure into an ASCII data word; character generators convert stored ASCII data words (and some timing commands) into groups of dots suitable for raster-scan display.

**A-scope**—An oscilloscope that uses an A-scan to present the range of a target as the distance along a horizontal line from the transmitted pulse pip to the target, or echo pip. Signals appear as vertical excursions of the horizontal line, or trace.

**ASDE**—See airport surface detection equipment.

**as-fired**—Values of thick-film resistors or smoothness of ceramic substrates as they come out of the firing furnace prior to trimming and polishing, respectively (if required).

**ASI**—An abbreviation for standards published by the American Standards Institute. Now American National Standards Institute.

**ASIC**—Abbreviation for application-specific integrated circuit. 1. Semiconductor circuits specifically designed to suit a customer's particular requirement, as opposed to general-purpose parts that can be used in many different systems or applications. 2. An integrated circuit designed to fill the specific requirement of a unique application.

**ask**—See amplitude-shift keying.

**aspect ratio**—1. Ratio of frame width to frame height. 2. The ratio of an object's height to its width. In graphics this ratio usually pertains to the face of a rectangular CRT or to the characters or symbols drawn by the character generator. 3. The ratio between the length of a film resistor and its width: equal to the number of squares of the resistor. 4. The ratio of the width of a

television picture tube to its height. In the United States, the television standard is 4:3.

**asperities**—Local microscopic points on an electrode surface at which there is considerable field enhancement. They lead to a dependence of electric strength on electrode area (area effect).

**aspheric**—1. Not spherical; an optical element having one or more surfaces that are not spherical. 2. A mirror or lens surface that varies slightly from a true spherical surface. This is done to reduce lens aberrations.

**ASR**—Abbreviation for automatic send and receive and airport surveillance radar. 1. A terminal equipped with recording devices, usually a paper-tape reader and punch, which is capable of answering a call, recording a message, or sending data loaded in its tape reader without the need for an operator in attendance at the time of the call. Also used to specify terminals that have paper-type equipment used by the operator. 2. A teletypewriter that contains a keyboard, page printer, paper-tape transmitter, and paper-tape punch. Paper tape can be prepared offline, which can take place while hard copy is being received from the line or while other paper tape is being transmitted.

**ASRA**—Abbreviation for automatic stereophonic recording amplifier. An instrument developed by Columbia Broadcasting System for stereo recording. Compression of the vertical component of the stereo recording signal is automatically decreased or increased as required by the recording conditions.

**assemble**—1. To collect, interpret, and coordinate the data required for a computer program, translate the data into computer language, and project it into the master routine for the computer to follow. 2. To translate from a symbolic program to a binary program by substituting binary operation codes for symbolic operation codes and replacing symbolic addresses with absolute or relocatable addresses.

**assembler**—1. A program that prepares a program in machine language from a program in symbolic language by substituting absolute operation codes for symbolic operation codes and absolute or relocatable addresses for symbolic addresses. 2. A unit that converts the assembly language of a computer program into the machine language of the computer, accepting mnemonics and symbolic addresses instead of actual binary values for addresses, instructions, and data. 3. A program that accepts instructions, addresses, and data in symbolic form (character strings that represent machine instructions, addresses, data, among others). Then it automatically translates symbols into their corresponding numerical values. It permits symbolic addressing by assigning values to labels used to indicate program-jump locations. 4. A simple programming language that allows the programmer to define labels and fixed values and to then use these labels with a mnemonic instruction set to produce a machine code program. 5. Program that converts source-code (mnemonic) input into op-code (binary) machine language instructions. If such a program were not available, the programmer would have to enter all instructions in ones and zeros, a much more tedious and error-prone procedure. 6. A computer program that converts a higher-level (Englishlike) programming language into machine-readable instructions.

**assembler program**—Software, usually supplied by the computer manufacturer, to convert an assembly language application program into machine language.

**assembly**—1. A complete operating unit, such as a radio receiver, made up of subassemblies, such as an amplifier and various components. 2. Process in which instructions written in symbolic form by the programmer are changed to machine language by the computer.

**assembly language**—1. A computer language that has one-to-one correspondence with an assembly program. The assembly program directs a computer to operate on a program in symbolic language to produce a program in machine language. *See also* high-order language; machine language, 3; and source language. 2. Grouped alphabet characters, called mnemonics, that replace the numeric instructions of machine language. These mnemonics are easier to remember than machine instructions and hence easier to develop into a working program. 3. A machine-oriented language based primarily on a one-to-one relationship between machine instructions and user-supplied source code. 4. Microprocessor commands written in mnemonic form. Typically, three-letter abbreviations, called mnemonics, are used to represent each instruction, and each mnemonic can usually be equated to one machine-code instruction. 5. A human-oriented symbolic-mnemonic source language that is used by the programmer to encode programs and associated databases. Assembly language programs are read by the assembler and converted to executable machine language programs during the assembly process. Assembly language is easier to remember and manipulate than machine language. 6. Human-oriented varieties of machine languages. Precisely the same final program code can be produced from an assembler as by hand-coding machine language. However, assembly languages prove more convenient for people than the numeric-only machine languages.

**assembly-language programming**—*See* symbolic-language programming.

**assembly-output language**—An optional symbolic assembly language listing of the object-code output from a high-level language compiler. Can be quite helpful as a debugging tool because it shows exact machine code in a readable format.

**assembly program**—A program that enables a computer to assemble mnemonic language into machine language; for example, a FORTRAN assembly program. Also called assembly routine.

**assembly robot**—A computerized robot, probably a sensory model, designed specifically for assembly-line jobs. For light, batch-manufacturing applications, the arm's design may be fairly anthropomorphic.

**assembly routine**—*See* assembly program.

**assertion checking**—Evaluating a program by embedding statements that should always hold true.

**assignable cause**—A definitely identified factor contributing to a quality variation.

**assigned frequency**—The center of the frequency band assigned to a station.

**assigned frequency band**—The frequency band, the center of which coincides with the frequency assigned to the station, and the width of which equals the necessary bandwidth plus twice the absolute value of the frequency tolerance.

**associative memory**—A computer memory in which the data are stored and indexed by content, as in a dictionary, in contrast with the storage of a random-access memory. 2. A memory in which the storage locations are identified by their contents rather than by their addresses. Enables faster interrogation to retrieve a particular data element.

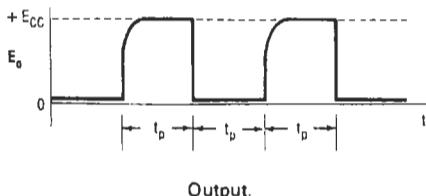
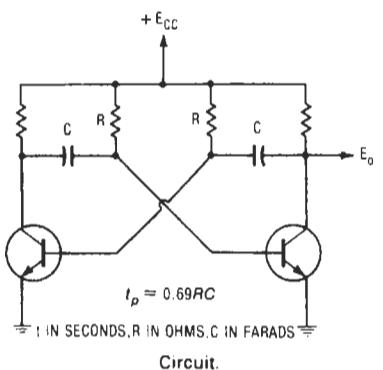
**associative storage**—Computer storage in which locations may be identified by specification of part or all of their contents. Also called parallel-search storage or content-addressed storage.

**astable**—1. Pertaining to a device that has two temporary states: the device alternates between these states with a period and duty cycle determined by circuit time constants. *See also* bistable. 2. Refers to a device that

has two temporary states. The device oscillates between the two states with a period and duty cycle predetermined by time constants.

**astable circuit**—A circuit that continuously alternates between its two unstable states at a frequency determined by the circuit constants. It can be readily synchronized by applying a repetitive input signal of slightly higher frequency. A blocking oscillator is an example of an astable circuit.

**astable multivibrator (free-running)**—A circuit having two momentarily stable states, between which it continuously alternates, remaining in each for a period controlled by the circuit parameters and switching rapidly from one to the other.



Astable multivibrator.

**static**—1. Having no particular orientation or directional characteristics; such as a vertical antenna. 2. Being in neutral equilibrium; having no tendency toward any change of position.

**static galvanometer**—A sensitive galvanometer used for detecting small currents. Consists of two small magnetized needles of equal size and strength arranged in parallel and with their north and south poles adjacent, suspended inside the galvanometer coil. Since the resultant magnetic moment is zero, the earth's magnetic field does not affect the system.

**A station**—One of a pair of transmitting stations in a loran system. The A-station signal always occurs less than half a repetition period after the immediately preceding signal of the other station of the pair and more than half a repetition period before the next succeeding signal of the other station.

**astigmatism**—A type of spherical aberration in which the rays from a single point of an object do not converge on the image, thereby causing a blurred image. Astigmatism in an electron-beam tube is a focus defect in which electrons in different axial planes come to focus at different points.

**astrionics**—Electronics as involved with aeronautics.

**astrocompass**—An instrument for determining direction relative to the stars. It is unaffected by the errors to which magnetic or gyrocompasses are subject.

**astrodome**—A rigid hemispherical structure used to cover large tracking instruments to protect them from the elements. It is usually constructed so that the dome rotates with the instrument.

**astronautics**—The science and art of operating space vehicles.

**astrotracker**—A device for tracking stars.

**A-supply**—The A battery, transformer filament winding, or other voltage source that supplies power for heating the filaments of vacuum tubes.

**asynchronous motor**—An ac motor whose speed is not proportional to the frequency of the supply voltage.

**asymmetrical cell**—A cell, such as a photoelectric cell, in which the impedance to the flow of current is greater in one direction than in the other direction.

**asymmetrical distortion**—Distortion affecting a two-condition or binary modulation or restitution, in which all the significant intervals corresponding to one of the two significant conditions have longer or shorter durations than the corresponding theoretical durations of the excitation. If this particular requirement is not met, distortion is present.

**asymmetrical SCR**—A fast silicon-controlled rectifier (SCR) with low reverse blocking, which is voltage that causes conduction without an input trigger at the gate input of the SCR.

**asymmetric sideband transmission**—See vestigial sideband transmission.

**asymmetry control**—In pH meters, an adjustment sometimes provided to compensate for differences in the electrodes.

**asymptote**—A line that comes nearer and nearer to a given curve but never touches it.

**asymptotic breakdown voltage**—A voltage that will break down insulation if applied over a long period.

**asynchronous**—1. A communication method in which data is sent when it is ready without being referenced to a timing clock, rather than waiting until the receiver signals that it is ready to receive. 2. Transmission in which each data byte is preceded by a start bit and followed by one or more stop bits. Data transmission is intermittent, with an irregular time interval between data bytes. 3. Lacking a regular time relationship; not related through repeating time patterns. Hence, as applied to computer program execution, unexpected or unpredictable with respect to the instruction sequence. 4. Modems, terminals, and transmissions in which each character of information is individually framed (synchronized), usually by start and stop elements. The interval between characters is not fixed. 5. An external interface that can be started and stopped by a microprocessor or other equipment. The opposite is *synchronous*, which means that the data is randomly available. 6. Having no set pattern, cycle, or speed of transmission. 7. Not synchronized by a clocking signal; in code sets, character codes containing start and stop bits. 8. A mode of data transmission in which time intervals between transmitted characters may be of unequal length. Transmission is independently controlled by start and stop elements at the beginning and end of each character. 9. Pertaining to a mode of data communications that provides a variable time interval between characters during transmission.

**asynchronous communication**—1. A method of transferring data in which the timing of character placement on connecting communication lines is not critical. Each transferred character is preceded by a start bit and followed by a stop bit, permitting the interval between characters to vary. 2. A relatively simple and

cheap system for moving data between machines at speeds up to 1200 or 2400 baud. 3. Data communication of the start/stop type. Each character is sent individually without regular or predictable time relationships with other characters. 4. Method of communications in which data is sent as soon as it is ready.

**asynchronous computer**—1. An automatic digital computer in which an operation is started by a signal denoting that the previous operation has been completed. 2. A computer in which each operation starts as a result of a signal generated by the completion of the previous operation or by the availability of the equipment required for the next operation.

**asynchronous device**—A device in which the speed of operation is not related to any frequency in the system to which it is connected.

**asynchronous input/output**—The ability to accept input data while simultaneously delivering output data.

**asynchronous inputs**—The terminals that affect the output state of a flip-flop independently of the clock terminals. Called set, preset, reset, or clear; sometimes referred to as dc inputs.

**asynchronous logic**—Logic networks whose operational speed depends only on the signal propagation through the network, rather than on clock pulses as in synchronous logic.

**asynchronous machine**—1. Any machine in which its speed of operation is not proportionate to the frequency of the system to which the machine is connected. 2. A multiprocessor system whose processes occur as needed by, and whose operations follow, input data instead of an autonomous clock.

**asynchronous operation**—1. Generally, an operation that is started by a signal at the completion of a previous operation. It proceeds at the maximum speed of the circuits until it is finished and then generates its own completion signal. 2. A mode in which entry of data into a flip-flop does not require a gating or clock pulse. 3. Operation of a switching network by a free-running signal that triggers successive instructions. The completion of one instruction triggers the next. 4. A computer operation that does not proceed in step with some external timing.

**asynchronous shift register**—A shift register that does not require a clock. Register segments are loaded and shifted only at data entry.

**asynchronous transmission**—Transmission in which each character of the information is synchronized individually (usually by the use of start and stop elements).

**ATARS**—Acronym for Automated Traffic Advisory and Resolution Service. A ground-based automatic collision-avoidance system being developed for use at air terminals.

**ATC**—1. Abbreviation for automatic temperature control (General Motors). A means of automatically maintaining desired passenger compartment temperature in a vehicle. Temperature is sensed by a thermistor. Control valves are actuated by a vacuum motor to adjust the proportion of heated or cooled air. 2. Also abbreviation for automated technical control. A computer system used to maintain control of a data-communication network.

**AT-cut crystal**—A quartz-crystal slab cut at a 35° angle with respect to the optical, or Z-axis, of the crystal. It has practically a zero temperature coefficient and is used at frequencies of about 0.8 to 250 MHz.

**ATE**—Abbreviation for automatic test equipment.

**ATG**—See automatic test generation.

**atmosphere**—1. The body of air surrounding the earth. 2. A unit of pressure defined as the pressure of

760 mm of mercury at 0°C. Approximately 14.7 pounds per square inch.

**atmospheric absorption**—The energy lost in the transmission of radio waves due to dissipation in the atmosphere.

**atmospheric absorption noise**—The dominant noise factor, at frequencies above 1000 MHz, caused by the absorption of energy from radio waves by oxygen and water vapor in the atmosphere.

**atmospheric duct**—Within the troposphere, a condition in which the variation of refractive index is such that the propagation of an abnormally large proportion of any radiation of sufficiently high frequency is confined within the limits of a stratum. This effect is most noticeable above 3000 MHz.

**atmospheric electricity**—Static electricity between clouds, or between clouds and the earth.

**atmospheric noise**—Also called atmospherics. 1. The noise heard during radio reception because of atmospheric interference. 2. A product of the discharging of lightning and other phenomena in the atmosphere.

**atmospheric pressure**—1. The barometric pressure of air at a particular location on the earth's surface. The nominal, or standard, value of atmospheric pressure is 760 mm of mercury (14.7 pounds per square inch) at sea level. Atmospheric pressure decreases at higher altitudes. 2. Pressure exerted by the atmosphere on all things exposed to it. Although it varies constantly, it is considered as a standard to be normal when it is 14.7 lb/in<sup>2</sup> (1.033 × 10<sup>4</sup> kg/m<sup>2</sup>) at sea level.

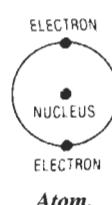
**atmospheric radio wave**—A radio wave that is propagated by reflections in the atmosphere. May include the ionospheric wave, the tropospheric wave, or both.

**atmospheric radio window**—That portion of the frequency spectrum that will allow radio-frequency waves to pass through the earth's atmosphere (approximately 10 to 10,000 MHz).

**atmospheric refraction**—The bending of the path of electromagnetic radiation from a distant point as the radiation passes obliquely through varying air densities.

**atmospherics**—Also referred to as static, atmospheric noise, and strays. In a radio tuner or receiver, noise due to natural weather phenomena and electrical charges existing in the atmosphere.

**atom**—1. The smallest portion of an element that exhibits all properties of the element. It is pictured as composed of a positively charged nucleus containing almost all the mass of the atom, surrounded by one or more electrons. In the neutral atom, the number of electrons is such that their total charge (negative) exactly equals the positive charge in the nucleus. 2. The basic unit of a chemical element, consisting of a positively charged nucleus surrounded by a number of electrons sufficient to counterbalance the charge of the nucleus. The identity of an element, in a chemical sense, depends on the number of positive charges in the nucleus of its atom. The nucleus also contains particles that contribute mass but no charge. The stability of a nucleus depends on its ratio of charge to mass.



**atomic battery**—See nuclear battery.

**atomic charge**—The electronic charge of an ion, equal to the number of ionization multiplied by the charge on one electron.

**atomic fission**—See fission.

**atomic frequency**—The natural vibration frequency of an atom.

**atomic fuel**—A fissionable material, i.e., one in which the atomic nucleus may be split to release energy.

**atomic mass unit (unified)**—One-twelfth of the mass of an atom of the  $^{12}\text{C}$  nuclide. Use of the old atomic mass unit (amu), defined by reference oxygen, is deprecated.

**atomic migration**—The progressive transfer of a valence electron from one atom to another within the same molecule.

**atomic number**—The number of protons (positively charged particles) in the nucleus of an atom. All elements have different atomic numbers, which determine their positions in the periodic table. For example, the atomic number of hydrogen is 1, that of oxygen is 8, iron 26, lead 82, and uranium 92.

**atomic ratio**—The ratio of quantities of different substances to the number of atoms of each.

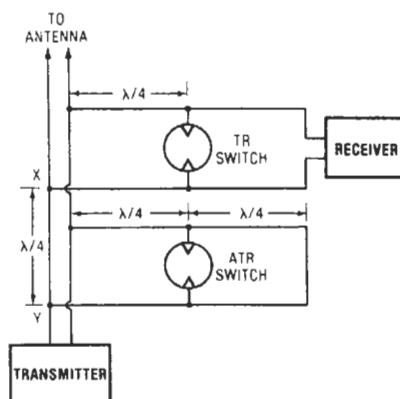
**atomic theory**—A generally accepted theory concerning the structure and composition of substances and compounds. It states that everything is composed of various combinations of ultimate particles called atoms.

**atomic time**—Time scales based on molecular or atomic resonance effects, which are apparently constant and equivalent (or nearly equivalent) to ephemeris time.

**atomic weight**—The approximate weight of the number of protons and neutrons in the nucleus of an atom. The atomic weight of oxygen, for example, is approximately 16 (actually it is 16.0044)—it contains 8 neutrons and 8 protons. Aluminum is 27 and contains 14 neutrons and 13 protons. If expressed in grams, these weights are called gram atomic weights.

**atr switch**—See antitransmit-receive switch.

**atr tube**—Abbreviation for antitransmit-receive tube. A gas-filled, radio-frequency switching tube used to isolate the transmitter while a pulse is being received.



Atr (switch) tube.

**ATS**—Abbreviation for automotive anti-theft system (General Motors). A security system that causes the horn to blow, headlights and parking lights to flash, and the dome light to turn on if the hood, trunk, or doors are opened without use of a key.

**attached foreign material**—In a semiconductor, a foreign substance that cannot be removed when subjected to a nominal gas flow. Lint, silicon dust, etc., are not considered attached since they can be removed after die mounts.

**attachment cap**—See attachment plug.

**attachment cord**—See patch cord.

**attachment plug**—An assembly consisting of two or more blades projecting from a small insulating base, with provision for connecting the plug to a cord. Also called attachment cap.

**attack**—1. The length of time it takes for a tone in an organ to reach full intensity after a key is depressed. On most organs this effect is adjustable by either a switch or potentiometer. 2. The action of a control system in response to a sudden error condition. 3. The responsiveness of an amplifier to signals with a fast rise-time, such as produced by percussive sounds of a transient nature. 4. The beginning of a sound or the initial transient of a musical note.

**attack time**—The interval required for an input signal, after suddenly increasing in amplitude, to attain a specified percentage (usually 63 percent) of the ultimate change in amplification or attenuation due to this increase.

**attendant's switchboard**—A switchboard, of one or more positions, that permits an operator in the central office to receive, transmit, or cut in on a call to or from one of the lines serviced by the office.

**attended operation**—Data-set applications in which individuals are required at both stations to establish the connection and transfer the data sets from talk (voice) mode to data mode. Compare with *unattended operation*.

**attention display**—A computer-generated tabular or vector message placed on the display tubes of a control facility to draw attention to a particular situation.

**attenuate**—To obtain a fractional part of or reduce in amplitude an action or signal.

**attenuating**—Decreasing electrical current, voltage, or power in a communicating channel. Refers to audio, radio, or carrier frequencies.

**attenuation**—1. The decrease in amplitude of a signal during its transmission from one point to another. It may be expressed as a ratio or, by extension of the term, in decibels. 2. See insertion loss. 3. The decrease in amplitude of a signal at a specified frequency due to its transmission through a filter. This is expressed as a function of the amplitude ratio  $V_1/V_2$ , which is the reciprocal of the magnitude of the transmission function. 4. Optical power loss per unit length, usually expressed in decibels per kilometer. 5. Loss of electrical power in a length of cable. Amount of power leaving a length of cable as compared with the amount introduced. Attenuation is measured in decibels per 100 feet. 6. Applied to coaxial cables, the power drop or signal loss in a circuit, expressed in decibels. It is also the decrease in amplitude of a wave with distance in the direction of wave propagation when the amplitude at any given place is constant in time, or the decrease in amplitude with time at a given place. Attenuation is generally expressed in decibels per unit, usually 100 feet, and is indicative of the power loss.

**attenuation constant**—1. The real component of the propagation constant. 2. For a traveling plane wave at a given frequency, the rate at which the amplitude of a field component (or the voltage or current) decreases exponentially in the direction of propagation, in nepers or decibels per unit length.

**attenuation distortion**—1. In a circuit or system, its departure from uniform amplification or attenuation over the frequency range required for transmission. 2. Distortion that causes a decrease in the amplitude of

a field component (voltage or current) in the direction of propagation.

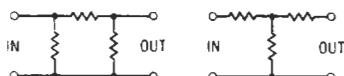
**attenuation equalizer**—A corrective network designed to make the absolute value of the transfer impedance of two chosen pairs of terminals substantially constant for all frequencies within a desired range.

**attenuation-frequency distortion**—A form of wave distortion in which the relative magnitudes of the different frequency components of the wave are changed.

**attenuation network**—1. A network providing relatively slight phase shift and substantially constant attenuation over a range of frequencies. 2. The arrangement of circuit elements, usually impedance elements, inserted in circuitry to introduce a known loss or to reduce the impedance level without reflections.

**attenuation ratio**—The magnitude of the propagation ratio, which indicates the relative decrease in energy.

**attenuator**—1. A resistive network that provides reduction of the amplitude of an electrical signal without introducing appreciable phase or frequency distortion. 2. A distributed network that absorbs part of a signal and transmits the remainder with a minimum of distortion or delay. 3. Network for reducing signal level. Sometimes necessary in the input circuit of a tuner to avoid overloading by strong local signals. 4. An electronic transducer, either fixed or adjustable, that reduces the amplitude of a wave without causing significant distortion.



Attenuators, I.

**attenuator tube**—A gas-filled, radio-frequency switching tube in which a gas discharge, initiated and regulated independently from the radio-frequency power, is used to control this rf power by reflection or absorption.

**atto**—Prefix meaning  $10^{-18}$ . Letter symbol is a.

**attraction**—The force that exists between two unlike magnetic poles (N and S), or between two unlike static charges (+ and -), or between two masses.

**attribute**—The manner in which a variable is handled by a computer.

**audibility**—1. The ability to be heard, usually construed as being heard by the human ear. 2. The ratio of the strength of a specific sound to the strength of a sound that can barely be heard. Usually expressed in decibels.

**audibility threshold**—The minimum sound intensity that the average human ear can hear, normally considered to be 0 dB sound pressure level at 1000 Hz.

**audible**—Capable of being heard; in most contexts, by the average human ear.

**audible ringing tone**—That tone received by the calling telephone, indicating that the called telephone is being rung.

**audible tones**—Sounds composed of frequencies that the average human can detect.

**audio**—Pertaining to frequencies corresponding to a normally audible sound wave. These frequencies range roughly from 15 to 20,000 hertz.

**audio amplifier**—*See* audio-frequency amplifier.

**audio band**—The range of audio frequencies passed by an amplifier, receiver, transmitter, etc. *See also* audio frequency.

**audio carrier**—In the NTSC system, a carrier located 4.5 MHz above the video carrier; it extends to

## attenuation equalizer — audio output

within 0.25 MHz of the assigned channel frequency. For channel 2, its active frequency is 59.75 MHz.

**audio-channel wire**—A small-diameter wire, shielded and jacketed, used primarily in radio and television for wiring consoles, panels, etc.

**audio component**—That portion of any wave or signal which contains frequencies in the audible range (between 15 and 20,000 hertz).

**audio frequency**—Abbreviated AF. Any frequency corresponding to a normally audible sound wave. Audio frequencies range roughly from 15 to 20,000 hertz.

**audio-frequency amplification**—An increase in voltage, current, or power of a signal at an audio frequency.

**audio-frequency amplifier**—Also called audio amplifier. A device that contains one or more electron tubes or transistors (or both) and is designed to amplify signals within a frequency range of about 15 to 20,000 hertz.

**audio-frequency choke**—An inductance used to impede the flow of audio-frequency currents.

**audio-frequency noise**—In the audio-frequency range, any electrical disturbance introduced from a source extraneous to the signal.

**audio-frequency oscillator**—An oscillator circuit using an electron tube, transistor, or other nonrotating device capable of producing audio signals.

**audio-frequency peak limiter**—A circuit generally used in the audio system of a radio transmitter to prevent overmodulation. It keeps the signal amplitude from exceeding a predetermined value.

**audio-frequency shift keying**—*See* AFSK.

**audio-frequency shift modulator**—A system of facsimile transmission over radio, in which the frequency shift required is applied through an 800-hertz shift of an audio signal rather than by shifting the transmitter frequency. The radio signal is modulated by the shifting audio signal, usually at 1500 to 2300 hertz.

**audio-frequency spectrum**—The full range of sounds we can hear. In a person with good hearing, the range of sounds in the audio spectrum is usually between 15 and 20,000 Hz. In older people it is usually 50 to 10,000 Hz.

**audio-frequency transformer**—Also called audio transformer. An iron-core transformer for use with audio-frequency currents to transfer signals from one circuit to another. Used for impedance matching or to permit maximum transfer of power.

**audiogram**—Also called threshold audiogram. A graph showing hearing loss, percentage of hearing loss, or percentage of hearing as a function of frequency.

**audio-level meter**—An instrument that measures audio-frequency power with reference to a predetermined level. Usually calibrated in decibels.

**audiometer**—An electronic instrument for measuring hearing acuity. In simple units, the listener is provided (usually through earphones) with an audio signal (commonly a pure tone) of known intensity and frequency. More complex instruments provide a variety of signals (pure tones, white noise, and speech) through a variety of output transducers (such as earphones, bone vibrators, or loudspeakers).

**audio mixer**—An amplifier circuit used for blending two or more audio signals, such as those delivered by microphones and record players.

**audion**—A three-electrode vacuum tube introduced by Dr. Lee de Forest.

**audio oscillator**—*See* audio-frequency oscillator.

**audio output**—The output signal from any audio equipment. It is generally measured in volts or watts, rms.

**audio patch bay**—Specific patch panels provided for termination of all audio circuits and equipment used in the channel and technical-control facility. This equipment can also be found in transmitting and receiving stations.

**audio peak limiter**—*See* audio-frequency peak limiter.

**audiophile**—A person who is interested in good musical reproduction for his or her own personal listening and who uses the latest audio equipment and techniques.

**audio rectification**—The phenomenon of rf signals being picked up, rectified, and amplified by audio circuits—notably by high-gain preamplifiers.

**audio response**—1. A computer output technique that is formatted from stored words previously recorded in the computer. Programmed instructions often communicate with a student through this technique. 2. The fidelity with which audio-frequency equipment reproduces its input signal.

**audio signal**—An electrical signal whose frequency is within the audio range.

**audio spectrum**—1. The continuous range of audio frequencies, extending from the lowest to the highest (from about 15 to 20,000 hertz). 2. The range of frequencies that can be detected as sound by the human ear.

**audio subcarrier**—Subcarriers of satellite video signals that are modulated by audio signals. The frequency range can be from 5 to 8 MHz but is usually 6.2 or 6.8 MHz.

**audio taper**—Semilogarithmic change of resistance. Used on tone controls in audio amplifiers to compensate for the lower sensitivity of the human ear when listening to low-volume sounds.

**audio transformer**—*See* audio-frequency transformer.

**audiovisual**—Involving both sight and sound (e.g., audiovisual education uses films, slides, phonograph records, and the like to supplement instruction).

**audiovisual system**—A system of communications that simultaneously transmits pictorial and audio signals.

**auditing**—Examination of software for consistency and traceability.

**augend**—In arithmetic addition, the number increased by having another number (called the addend) added to it.

**augmented operation code**—In a computer, an operation code that is further defined by information contained in another portion of an instruction.

**aural**—Pertaining to the ear or to the sense of hearing. This term is often used to distinguish between sound that is actually heard and sound represented by audio-frequency currents. *See also* audio.

**aural radio range**—A radio range whose courses are normally followed by interpretation of an aural signal.

**aural signal**—The signal corresponding to the sound portion of a television program. In general, the audible component of a signal.

**aural transmitter**—The equipment used to transmit the aural (sound) signals from a television broadcast station.

**aurora**—Sheets, streamers, or streaks of pale light often seen in the skies of the northern and southern hemispheres. The aurora borealis and aurora australis.

**auroral absorption**—Absorption of radio waves due to auroral activity. *See also* aurora.

**auroral absorption index**—A factor that relates the average auroral absorption with the geographic location of the points of reflection from the ionosphere.

**authentication**—Security measure designed to protect a communications system against fraudulent transmissions and establish the authenticity of a message by an

authenticator within the transmission derived from certain predetermined elements of the message itself.

**authenticator**—A group of letters or numerals, or both, inserted at a predetermined point in a transmission or message for the purpose of attesting to the authenticity of the message or transmission.

**authoring**—The process of planning, designing, and producing multimedia applications.

**authorized access switch**—A device used to make an alarm system or some portion or zone of a system inoperative in order to permit authorized access through a protected port. A shunt is an example of such a device.

**authorized carrier frequency**—A specific carrier frequency authorized for use, from which the actual carrier frequency is permitted to deviate, solely because of frequency instability, by an amount not to exceed the frequency tolerance.

**autoalarm**—Also called automatic alarm receiver. 1. A device that is tuned to the international distress frequency of 500 kHz and that automatically actuates an alarm if any signal is received. 2. A circuit or device operated from a radio receiver to alert a radio operator that an incoming message is addressed to him or her. 3. Complete receiving, selecting, and warning device capable of being actuated automatically by intercepted radio-frequency signals forming the international automatic-alarm signal.

**auto balance**—A system for detecting errors in color balance in the white and black areas of the picture and automatically adjusting the white and black levels of both the red and blue signals as needed for correction.

**auto call**—An alerting device that sounds a preset code of signals in a building to page those persons whose code is being sounded.

**autocondensation**—A method of introducing high-frequency alternating current into living tissue for therapeutic purposes. The patient is connected as one plate of a capacitor to which the current is applied.

**autoconduction**—A method of introducing high-frequency alternating currents into living tissues for therapeutic purposes. The patient is placed inside a coil and acts essentially as the secondary of a transformer.

**autocorrelation**—1. The correlation of a waveform with itself. It gives the Fourier transform of the power spectrum of the waveform (the power-density spectrum in the case of random signals). 2. A mathematical technique to measure the degree of rhythmic activity in physical phenomena that vary in a complex manner as a function of time.

**autocorrelation function**—A measure of the similarity between time-delayed and undelayed versions of the same signal, expressed as a function of delay.

**autocorrelator**—A circuit that distinguishes coherent programs (music or speech) from random noise (hiss) and operates filters that attenuate noise without an audible loss of program frequencies.

**autodyne circuit**—A vacuum-tube circuit that serves simultaneously as an oscillator and as a heterodyne detector.

**autodyne reception**—A type of radio reception employed in regenerative receivers for the reception of cw code signals. In this system the incoming signal beats with the signal from an oscillating detector to produce an audible beat frequency.

**AUTOEXEC.BAT**—Abbreviation for automatic execute batch file. The main file that tells a computer what to do when it is turned on. It literally automatically executes a batch of files.

**auto iris control**—An accessory unit that measures the video level of a TV camera and opens and closes the iris of the lens to compensate for light changes.

**auto light range**—The range of light (e.g., sunlight to moonlight) over which a TV camera is capable of automatically operating at specified output.

**autoluminescence**—The luminescence of a substance that is produced by energy within it (e.g., radioactive material).

**auto-man**—A locking switch that controls the method of operation (i.e., automatic or manual).

**automata**—A plural form of automaton.

**automated communications**—Combination of techniques and facilities by which intelligence is conveyed from one point to another without human effort.

**automatic**—1. Self-regulating or self-acting; capable of producing a desired response to certain predetermined conditions. 2. Self-acting and self-regulating; operating without human intervention; often implying the presence of a feedback control system. 3. Pertaining to a process or device that, under specific conditions, performs its functions without intervention by a human operator.

**automatic-alarm receiver**—Complete receiving, selecting, and warning device capable of being actuated automatically by intercepted radio-frequency signals forming the international automatic-alarm signal.

**automatic-alarm-signal keying device**—A device that automatically keys the radio-telegraph transmitter on board a vessel to transmit the international automatic-alarm signal.

**automatic answer**—A feature by which a communicating word processor, twx, etc., may receive text without an operator in attendance.

**automatic back bias**—A radar-receiver technique that consists of one or more automatic gain-control loops to prevent large signals from overloading a receiver, whether by jamming or by actual echoes.

**automatic bass compensation**—Abbreviated abc. 1. A circuit used in a receiver or audio amplifier to make the bass notes sound more natural at low-volume settings. The circuit, which usually consists of resistors and capacitors connected to taps on the volume control, automatically compensates for the poor response of the human ear to weak sounds. 2. A circuit used in some audio equipment to increase the amplitude of the bass notes to make them appear more natural at low volume settings.

**automatic bias**—*See* self-bias.

**automatic brightness control**—A circuit used in television receivers to keep the average brightness of the reproduced image essentially constant. Its action is similar to that of an automatic volume-control circuit.

**automatic call**—A communications feature that allows a transmission control unit to automatically establish a connection with one or more message recipients.

**automatic call distributor**—*See* ACD.

**automatic calling unit**—Abbreviated ACU. A dialing device, supplied by the communication common carrier, that permits a business machine to dial calls automatically over the communication networks.

**automatic carriage**—A control mechanism for a typewriter or other listing device that can automatically control the feeding, spacing, skipping, and ejecting of paper or preprinted forms.

**automatic check**—An operation performed by equipment built into an electronic computer to automatically verify proper operation.

**automatic chrominance control**—A color-television circuit that automatically controls the gain of the chrominance bandpass amplifier by varying the bias.

**automatic circuit breaker**—A device that automatically opens a circuit, usually by electromagnetic means, when the current exceeds a safe value. Unlike

## auto light range — automatic digital network

a fuse, which must be replaced once it blows, the circuit breaker can be reset manually when the current is again within safe limits.

**automatic coding**—A technique by which a digital computer is programmed to perform a significant portion of the coding of a problem.

**automatic color purifier**—*See* automatic degausser.

**automatic computer**—A computer capable of processing a specified volume of work without a need for human intervention other than program changes.

**automatic connections**—Connections between users made by electronic switching equipment without human intervention.

**automatic constant**—In a calculator, a provision that allows the user to multiply or divide a series of numbers by the same divider or multiplier without reentering each time.

**automatic contrast control**—A television circuit that automatically changes the gain of the video intermediate-frequency and radio-frequency stages to maintain proper contrast in the television picture.

**automatic controller**—A device or instrument for measuring and regulating that operates by receiving a signal from a sensing device, comparing this signal with a desired value, and issuing signals for corrective action.

**automatic crossover**—1. A type of current-limiting circuit on a power supply provided with an adjustment for setting the short-circuit current to an adjustable maximum value. 2. A term applied to bimodal power supplies (constant voltage/constant current) that describes the transferral from one operating mode to the other at a predetermined value of load resistance. Usually the crossover point is preset by means of front panel controls.

**automatic current limiting**—An overload-protection mechanism designed to limit the maximum output current of a power supply to a preset value. Usually it automatically restores the output when the overload is removed.

**automatic cutout**—A device, operated by electromagnetism or centrifugal force, to automatically disconnect some parts of an equipment after a predetermined operating limit has been reached.

**automatic data processing**—Abbreviated ADP. The processing of digital information by automatic computers and other machines. Also called integrated data processing.

**automatic data-processing system**—A system that includes electronic data-processing equipment together with auxiliary and connecting communications equipment.

**automatic degausser**—Also called automatic color purifier and degausser. An arrangement of degaussing coils mounted around a color-television picture tube. These coils are energized only for a short while after the set is turned on. They serve to demagnetize any parts of the picture tube that may have been affected by the earth's magnetic field or the magnetic field of any nearby home appliance.

**automatic dial**—A communications feature whereby a calling unit has the ability to automatically establish a connection with one or more message recipients.

**automatic dialer**—1. Device that will automatically dial any of a group of preselected telephone numbers. 2. A device that automatically dials telephone numbers on a network.

**automatic dialing unit**—Abbreviated ADU. A device capable of generating dialing digits automatically.

**automatic digital network**—Automatic communications network for end-to-end message-switched digital data communication.

**automatic direction finder**—Abbreviated ADF. Also called an automatic radio compass. An electronic device, usually for marine or aviation application, which provides a radio bearing to any transmitter whose frequency is known but whose direction and location are not.

**automatic electronic data-switching center**—Communications center designed specifically for the automatic electronic transmission, reception, relay, and switching of digitized data.

**automatic error correction**—A technique, usually requiring the use of special codes and/or automatic retransmission, that detects and corrects errors occurring in transmission. The degree of correction depends on coding and equipment configuration.

**automatic exchange**—A telephone exchange in which connections are made between subscribers by means of devices set in operation by the originating subscriber's instrument without the intervention of an operator.

**automatic fine tuning**—A circuit in a receiver that automatically maintains the correct tuner oscillator frequency and compensates for drift and for moderate amounts of inaccurate tuning. Similar to automatic frequency control.

**automatic focusing**—A method of electrostatically focusing a television picture tube; the focusing anode is internally connected through a resistor to the cathode and thus requires no external focusing voltage.

**automatic frequency control**—Abbreviated AFC. 1. A system that produces an error voltage in proportion to the amount by which an oscillator drifts away from its correct frequency, the error voltage acting to reverse the drift. 2. A control circuit in a receiver or tuner that compensates for small variations in the carrier signal frequency to provide a stable audio output. A circuit function in a tuner or receiver that keeps the unit accurately tuned to the desired station, eliminating any tendency to drift.

**automatic frequency correction**—*See* automatic frequency control.

**automatic function key correction**—When the wrong function key is depressed in a calculator, pressing the correct function key automatically replaces it.

**automatic gain control**—1. A means of controlling gain of a receiver through feedback to suit the strength of the incoming signal. Ideally, the output level at the speaker should remain constant over a wide range of input signals. For low-level inputs the feedback signal is small and gain is high. For stronger signals the feedback loop cuts gain to prevent overload. 2. A self-acting compensation device that maintains the output of a transmission system constant within narrow limits in the face of wide variations in the attenuation of the system. 3. A radar circuit that prevents saturation of the radar receiver by long blocks of received signals or by a carrier modulated at low frequency. 4. A process by which gain is automatically adjusted as a function of input or other specified parameter.

**automatic gain stabilization**—A circuit, used in certain identification friend-or-foe equipment and radar beacon systems, which serves to maintain optimum sensitivity in a superregenerative stage by keeping the noise-pulse load constant. The system prevents random noises from triggering the automatic transmitter associated with the receiver.

**automatic grid bias**—Grid-bias voltage provided by the difference in potential across a resistance (or resistances) in the grid or cathode circuit due to grid or cathode current or both.

**automatic intercept**—Automatic recording of messages a caller may wish to leave when the called party is away from his telephone.

**automatic level compensation**—A system that automatically compensates for variations in the circuit. *See also* automatic volume control.

**automatic level control**—*See* ALC.

**automatic light control**—The process by which the illumination incident on the face of a television pickup device is automatically adjusted as a function of scene brightness.

**automatic message accounting**—*See* automatic toll ticketing.

**automatic message-switching center**—A center in which messages are routed automatically according to information they contain.

**automatic modulation control**—A transmitter circuit that reduces the gain for excessively strong audio input signals without affecting the strength of normal signals, thus permitting higher average modulation without overmodulation; this is equivalent to an increase in the carrier-frequency power output.

**automatic noise-limiter**—A circuit that automatically clips off all noise peaks above the highest peak of the desired signal being received. This circuit prevents strong atmospheric or human-made interference from being troublesome.

**automatic numbering equipment**—Equipment used in association with tape transmitters to transmit a channel number.

**automatic pedestal control**—The process by which the pedestal height of a television signal is automatically adjusted as a function of the input or other specified parameter.

**automatic phase control**—A circuit used in color television receivers to synchronize the burst signal with the 3.58-MHz color oscillator.

**automatic pilot**—*See* autopilot.

**automatic programming**—Any technique designed to simplify the writing and execution of programs in a computer. Examples are assembly programs that translate from the programmer's symbolic language to the machine language, those which assign absolute addresses to instruction and data words, and those which integrate subroutines into the main routine.

**automatic quality control**—A technique in which the quality of a product being processed is evaluated in terms of a predetermined standard, and proper corrective action is taken automatically if the quality falls below the standard.

**automatic radio compass**—A radio direction finder that automatically rotates the loop antenna to the correct position. A bearing can then be secured from the indicator dials without mechanical adjustment or calculation. *See also* automatic direction finder.

**automatic record changer**—An electrically operated mechanism that automatically feeds, plays, and rejects a number of records in a preset sequence. It consists of a motor, turntable, pickup arm, and changer. Some changers are designed to play automatically 16 $\frac{2}{3}$ , 33 $\frac{1}{3}$ , 45-, and 78-rpm records.

**automatic regulation**—In a power supply, the automatic holding of the output voltage or current to a constant value in spite of variations in the input voltage or load resistance.

**automatic relay**—A means of selective switching that causes automatic equipment to record and retransmit communications.

**automatic repeater station**—A station that receives signals and simultaneously retransmits them, but usually on a different frequency.

**automatic repeat request**—Abbreviated arr. A system of error checking in which an error-detecting code

is included with the transmitted data. When the receiver is unable to verify the message, it initiates a retransmission.

**automatic reset**—The automatic reversion of a timer to its ready state after it has completed a timing cycle or after the input circuit has been interrupted.

**automatic reset relay**—Also called automatic reset. 1. A stepping relay that returns to its home position either when it reaches a predetermined contact position or when a pulsing circuit fails to energize the driving coil within a given time. It may either pulse forward or be spring-reset to the home position. 2. An overload relay that restores the circuit as soon as an overcurrent situation is corrected.

**automatic retransmission**—Retransmission of signals by a radio station whereby the retransmitting station is actuated solely by the presence of a received signal through electrical or electromechanical means, i.e., without any direct, positive action by the control operator.

**automatic reverse**—Ability of some four-track stereo tape recorders to play the second pair of stereo tracks automatically, in the reverse direction, without need to interchange the empty and full reels after the first pair of stereo tracks has been played.

**automatic scanning**—A variable-speed sweep of the entire frequency range of a radio-frequency interference meter. It may also include the scanning of a portion of this frequency range over a predetermined sector.

**automatic scanning receiver**—A receiver that can automatically and continuously sweep across a preselected frequency, either to stop when a signal is found or to plot signal occupancy within the frequency spectrum being swept.

**automatic secure voice communications**—A network that provides cryptographically secure voice communications through the use of a combination of wideband and narrow-band voice-digitizing techniques.

**automatic selective control (or transfer) relay**—A device that operates to select automatically between certain sources or conditions in an equipment, or performs a transfer operation automatically.

**automatic send**—A communications capability whereby a communicating system has the ability to automatically send out a message in an unattended mode.

**automatic send/receive**—A teletype-writer unit that includes a keyboard, printer, paper tape, reader/transmitter, and paper-tape punch. This combination of facilities may be used online or offline, and, in some cases, online and offline simultaneously.

**automatic sensitivity control**—1. A circuit used for automatically maintaining receiver sensitivity at a predetermined level. It is similar to an automatic gain control, but it affects the receiver constantly rather than during the brief interval selected by the range gate. 2. The self-acting mechanism that varies the system sensitivity as a function of the specified control parameters. This may include automatic target control, automatic light control, or any combination thereof.

**automatic sequencing**—The ability of a computer to perform successive operations without additional instructions from a human being.

**automatic short-circuiter**—A device used in some forms of single-phase commutator motors to short-circuit the commutator bars automatically.

**automatic short-circuit protection**—An automatic current-limiting system that enables a power supply to continue operating at a limited current, and without damage, into any output overload, including a short circuit. The output voltage is restored to normal when the overload is removed, as distinguished from a fuse or circuit-breaker system that opens with overload and must be replaced or reclosed manually to restore power.

## automatic reset — automatic video-noise leveling

**automatic shutoff**—In a tape recorder, a switching arrangement that automatically shuts the recorder off when the tape breaks or runs out. Also, a switching arrangement that stops a record changer after the last record.

**automatic starter**—1. A device which, after being given the initial impulse by means of a push button or similar device, starts a system or motor automatically in the proper sequence. 2. A self-acting starter that is completely controlled by master or pilot switches or some other sensing device.

**automatic switchboard**—Telephone switchboard in which the connections are made by the operation of remotely controlled switches.

**automatic switch center**—A switch center in which messages originating at any subscriber terminal are relayed automatically through one or more switching centers to their destinations.

**automatic target control**—The self-acting mechanism that controls the vidicon target potential as a function of the scene brightness.

**automatic telegraph transmission**—A form of telegraphy in which signals are transmitted mechanically from a perforated tape.

**automatic telegraphy**—A form of telegraphy in which signals are transmitted and/or received automatically.

**automatic telephone dialer**—A device that, when activated, automatically dials one or more preprogrammed telephone numbers (e.g., police, fire department) and relays a recorded voice or coded message giving the location and nature of the alarm; used with intrusion alarms and security systems.

**automatic test generation**—Abbreviated ATG. Automatic test-pattern generation (ATPG). Calculation of a specific set of input test patterns with a computer program providing algorithmic and heuristic routines.

**automatic threshold variation**—A constant false-alarm rate scheme that is an open-loop type of automatic gain control in which the decision threshold is varied continuously in proportion to the incoming intermediate frequency and video noise level.

**automatic time switch**—A combination of a switch with an electric or spring-wound clock arranged to turn an apparatus on and off at predetermined times.

**automatic toll ticketing**—System whereby toll calls are automatically recorded, timed, and toll tickets printed, under control of the calling telephone's dial pulses and without the intervention of an operator. Also called automatic message accounting.

**automatic tracking**—In radar, the process whereby a mechanism, actuated by the echo, automatically keeps the radar beam locked on the target; may also determine the range simultaneously.

**automatic transfer equipment**—Equipment that automatically transfers a load so that a source of power may be selected from one of several incoming lines.

**automatic tuning**—An electrical, mechanical, or electrical/mechanical system that automatically tunes a circuit to a predetermined frequency when a button or other control is operated.

**automatic turntable**—A record player whose tone arm is positioned for playing records when a control is operated, and which shuts off automatically at the end of play. See record changer.

**automatic video-noise leveling**—A constant false-alarm rate scheme in which the video-noise level at the output of the receiver is sampled at the end of each range sweep and the receiver gain is readjusted accordingly to maintain a constant video-noise level at the output.

**automatic voltage regulator**—A device or circuit that maintains a constant voltage, regardless of any variation in input voltage or load.

**automatic volume compression**—See volume compression.

**automatic volume control**—Abbreviated AVC.

1. A self-acting compensation device that maintains the output of a transmission system constant within narrow limits in the face of wide variations in attenuation in that system. 2. A self-acting device that maintains the output of a radio receiver or amplifier substantially constant within relatively narrow limits while the input voltage varies over a wide range. 3. See automatic level compensation.

**automatic volume expansion**—Also called volume expansion. An audio-frequency circuit that automatically increases the volume range by making loud portions louder and weak ones weaker. This is done to make radio reception sound more like the actual program, because the volume range of programs is generally compressed at the point of broadcast.

**automatic zero and full-scale calibration correction**—A system of zero and sensitivity stabilization in which electronic servos are used that compare demodulated "zero" and "full-scale" signals with reference voltages.

**automation**—1. The method or act of making a manufacturing or processing system partially or fully automatic. 2. The entire field of investigation, design, development, application, and methods of rendering or making processes or machines self-acting or self-moving; rendering automatic. 3. Automatically controlled operation of an apparatus process or system by mechanical or electronic devices that take the place of observation, effort, and decision by a human operator.

**automaton**—1. A device that automatically follows predetermined operations or responds to encoded instructions. 2. Any communication-linked set of elements. 3. A machine that exhibits living properties. 4. A mechanism, fixed or mobile, possessing the ability to manipulate objects external to itself under the constant control of a programming routine previously supplied by an external intelligence. 5. A machine that is designed to simulate the operations of living things.

**automonitor**—1. To instruct an automatic digital computer to produce a record of its information-handling operations. 2. A program or routine for this purpose.

**automotive analyzer**—An instrument containing numerous automotive test features combined into one portable unit.

**automotive electronics**—The branch of engineering science that deals with the generation, control, conversion, and application of electricity in self-propelled vehicles.

**automotive primary wire**—Low-voltage single or multiconductor wire for automotive applications. Resistant to oil and weather.

**autopatch**—1. A repeater-to-telephone connection that makes it possible to place a telephone call from a mobile transmitter that has DTMF capability. An access code is frequently required to establish the connection to the phone line. 2. A remotely controllable device frequently used at a repeater location that patches a radiocommunications system into a telephone land-line network. 3. A component that allows telephone calls to be placed through a repeater.

**autopilot**—Also called automatic pilot, gyropilot, or robot pilot. A device containing amplifiers, gyroscopes, and servomotors that automatically control and guide the flight of an aircraft or guided missile. The autopilot detects any deviation from the planned flight and automatically

applies the necessary corrections to keep the aircraft or missile on course.

**autopolarity**—A feature of a digital voltmeter or digital multimeter wherein the correct polarity (either negative or positive) for a measured quantity is automatically indicated on the display.

**auto radio**—A radio receiver designed to be installed in an automobile and powered by the storage battery of the automobile.

**autoregulation induction heater**—An induction heater in which a desired control is effected by the change in characteristics of a magnetic charge as it is heated at or near its Curie point.

**auto reverse (cassette deck)**—Automatically reverses tape direction at the end of each side of an audio-cassette, for extended unattended listening.

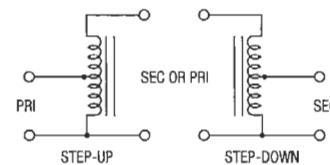
**auto single play**—A turntable in which records are played one at a time and the arm performs a playing cycle, lifting itself from the record at the end (and in some cases shutting off the motor).

**autostarter**—See autotransformer starter.

**Autosyn**—A trade name of the Bendix Corp. for a remote-indicating instrument or system based on the synchronous-motor principle, in which the angular position of the rotor of a motor at the measuring source is duplicated by the rotor of the indicator motor.

**auto tracking**—Also called automatic tracking operation. A master/slave connection of two or more power supplies, each of which has one of its output terminals in common with one of the output terminals of all of the other supplies, such connections being characterized by one-knob control and proportional output voltage from all supplies. Useful where simultaneous turn-up, turn-down, or proportional control of all power supplies in a system is required.

**autotransformer**—1. A transformer with a single winding (electrically) in which the whole winding acts as the primary winding, and only part of the winding acts as the secondary (step-down); or part of the winding acts as the primary, and the whole winding acts as the secondary (step-up). 2. A voltage, current, or impedance transforming device in which parts of one winding are common to both the primary and secondary circuits.



Autotransformers, 1.

**autotransformer starter**—Also called a compensator or autostarter. A motor starter having an autotransformer to furnish reduced voltage for starting. Includes the necessary switching mechanism.

**autozero**—Displaying all zeros in a digital multimeter or digital voltmeter when no measurement is being made.

**aux**—Abbreviation for auxiliary. Often applied to amplifier inputs, where it refers to an extra input facility as distinct from "mic," "tuner," "pickup," etc.

**auxiliary actuator**—A mechanism that may be attached to a switch to modify its characteristics.

**auxiliary bass radiator**—A parasitic (nonelectrically driven) unit resembling a bass speaker unit located

in a loudspeaker enclosure as if it were an ordinary unit, to increase the movement of air and hence enhance the bass performance at a given enclosure volume.

**auxiliary circuit**—Any circuit other than the main circuit.

**auxiliary contacts**—In a switching device, contacts, in addition to main circuit contacts, that function with the movement of the latter.

**auxiliary electrodes**—Metallic electrodes pushed or driven into the earth to provide electrical contact for the purpose of performing measurements on grounding electrodes of grounded grid systems.

**auxiliary equipment**—Equipment not directly controlled by the central processing unit of a computer.

**auxiliary function**—In automatic control of machine tools, a machine function other than the control of the motion of a workpiece or cutter, e.g., control of machine lubrication and cooling.

**auxiliary-link station**—A station, other than a repeater station, at a specific land location, licensed only for the purpose of automatically relaying radio signals from that location to another specific land location.

**auxiliary memory**—*See* auxiliary storage.

**auxiliary operation**—An operation performed by equipment not under continuous control of the computer central processing unit.

**auxiliary relay**—1. A relay that responds to the opening or closing of its operating circuit to assist another relay or device in the performance of a function. 2. A relay actuated by another relay and used to control secondary circuit functions such as signals, lights, or other devices. Also called slave relay.

**auxiliary-station line filter**—A line filter for use at repeater points to separate frequencies of different carrier systems using the same line pair. For example, such a filter might be used at a high-frequency carrier-system repeater to bypass the low-frequency carrier system and voice frequencies around the repeater.

**auxiliary storage**—1. In a computer, storage that supplements the main storage, such as hard disks, floppy disks, magnetic tapes, or optical discs. 2. Storage capacity, such as magnetic tape, disk, or drum, in addition to the main memory of a computer. Also called auxiliary memory.

**auxiliary switch**—A switch actuated by some device such as a circuit breaker, for signaling, interlocking, or other purpose.

**auxiliary transmitter**—A transmitter held in readiness in case the main transmitter of a broadcasting station fails.

**availability**—1. The ratio, expressed as a percent, of the time during a given period that an equipment is correctly operating to the total time in that period. Also called operating ratio. 2. The probability that a system is operating satisfactorily at any point in time when used under stated conditions, where the total time considered includes operating time, active repair time, administrative time, and logistic time.

**available conversion gain**—Ratio of available output-frequency power from the output terminals of a transducer to the available input-frequency power from the driving generator, with terminating conditions specified for all frequencies that may affect the result. Applies to outputs of such magnitude that the conversion transducer is operating in a substantially linear condition.

**available gain**—The ratio of the available power at the output terminals of the network to the available power at the input terminals of the network.

**available line**—In a facsimile system, that portion of a scanning line that can be used for picture signals.

## auxiliary circuit — avalanche noise

Expressed as a percentage of the length of the scanning line.

**available machine time**—Time after the application of power during which a computer is operating correctly.

**available power**—1. The mean square of the open-circuit terminal voltage of a linear source, divided by four times the resistive component of the source impedance. 2. Of a network, the power that would be delivered to a conjugately matched load. It is the maximum power that a network can deliver. Available power, though defined in terms of an output load impedance, is independent of that impedance.

**available power gain**—Sometime called completely matched power gain. Ratio of the available power from the output terminals of a linear transducer, under specified input-termination conditions, to the available power from the driving generator. The available power gain of an electrical transducer is maximum when the input-termination admittance is the conjugate of the driving-point admittance at the input terminals of the transducer.

**available signal-to-noise ratio**—Ratio of the available signal power at a point in a circuit to the available random-noise power.

**avalanche**—1. Rapid generation of a current flow with reverse-bias conditions as electrons sweep across a semiconductor junction with enough energy to ionize other bonds and create electron-hole pairs, making the action regenerative. 2. One of the mechanisms responsible for voltage breakdown of semiconductor junctions and devices. When avalanche occurs, carriers moving through the crystal lattice have achieved sufficient kinetic energy to knock further carriers from the lattice, producing a snowballing increase in current level. Provided the current increase is limited externally, avalanche breakdown causes no permanent damage to the device.

**avalanche breakdown**—1. In a semiconductor diode, a nondestructive breakdown caused by the cumulative multiplication of carriers through field-induced impact ionization. 2. In a reverse-biased semiconductor, the sudden, marked increase of reverse current at the bias voltage at which avalanche begins. The action resembles a breakdown but it is nondestructive when the current is limited by external means. 3. A breakdown that is caused by the action of a strong electric field which causes some free carriers to gain enough energy to liberate new hole-electron pairs by ionization.

**avalanche conduction**—A form of conduction in a semiconductor in which charged-particle collisions create additional hole-electron pairs.

**avalanche current**—The high current through a semiconductor junction in response to an avalanche voltage.

**avalanche diode**—1. Also called breakdown diode. A silicon diode that has a high ratio of reverse-to-forward resistance until avalanche breakdown occurs. After breakdown the voltage drop across the diode is essentially constant and is independent of the current. Used for voltage regulating and voltage limiting. Originally called zener diode, before it was found that the zener effect had no significant role in the operation of diodes of this type. 2. A silicon diode in which avalanche breakdown occurs across the diode's pn junction. *See* IMPATT diode; TRAPATT diode.

**avalanche impedance**—*See* breakdown impedance.

**avalanche noise**—1. A phenomenon in a semiconductor junction in which carriers in a high-voltage gradient develop sufficient energy to dislodge additional carriers through physical impact. 2. Electrical noise

generated in a junction diode operated at the point at which avalanche just begins.

**avalanche photodiode**—1. A photodiode that takes advantage of the avalanche multiplication of photocurrent. It is particularly suited to low-noise and/or high-speed applications. 2. A device that utilizes avalanche multiplication of photocurrent by means of hole electrons created by absorbed photons. When the device's reverse-bias voltage nears breakdown level, the hole-electron pairs collide with substrate atoms to produce multiple hole-electron pairs.

**avalanche transistor**—A transistor that, when operated at a high reverse-bias voltage, supplies a chain generation of electron-hole pairs.

**avalanche voltage**—The applied voltage at which avalanche breakdown occurs.

**avalanching**—A process resulting from high fields in a semiconductor device, in which an electron is accelerated by the field, hits an atom, and releases more electrons, which continue the sequence.

**AVC**—See automatic volume control.

**average**—See arithmetic mean.

**average absolute pulse amplitude**—The average of the absolute value of instantaneous amplitude taken over the pulse duration. Absolute value means the arithmetic value regardless of algebraic sign.

**average brightness**—The average illumination in a television picture.

**average calculation operation**—A typical computer calculating operation longer than an addition and shorter than a multiplication, often taken as the mean of nine additions and one multiplication.

**average current**—The arithmetic mean of the instantaneous currents of a complex wave, averaged over one half cycle.

**average electrode current**—The value obtained by integrating the instantaneous electrode current over an averaging time and dividing by the average time.

**average life**—See mean life, 1.

**average noise factor**—See average noise figure.

**average noise figure**—Also called average noise factor. In a transducer, the ratio of total output noise power to the portion attributable to thermal noise in the input termination, with the total noise being summed over frequencies from zero to infinity and the noise temperature of the input termination being standard (290 K).

**average outgoing quality**—The ultimate average quality of products shipped to the customer that results from composite sampling and screening techniques.

**average power output of an amplitude-modulated transmitter**—The radio-frequency power delivered to the transmitter output terminals, averaged over a modulation cycle.

**average pulse amplitude**—The average of the instantaneous amplitudes taken over the pulse duration.

**average rate of transmission**—Effective speed of transmission.

**average value**—1. The value obtained by dividing the sum of a number of quantities by the number of quantities. The average value of a sine wave is 0.637 times the peak value. 2. The dc voltage of current amplitude that will transfer the same electrical charge to a capacitor as the ac waveform during a half period. Mathematically, it is the average of the absolute value of all the instantaneous amplitudes.

**average voltage**—The sum of the instantaneous voltages in a half-cycle waveshape, divided by the number of instantaneous voltages. In a sine wave, the average voltage is equal to 0.637 times the peak voltage.

**aviation channels**—A band of frequencies, below and above the standard broadcast band, assigned exclusively for aircraft and aviation applications.

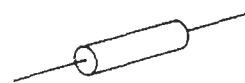
**aviation services**—The aeronautical mobile and radionavigational services.

**avionics**—1. An acronym designating the field of aviation electronics. 2. The branch of electronics that is concerned with aviation applications. 3. The design, production, and application of electronic devices and systems for use in aviation and astronautics.

**Avogadro's number**—The actual number of molecules in one gram-molecule, or of atoms in one gram-atom, of an element or any pure substance (6.023 × 10<sup>23</sup> molecules/mole).

**AWG**—1. American wire gage. A means of specifying wire diameter. The higher the number, the smaller the diameter. 2. A scale of gage sizes which, with the exception of the largest sizes, 4/0 through 1/0, increases with the descending values of wire diameter. For example, a 1 AWG wire has a diameter of 0.289 inch (7.34 mm) and a wire of 40 AWG has a diameter of 0.0031 inch (78.74 µm). AWG is applied to stranded as well as solid conductors.

**axial leads**—Leads coming out the ends and along the axes of a resistor, capacitor, or other axial part, rather than out the side.



Axial leads.

**axial ratio**—Ratio of the major axis to the minor axis of the polarization ellipse of a waveguide. This term is preferred over *ellipticity* because, mathematically, ellipticity is 1 minus the reciprocal of the axial ratio.

**axis**—The straight line, either real or imaginary, passing through a body around which the body revolves or around which parts of a body are symmetrically arranged.

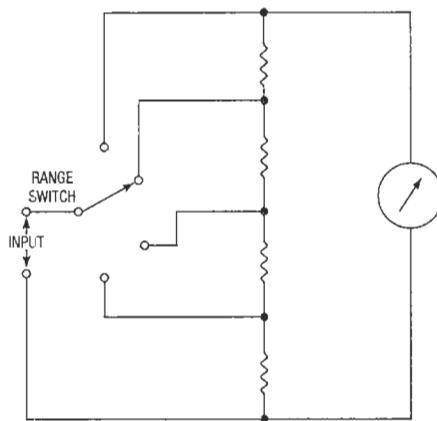
**Ayrton-Perry winding**—1. Two conductors connected in parallel so that the current flows in opposite directions in each conductor and thus neutralizes the inductance between the two. 2. A noninductive winding with two inductors that conduct current in opposite directions, with the opposing currents canceling the magnetic field.

**Ayrton shunt**—Also called universal shunt. A high-resistance parallel connection used to increase the range of a galvanometer without changing the damping.

**azel display**—A modified type of plan-position indicator presentation showing two separate radar displays on one cathode-ray screen. One display presents bearing information, and the other shows elevation.

**az-el mount**—An antenna mount that tracks satellites by moving in two directions: the azimuth in the horizontal plain, and elevation up from the horizon.

**azimuth**—1. The angular measurement in a horizontal plane and in a clockwise direction. 2. In a tape recorder, the angle that recording and playback head gaps make with the line along which the tape moves. The head is oriented until this angle is 90°. 3. The vertical setting (alignment) of the head in a tape recorder. 4. Compass direction from due north measured in degrees clockwise. (True north can be found by sighting the star Polaris at



Ayrton shunt.

night, or by applying a local correction for magnetic deviation to a compass reading.)

**azimuth alignment**—Alignment of the recording and reproducing gaps so that their center lines lie parallel with one another. Misalignment of the gaps causes a loss in output at short wavelengths. *See head alignment.*

**azimuth blanking**—Blanking of the CRT screen in a radar receiver as the antenna scans a selected azimuth region.

**azimuth-elevation mount**—A movable dish-antenna mount and aiming system in which one pivot allows rotation in the horizontal plane about the azimuth

angle from due north. The other pivot is the elevation above the horizon. (This mount can be more difficult to aim than a polar mount.)

**azimuth gain reduction**—A technique that allows control of the radar receiver system throughout any azimuth sectors.

**azimuth loss**—High-frequency losses that are caused by recording head misalignment.

**azimuth rate**—The rate of change of true bearing.

**azimuth resolution**—The angle or distance by which two targets must be separated in azimuth to be distinguished by a radar set when the targets are at the same range.

**azimuth stabilization**—The presentation of indications on a radar display so that north, or any specific reference line of direction, is always at the top of the screen.

**azimuth-stabilized plan-position indicator**—A plan-position indicator scope on which the reference bearing (usually true or magnetic north) remains fixed with respect to the indicator, regardless of the vehicle orientation.

**azimuth versus amplitude**—An electronic counter-countermeasures receiver with plan-position indicator-type display attached to the main antenna, used to display strobes due to jamming aircraft. It is useful in making passive position fixes when two or more radar sites can operate together.

**azusa**—A short base-line continuous-wave phase-comparison electronic tracking system operating on the C-band, in which a single station provides two direction cosines and slant range.

# B

**B**—1. Symbol for the base of a transistor. 2. Symbol for magnetic flux. 3. Abbreviation for photometric brightness. 4. B or b. Abbreviation for susceptance.

**B-** (**B-minus or B-negative**)—Negative terminal of a B battery or the negative polarity of other sources of anode voltage. Denotes the terminal to which the negative side of the anode-voltage source should be connected.

**B+** (**B-plus or B-positive**)—Positive terminal of a B battery or the positive polarity of other sources of anode voltage. The terminal to which the positive side of the anode voltage source should be connected.

**babble**—1. The aggregate crosstalk from a large number of disturbing channels. 2. In a carrier or other multiple-channel system, the unwanted disturbing sounds that result from the aggregate crosstalk or mutual interference from other channels. 3. Crosstalk from a large number of channels in a system.

**babble signal**—A type of electronic deception signal used to confuse enemy receivers. Generally, it has characteristics of energy transmission signals. It can be composed by superimposing incoming signals on previously recorded intercepted signals; this composite signal can then be radiated as a jamming signal.

**BABS**—Abbreviation for blind approach beacon system. A pulse-type ground-based navigation beacon used for runway approach. The BABS ground beacon is installed beyond the far end of the runway on the extended center line. When interrogated by an aircraft, it retransmits two diverging beams, one of short- and the other of long-duration pulses. The beams are transmitted alternately, but because of the first switching, the aircraft receives what appears to be a continuous transmission of both beams. The cathode-ray tube in the aircraft displays both long and short pulses superimposed on each other. When the aircraft is properly aligned with the runway, the pulses will be of equal amplitude.

**back bias**—1. A degenerative or regenerative voltage that is fed back to circuits before its originating point. Usually applied to a control anode of a tube. 2. A voltage applied to a grid of a tube (or tubes) to restore a condition that has been upset by some external cause. 3. *See also reverse bias.*

**back bonding**—Bonding active chips to a substrate using the back of the chip, leaving the face with its circuitry uppermost. The opposite of back bonding is face-down bonding.

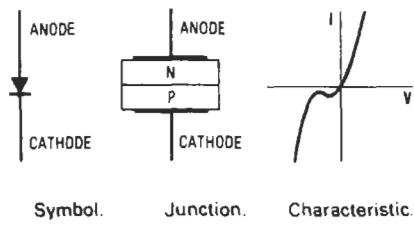
**backbone**—A high-voltage, high-capacity transmission line or group of lines having a limited number of large-capacity connections between loads and points of generation.

**backbone network**—1. A network that links several smaller networks. 2. A transmission facility designed to interconnect low-speed distribution channels or clusters of dispersed user devices.

**back contact**—Relay, key, jack, or other contact designed to close a circuit and permit current to flow when, in the case of a relay, the armature has released or fallen back, or, in other cases, when the equipment is inoperative.

**back current**—Also called reverse current. The current that flows when reverse bias is applied to a semiconductor junction.

**back diode**—A tunnel diode that is usually chosen for its reverse-conduction characteristics.



*Back diode.*

**back echo**—An echo due to the back lobe of an antenna.

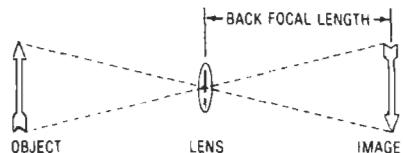
**back emission**—Also called reverse emission. Emission from an electrode occurring only when the electrode has the opposite polarity from that required for normal conduction. A form of primary emission common to rectifiers during the inverse portion of their cycles.

**back end**—In semiconductor manufacturing, the package assembly and test stages of production. Includes burn-in and environmental test functions.

**backfill**—Filling an evacuated (hybrid) circuit package with dry inert gas prior to hermetic sealing of the package.

**backfire**—*See* arcback.

**back focal length**—Distance from the center of a lens to its principal focus on the side of the lens away from the object.



*Back focal length.*

**back focus**—The distance from the rear vertex of a lens to the focal plane, with the subject at infinite distance.

**background**—1. The picture white of the copy being scanned when the picture is black and white only. Also undesired printing in the recorded copy of the picture being transmitted, resulting in shading of the background area. 2. Noise heard during a radio program; this noise is caused by atmospheric interference or operation of the receiver at such high gain that inherent tube and circuit noises become noticeable. 3. A low-priority job that a computer works on when it isn't occupied by more pressing matters.

**background control**—In color television, a potentiometer used as a means of controlling the dc level of a color signal at one input of a tricolor picture tube. The setting of this control determines the average (or background) illumination produced by the associated color phosphor.

**background count**—Count caused by radiation from sources other than the one being measured.

**background noise**—1. The total system noise independent of the presence or absence of a signal. The signal is not included as part of the noise. 2. In a receiver, the noise in the absence of signal modulation in the carrier. 3. Any unwanted sound that intrudes upon program material, such as sounds produced as a result of surface imperfections of a disc record.

**background processing**—The automatic execution of lower-priority programs in a computer when the system resources are not being used for higher-priority (foreground) programs. For example, background program processing is temporarily suspended to service interrupt requests from I/O devices that require foreground processing.

**background program**—1. Low-priority program in a multiprogramming environment, which operates when the processor is not doing anything else. 2. That portion of the resident computer program that is run when no immediate pressing needs exist in the system.

**background radiation**—Radiation due to the presence of radioactive material in the vicinity of the measuring instrument.

**background response**—In radiation detectors, response caused by ionizing radiation from sources other than that to be measured.

**backhaul**—A terrestrial communications channel linking an earth station to a local switching network or population center.

**back-haul**—Use of excess circuit mileage by routing through switching centers that are not in a direct facility path between an originating office and a terminating office.

**backing**—Flexible material (usually cellulose acetate or polyester) on which is deposited the magnetic-oxide coat that "records" the signal on magnetic recording tape. Also known as base.

**backing up**—Making copies of files to prevent loss of their contents if the originals are damaged.

**backlash**—In a potentiometer, the maximum difference that occurs in shaft position when the shaft is moved to the same actual output-ratio point from opposite directions. Resolution and contact-width effects must be excluded from this measure.

**backloaded horn**—A speaker enclosure arranged so the sound from the front of the cone feeds directly into the room, and the sound from the rear feeds into the room via a folded horn.

**back loading**—A form of horn loading particularly applicable to low-frequency speakers; the rear radiating surface of the speaker feeds the horn, and the front part of the speaker is directly exposed to the room.

**back lobe**—1. In the radiation pattern of a directional antenna, that part which extends backward from the main lobe. 2. The three-dimensional petal-shaped pattern representing antenna directional response that is pointing away from the intended direction.

**back metallization**—Metal applied to the side of the transistor wafer opposite the active areas. Provides the collector contact in bipolar transistors and permits the transistor chips to be bonded to the package or thin-film circuit substrate.

**back pitch**—The winding pitch of the back end of the armature, that is, the end opposite the commutator.

**backplane**—1. Area of a computer or other equipment where various logic and control elements are interconnected. Often takes the form of a rat's nest of wires interconnecting printed-circuit cards in the back of computer racks or cabinets. 2. The physical area where printed circuit boards in a system plug in. Usually contains the buses of the system either in printed-circuit or wire-wrap form. Also called a motherboard. 3. A printed circuit card located in the back of a chassis. It has sockets into which specific modules fit for interconnection. 4. A printed circuit motherboard with connectors placed at intervals to allow connection and communication between daughterboards.

**backplate**—In a camera tube, the electrode to which the stored-charge image is capacitively coupled.

**back porch**—In a composite picture signal, that portion which lies between the trailing edge of a horizontal-sync pulse and the trailing edge of the corresponding blanking pulse. A color burst, if present, is not considered part of the back porch.

**back-porch effect**—The continuation of collector current in a transistor for a short time after the input signal has dropped to zero. The effect is due to storage of minority carriers in the base region. It also occurs in junction diodes.

**back-porch tilt**—The slope of the back porch from its normal horizontal position. Positive and negative refer, respectively, to upward and downward tilt to the right.

**backscattering**—1. Radiation of unwanted energy to the rear of an antenna. 2. The reflected radiation of energy from a target toward the illuminating radar.

**back-shunt keying**—A method of keying a transmitter, in which the radio-frequency energy is fed to the antenna when the telegraph key is closed and to an artificial load when the key is open.

**backside illumination**—A charge-coupled device fabrication technique employing thinned silicon, in which the image is impressed on the side opposite the MOS electrodes.

**backspace**—In a computer, an operation whose function is to move backward in a sequential file one record at a time.

**backstop**—That part of the relay that limits the movement of the armature away from the pole face or core. In some relays, a normally closed contact may serve as a backstop.

**backswing**—The amplitude of the first maximum excursion in the negative direction after the trailing edge of a pulse, expressed as a percentage of the 100-percent amplitude.

**backtalk**—Transfer of information to the active computer from a standby computer.

**back-to-back circuit**—Two tubes or semiconductor devices connected in parallel but in opposite directions so that they can be used to control current without introducing rectification. Also called inverse-parallel connection.

**backup**—1. A duplicate copy of a file or program. 2. A system, device, file or facility that can be used as an

alternative in case of a malfunction or loss of data. 3. An item kept available to replace an item that fails to perform satisfactorily. 4. An item under development intended to perform the same general function performed by another item also under development. 5. The hardware and software resources available to recover after a degradation or failure of one or more system components. 6. A system or element, such as a circuit component, that is used to replace a similar system or component in case of failure of the latter.

**backup control**—See redundancy.

**backup copy**—A copy of a file or data set to be kept for reference in case the original file or data set is destroyed or lost.

**backup facility**—A communications-electronics facility that is established for the purpose of replacing or supplementing another facility or facilities under real or simulated emergency conditions.

**backup item**—An additional item to perform the general functions of another item. It may be secondary to an identified primary item or a parallel development to improve the probability of success in performing the general function.

**backwall**—The plate in a pot core that connects the center post to the sleeve.

**backwall photovoltaic cell**—A cell in which light must pass through the front electrode and a semiconductor layer before reaching the barrier layer.

**backward-acting regulator**—A transmission regulator in which the adjustment made by the regulator affects the quantity that caused the adjustment.

**backward diode**—A highly doped, alloyed germanium junction that operates on the principle of quantum-mechanical tunneling. The diode is “backward” because its easy current direction is in the negative-voltage rather than the positive-voltage region of the  $I/V$  curve. The backward diode has a negative-resistance region, but the resultant valley of its  $I/V$  curve is much less pronounced than in tunnel diodes.

**backward wave**—In a traveling-wave tube, a wave having a group velocity opposite the direction of electron-stream motion.

**backward-wave oscillator**—An oscillator employing a special vacuum tube in which oscillatory currents are produced by using an oscillatory electromagnetic field to bunch the electrons as they flow from cathode to anode.

**backward-wave tube**—A traveling-wave tube in which the electrons travel in a direction opposite to that in which the wave is propagated.

**back wave**—See spacing wave.

**baffle**—1. In acoustics, a shielding structure or partition used to increase the effective length of the external transmission path between two points (e.g., between the front and back of an electroacoustic transducer). A baffle is often used in a speaker to increase the acoustic loading of the diaphragm. (Although this term sometimes is used to designate the entire cabinet, or enclosure, that houses a loudspeaker, strictly speaking it refers to the panel on which the speaker is mounted, usually the front panel of such an enclosure. The term derives from its original use in preventing, or baffling, the speaker's rear sound waves from interfering with its front waves.) 2. In a gas tube, an auxiliary member placed in the arc path and having no separate external connection. 3. A device for deflecting oil or gas in a circuit breaker. 4. A single shielding device designed to reduce the effect of ambient light on the operation of an optical transmission link. 5. An opaque shielding device designed to reduce the effect of stray light on an optical system.

**baffle plate**—A metal plate inserted into a wave-guide to reduce the cross-sectional area for wave-conversion purposes.

**bail**—A loop of wire used to prevent permanent separation of two or more parts assembled together (e.g., the bail holding dust caps on round connectors).

**Bakelite**—A trademark of the Bakelite Corp. for its line of plastic and resins. Formerly, the term applied only to its phenolic compound used as an insulating material in the construction of radio parts.

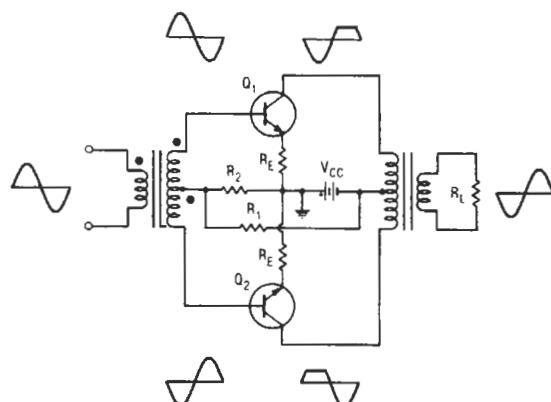
**bake-out**—Subjecting an unsealed (hybrid) circuit package to an elevated temperature to bake out moisture and unwanted gases prior to final sealing.

**balance**—1. The effect of blending the volume of various sounds coming over different microphones in order to present them in correct proportion. 2. The maintenance of equal average volume from both speaker systems of a stereo installation. 3. Relative volume, as between different voices or instruments, bass and treble, or left and right stereo channels. 4. Either a condition of symmetry in an electrical circuit, such as a Wheatstone bridge, or the condition of zero output from a device when properly energized. In the latter sense, depending on the nature of the excitation, two general categories of balance may be encountered: for dc excitation, resistive balance; for ac excitation, resistive and/or reactive balance.

**balance control**—1. On a stereo amplifier, a differential gain control used to vary the volume of one speaker system relative to the other without affecting the overall volume level. As the volume of one speaker increases and the other decreases, the sound appears to shift from left to center to right, or vice versa. 2. A variable resistor used to compensate for any slight loss of signal in the right or left channel of a stereo amplifier. To some extent, this control can compensate for unbalanced speakers and be used for adjustment when the listener is not in an equidistant position between the two loudspeakers. 3. A variable component, such as a potentiometer or variable capacitor, used to balance bridges, null circuits, or phase speakers.

**balanced**—1. Electrically alike and symmetrical with respect to ground. 2. Arranged to provide balance between certain sets of terminals. 3. A type of line in which both wires are electrically equal.

**balanced amplifier**—1. An amplifier circuit with two identical signal branches connected to operate in phase opposition and with their input and output connections each balanced to ground; for example, a push-pull amplifier. 2. A transistor amplifier stage in which two identical transistors are used and the input signal and output power are equally divided between them.



Balanced push-pull amplifier.

This technique produces approximately twice the output power of a single transistor stage, with generally improved dynamic range and reduced voltage standing-wave ratio.

**balanced armature**—An armature that is approximately in equilibrium with respect to both static and dynamic forces.

**balanced-armature unit**—The driving unit used in magnetic speakers, consisting of an iron armature pivoted between the poles of a permanent magnet and surrounded by coils carrying the audio-frequency current. Variations in the audio-frequency current cause corresponding changes in the armature magnetism and corresponding movements of the armature with respect to the poles of the permanent magnet.

**balanced bridge**—A bridge circuit with its components adjusted so that it has an output voltage of zero.

**balanced circuit**—1. A circuit with two sides electrically alike and symmetrical to a common reference point, usually ground. 2. A circuit terminated by a network that has infinite impedance losses. 3. A circuit terminated by a network whose impedance balances that of the line, resulting in negligible return losses. 4. A circuit whose electrical midpoint is grounded, as opposed to the single-ended circuit, which has one side grounded. 5. A nulled bridge circuit. 6. Telephone circuit in which the two conductors are electrically balanced to each other and to ground. 7. A circuit so arranged that the impressed voltages on each conductor of the pair are equal in magnitude but opposite in polarity with respect to ground.

**balanced converter**—See balun.

**balanced currents**—Also called push-pull currents. In the two conductors of a balanced line, currents that are equal in value and opposite in direction at every point along the line.

**balanced detector**—A demodulator for frequency-modulation systems. In one form, the output consists of the rectified difference of the two voltages produced across two resonant circuits, one circuit being tuned slightly above the carrier frequency and the other slightly below.

**balanced line**—A line or circuit utilizing two identical conductors. Each conductor is operated so that the voltages on them at any transverse plane are equal in magnitude and opposite in polarity with respect to ground. Thus, the currents on the line are equal in magnitude and opposite in direction. A balanced line is preferred where minimum noise and crosstalk are desired.

**balanced-line system**—A system consisting of a generator, balanced line, and load adjusted so that the voltages of the two conductors at all transverse planes are equal in magnitude and opposite in polarity with respect to ground.

**balanced low-pass filter**—A low-pass filter designed to be used with a balanced line.

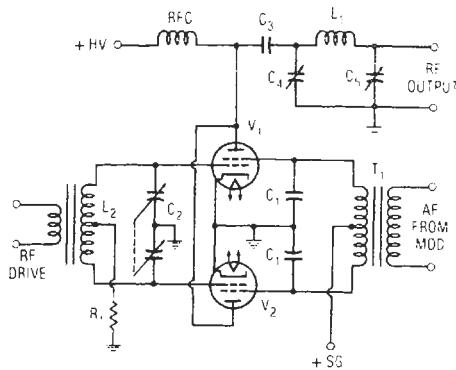
**balanced magnetic switch**—A magnetic switch that is operated by a balanced magnetic field in such a manner as to resist defeat with an external magnet. It signals an alarm when it detects either an increase or decrease in magnetic field strength.

**balanced method**—A method of measurement in which the reading is taken at zero. It may be a visual or audible reading; in the latter case, the null is the no-sound setting.

**balanced modulator**—An amplitude modulator in which the control grids of two tubes are connected for parallel operation, and the screen grids and plates for push-pull operation. After modulation, the output contains the two sidebands without the carrier.

**balanced network**—1. A hybrid network in which the impedances of the opposite branches are equal. 2. A network in which the corresponding series impedance

## balanced armature — balancing network



Balanced modulator.

elements are identical and symmetrical with respect to ground.

**balanced oscillator**—Any oscillator in which (a) the impedance centers of the tank circuits are at ground potential and (b) the voltages between either end and the centers are equal in magnitude and opposite in phase.

**balanced output**—A three-conductor output (as from a microphone) in which the signal voltage alternates above and below a third neutral circuit. This symmetrical arrangement tends to cancel any hum picked up by long lengths of interconnecting cable.

**balanced output transformer**—1. A push-pull output transformer with a center-tapped primary winding. 2. An output transformer with a grounded center tap on its secondary winding.

**balanced probe**—A probe, used with an electronic voltmeter or oscilloscope, that has a balanced input and (usually) a single-ended output.

**balanced telephone line**—A telephone line that is floated with respect to ground so that the impedance measured from either side of the line to ground is equal to that of the other side to ground.

**balanced termination**—For a system or network having two output terminals, a load presenting the same impedance to ground for each output terminal.

**balanced transmission line**—A transmission line having equal conductor resistances per unit length and equal impedances from each conductor to earth and to other electrical circuits.

**balanced voltages**—Also called push-pull voltages. On the two conductors of a balanced line, voltages (relative to ground) that are equal in magnitude and opposite in polarity at every point along the line.

**balanced-wire circuit**—A circuit with two sides electrically alike and symmetrical to ground and other conductors. Commonly refers to a circuit the two sides of which differ only by chance.

**balancer**—In a direction finder, that portion used for improving the sharpness of the direction indication. It balances out the capacitance effect between the loop and ground.

**balance stripe**—A magnetic sound stripe placed on the edge of a motion-picture film opposite the main stripe; it provides mechanical balance for the film.

**balance-to-unbalance transformer**—A device for matching a pair of lines, balanced with respect to earth, to a pair of lines not balanced with respect to earth. See also balun.

**balancing network**—1. An electrical network designed for use in a circuit in such a way that two branches of the circuit are made substantially conjugate

(i.e., such that an electromotive force inserted into one branch produces no current in the other). 2. Electronic circuitry used to match two-wire to four-wire facilities, sometimes called a hybrid. Balancing is necessary to maximize power transfer and minimize echo. 3. Another name for a hybrid, a circuit that connects a two-wire line to a four-wire line and maximizes power transfer while minimizing echo.

**balancing unit** — An antenna-matching device used to permit efficient coupling of a transmitter or receiver having an unbalanced output circuit to an antenna having a balanced transmission line. 2. A device for converting balanced to unbalanced transmission lines, and vice versa, by placing suitable discontinuities at the junction between the lines instead of using lumped components.

**ball** — In face bonding, a method of providing chips with contact.

**ballast** — A device used with an electronic-discharge lamp to obtain the necessary circuit conditions (voltage, current, and waveform) for starting and operating.

**ballasting** — An integrated circuit design technique that prevents current hogging.

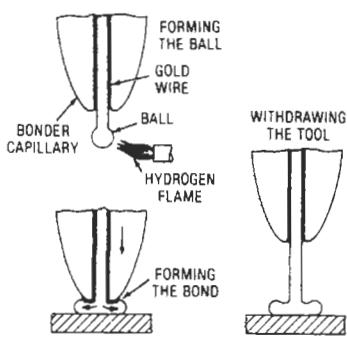
**ballast lamp** — A lamp that maintains a nearly constant current by increasing its resistance as the current increases.

**ballast resistor** — A special type of resistor used to compensate for fluctuations in alternating-current power-line voltage. It is usually connected in series with the power supply to a receiver or amplifier. The resistance of a ballast resistor increases rapidly with increases in current through it, thereby tending to maintain an essentially constant current despite variations in the line voltage.

**ballast tube** — A current-controlling resistance device designed to maintain a substantially constant current over a specified range of variations in the applied voltage to a series circuit.

**ball bond** — 1. A type of thermocompression bond in which a gold wire is flame-cut to produce a ball-shaped end that is then bonded to a metal pad by pressure and heat. 2. A bond formed when a ball-shaped end interconnecting wire is deformed by thermocompression against a metallized pad. The bond is also called a nail-head bond from the appearance of the flattened ball.

**ball bonding** — A bonding technique that uses a capillary tube to feed the bonding wire. The end of the wire is heated and melts, thus forming a large ball. The capillary and ball are then positioned on the contact area and the capillary is lowered. This forms a large bond. The capillary is then removed and a flame is applied, severing the wire and forming a new ball.



Ball bonding.

**ballistic galvanometer** — An instrument that indicates the effect of a sudden rush of electrical energy, such as the discharge current of a capacitor.

**ballistic-missile early-warning system** — An electronic system for providing detection and early warning of attack by enemy intercontinental ballistic missiles. Abbreviated BMEWS.

**ballistics** — A general term used to describe the dynamic characteristics of a meter movement—most notably, response time, damping, and overshoot.

**ballistic trajectory** — In the trajectory of a missile, the curve traced after the propulsive force is cut off and the body of the missile is acted upon only by gravity, aerodynamic drag, and wind.

**balop** — Contraction of balopticon, an apparatus for the projection of opaque images in conjunction with a television camera.

**balopticon** — See balop.

**balun (balanced unbalanced)** — 1. Also called balanced converter or bazooka. An acronym from balanced to unbalanced. A device used for matching an unbalanced coaxial transmission line to a balanced two-wire system. 2. Usually, a transformer designed to accept 75-ohm unbalanced input (coaxial cable) and deliver the signal at 300-ohm balanced (twin lead). Usable in the converse sense, and sometimes necessary for matching a tuner with 300-ohm balanced antenna terminals to a 75-ohm coaxial line. 3. An impedance-matching transformer device used to connect balanced twisted-pair cabling with unbalanced coaxial or other cabling systems.

**banana jack** — A jack that accepts a banana plug. Generally designed for panel mounting.

**banana plug** — A plug with a banana-shaped spring-metal tip and with elongated springs to provide a low-resistance compression fit.

**band** — 1. Any range of frequencies lying between two defined limits that is used for a specified purpose. 2. A group of radio channels assigned by the FCC to a particular type of radio service.

very low freq. (VLF)	10–30 kHz
low freq. (LF)	30–300 kHz
medium freq. (MF)	300–3000 kHz
high freq. (HF)	3–30 MHz
very high freq. (VHF)	30–300 MHz
ultrahigh freq. (UHF)	300–3000 MHz
superhigh freq. (SHF)	3000–30,000 MHz
extremely high freq. (EHF)	30–300 GHz

3. A group of tracks or channels on a magnetic drum in an electronic computer. See also track. 4. In instrumentation, a range of values that represents the scope of operation of an instrument.

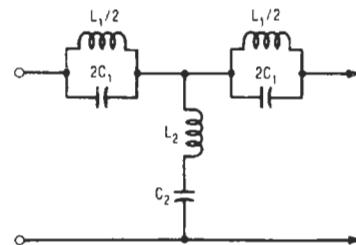
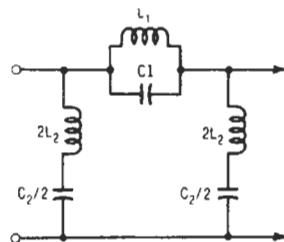
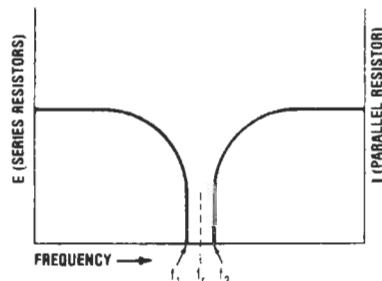
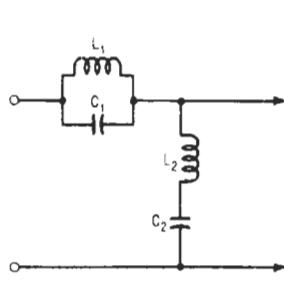
**bandage** — Rubber ribbon, about 4 inches wide, used as a temporary moisture protection for a splice in telephone or coaxial cable.

**band center** — The geometric mean between the limits of a band of frequencies.

**band compression** — Reduction of the frequency band needed to transmit a message while maintaining acceptable quality of the message.

**banded cable** — Two or more cables banded together by stainless-steel strapping.

**band-elimination filter** — 1. Also called band-stop filter. A wave filter with a single attenuation band, neither of the cutoff frequencies being zero or infinite. The filter passes frequencies on either side of this band. 2. A filter that attenuates frequencies within its rejection band, but passes frequencies above and below this band.



Band-elimination filters.

**bandgap**—1. The energy difference between the conduction band and the valence band in a material. 2. The difference in the energy of an electron in a stable state and an electron in an excited state after absorbing energy. 3. The minimum energy required for a valence electron in a semiconductor to make a transition into the conduction band where the electron can move more freely throughout the crystal.

**bandgap energy**—The difference in energy between the conduction band and the valence band.

**band marking**—A continuous circumferential band applied to a conductor at regular intervals for identification.

**band opening**—A condition that results in greater-than-normal communication range on VHF and UHF amateur bands.

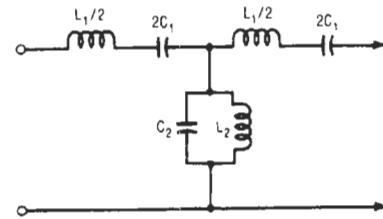
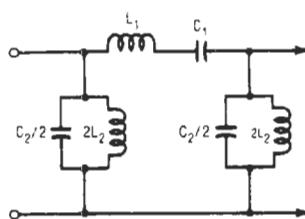
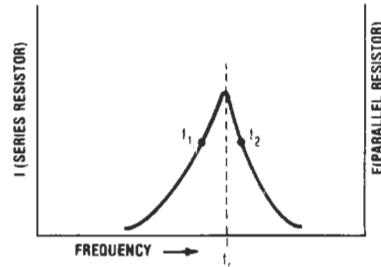
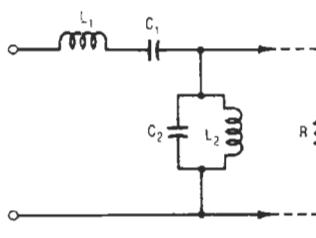
**bandpass**—1. A specific range of frequencies that will be passed through a device. 2. The number of hertz expressing the difference between the limiting frequencies at which the desired fraction (usually half-power) of the maximum output is obtained.

**bandpass amplifier**—An amplifier that is tuned to pass only selected frequencies between preset limits.

**bandpass amplifier circuit**—A stage designed to uniformly amplify signals of certain frequencies only.

**bandpass coupling**—A coupling circuit with an essentially flat-topped frequency response so that a band of frequencies rather than a single frequency is coupled to a following circuit.

**bandpass filter**—A wave filter with a single transmission band, neither of the cutoff frequencies being zero



Bandpass filters.

or infinite. The filter attenuates frequencies on either side of this band.

**bandpass flatness** — The variations in gain in the bandpass of a filter or tuned circuit.

**bandpass response** — Also called flat-top response. The response characteristic in which a definite band of frequencies is transmitted uniformly.

**band plan** — A voluntary system of frequency allocations for each amateur radio band.

**band-reject filter** — A filter that does not pass a band of frequencies but passes both higher and lower frequencies. Sometimes called a notch filter.

**band selector** — Also called bandswitch. A switch used to select any one of the bands in which an electronic apparatus such as a receiver, signal generator, or transmitter is designed to operate.

**B & S gage** — Brown and Sharpe wire gage, in which the conductor sizes rise in geometrical progression. Adopted as the American wire gage (AWG) standard.

**bandsplitting** — Also called split-streaming. A technique for combining several data channels onto one transmission facility by interleaving the data on a bit-by-bit basis. *See also multiplexing.*

**bandspreading** — 1. The spreading of tuning indications over a wider range to facilitate tuning in a crowded band of frequencies. 2. The method of double-sideband transmission in which the frequency band of the modulating wave is shifted upward so that the sidebands produced by modulation are separated from the carrier by a frequency at least equal to the bandwidth of the original modulating wave. In this way, second-order distortion products may be filtered out of the demodulator output.

**bandspread tuning control** — A separate tuning control provided on some shortwave receivers to spread the stations in a single band of frequencies over an entire tuning dial.

**band-stop filter** — *See* band-elimination filter.

**bandswitch** — *See* band selector.

**bandswitching** — In a receiver, transmitter, or test instrument, the process of selecting one of two or more self-contained tuned circuits to change from one frequency spectrum to another within the frequency range of the device's intended operation.

**bandwidth** — 1. The range within the limits of a band. The width of a bandpass filter is generally taken as the limits between which its attenuation is not more than 3.0 decibels greater than its average attenuation throughout its passband. Also used in connection with receiver selectivity, transmitted frequency spectrum occupancy, etc. 2. In a given facsimile system, the difference in hertz between the highest and lowest frequency components required for the adequate transmission of the facsimile signals. 3. The least frequency interval of a wave, outside of which the power spectrum of a time-varying quantity is everywhere less than some specified fraction of its value at a reference frequency. 4. The range of frequencies of a device, within which its performance, with respect to some characteristic, conforms to a specified standard. 5. The range of audio frequencies over which an amplifier or receiver will respond and provide a useful output. 6. The complete range of frequencies over which a particular information system can function. Because it varies with length in optical fibers, bandwidth is typically expressed as a frequency-distance (megahertz-kilometer) product. 7. A range of frequencies available for signaling. In data transmission, the greater the bandwidth, the greater the capacity to transmit data bits. *See hertz.* 8. The number of hertz expressing the difference between the lower and upper limiting frequencies of a frequency band; also, the width of a band of frequencies. 9. The information-carrying capability of a communication line or channel.

10. In data communications, the difference between the highest and lowest frequencies of a band. A measure of the capacity of a communication channel, expressed in bits per second or bauds in digital communications channels, and in cycles per second or hertz in an analog system. 11. The difference between an analog signal's lowest frequency component and its highest signal component as measured in hertz (Hz). 12. The speed of a digital communications circuit in bits per second.

**bandwidth limited gain control** — A control that adjusts the gain of an amplifier while varying the bandwidth. An increase in gain reduces the bandwidth.

**bang-bang controller** — A discontinuity-type nonlinear system that contains time delay, dead space, and hysteresis.

**bank** — An aggregation of similar devices (e.g., transformers, lamps) connected and used together. In automatic switching, a bank is an assemblage of fixed contacts over which one or more wipers or brushes move to establish electric connections.

**bank-and-wiper switch** — A switch in which the electromagnetic ratchets or other mechanisms are used, first, to move the wipers to a desired group of terminals, and second, to move the wipers over the terminals of this group to the desired bank contacts.

**bank winding** — Also called banked winding. A compact multilayer form of coil winding used for reducing distributed capacitance. Single turns are wound successively in two or more layers, the entire winding proceeding from one end of the coil to the other without being returned.

**bantam tube** — A compact tube having a standard octal base but a considerably smaller glass envelope than the standard glass octal tube has.

**bar** — *See* microbar. 1. A subdivision of a crystal slab. 2. A vertical or horizontal line on a television screen, used for testing. 3. A symbol, placed over a letter, used to indicate the inverse, or complement, of a function. For example, inversion of A is  $\bar{A}$ , read "A bar" or "not A".

**bar code** — 1. A self-contained message with information encoded in the physical widths of bars and spaces in a printed pattern. 2. Coding of consumer products that uses combinations of bars of varying thicknesses. Designed to be read by an optical wand or bar code reader. 3. A printed bar-and-space representation of digital data configured to represent numeric or alphanumeric information. In a more restricted sense, a bar code is a sequence of binary ones and zeros that represents a character, or a set of sequences that represents a set of characters. The machine-readable pattern of bars and spaces is called the symbol. Therefore the term *bar code*, comprising the symbol and the code, represents messages with data encoded in the widths of printed bars and (in some cases) the spaces between the bars. 4. A code made up of a series of variable-width vertical lines that can be read by an optical bar reader.



*Bar code.*

**bar code reader** — A photoelectric scanner that reads bar codes by means of reflected light.

**bar code scanner**—An optical scanning device designed to read information printed in the form of bars of different size by detection and processing of the varying reflectivity of light in the bar code.

**bare conductor**—A conductor not covered with any insulating material.

**bar generator**—A generator of pulses or repeating waves that are equally separated in time. These pulses are synchronized by the synchronizing pulses of a television system so that they produce a stationary bar pattern on a television screen.

**bar-graph display**—A display presenting an illuminated line or bar whose length varies in proportion to some parameter being measured.

**bar-graph monitoring oscilloscope**—An oscilloscope for observation of commutated signals appearing as a series of bars with lengths proportional to channel modulation. The same oscilloscope is commonly used for setup and troubleshooting observations.

**barium**—An element, the oxide of which is used in the cathode coating of vacuum tubes.

**barium titanate**—A ceramic that has electric properties and is capable of withstanding much higher temperatures than Rochelle salt crystals. Used in crystal pickups, sonar transducers, and capacitors.

**Barkhausen effect**—A succession of abrupt changes that occur when the magnetizing force acting on a piece of iron or other magnetic material is varied.

**Barkhausen interference**—Interference caused by Barkhausen oscillations.

**Barkhausen-Kurz oscillator**—Circuit for generating ultrahigh frequencies. Its operation depends on the variation in the electrical field around the positive grid and less positive plate of a triode; the variation is caused by oscillatory electrons in the interelectrode spaces.

**Barkhausen oscillation**—A form of parasitic oscillation in the horizontal-output tube of a television receiver; it results in one or more narrow, dark, ragged vertical lines near the left side of the picture or raster.

**Barkhausen oscillator**—*See* Barkhausen-Kurz oscillator.

**Barkhausen tube**—*See* positive-grid oscillator tube.

**bar magnet**—A bar of metal that has been so strongly magnetized that it holds its magnetism and thereby serves as a permanent magnet.

**barn**—A unit of measure of nuclear cross sections. Equal to  $10^{-24}$  square centimeter.

**Barnett effect**—The magnetization resulting from the rotation of a magnetic specimen. The rotation of a ferromagnet produces the same effect as placing the ferromagnet in a magnetic field directed along the axis of rotation. On the macroscopic model, the domains of a ferromagnet can be considered a group of electron systems, each acting as an independent gyroscope or gyrostat.

**barometer**—An instrument for measuring atmospheric pressure. There are two types of barometers commonly used in meteorology: the mercury barometer and the aneroid barometer.

**barometric pressure**—The weight of the atmosphere per unit of surface. The standard barometer reading at sea level and 59°F (15°C) is 29.92 inches (760 mm) of mercury absolute.

**bar pattern**—A pattern of repeating lines or bars on a television screen. When such a pattern is produced by pulses that are equally separated in time, the spacing between the bars on the television screen can be used to measure the linearity of the horizontal or vertical scanning systems.

## bar code scanner — barrier shield

**bar quad**—*See* B-quad.

**barrage jamming**—Simultaneous jamming of a number of adjacent channels or frequencies.

**barrel**—1. The cylindrical portion of a solderless terminal, splice, or contact, in which the conductor is accommodated. 2. The portion(s) of a terminal or contact that is (are) crimped. When designed to receive the conductor, it is called the wire barrel. When designed to support or grip the insulation, it is called the insulation barrel.

**bar relay**—A relay in which a bar actuates several contacts simultaneously.

**barrel distortion**—1. Negative distortion that causes a grid pattern to be imaged as barrel-shaped. 2. In television, distortion that makes the televised image appear to bulge outward on all sides like a barrel. 3. In camera or image tubes, the distortion that results in a monotonic decrease in radial magnification in the reproduced image away from the axis of symmetry of the electron optical system. 4. A distortion of a video image that results in the image resembling a barrel rather than a perfect rectangle. 5. Image distortion in an optical or video system, characterized by bending of the edges of a displayed grid into a barrel shape with convex sides and compressed corners. Can be corrected by image processing techniques.

**barrel effect**—The boomy or hollow voice quality obtained when the voice is transmitted from a reverberant environment; usually accompanied by a loss of intelligibility and a sense of loss of privacy for far-end users.

**barretter**—1. A voltage-regulator tube consisting of an iron-wire filament in a hydrogen-filled envelope. The filament is connected in a series with the circuit to be regulated and maintains a constant current over a given voltage variation. 2. A positive coefficient resistor whose resistance increases as temperature increases.

**barretter mount**—A waveguide mount in which a barretter can be inserted to measure electromagnetic power.

**barricade shield**—A type of movable shield for protection from radiation.

**barrier**—1. A partition for the insulation or isolation of electric circuits or electric arcs. 2. In a semiconductor, the electric field between the acceptor ions and the donor ions at a junction. *See* depletion layer.

**barrier capacitance**—*See* depletion-layer capacitance.

**barrier-film rectifier**—A rectifier in which a film having unilateral (single-direction) conductivity is in contact with metal or other normally conducting plates.

**barrier grid**—A grid close to, or in contact with, a storage surface of a charge storage tube. This grid establishes an equilibrium voltage for secondary-emission charging, and it serves to minimize redistribution.

**barrier height**—In a semiconductor, the difference in potential from one side of a barrier to the other.

**barrier layer**—*See* depletion layer.

**barrier-layer cell**—A type of photovoltaic cell in which light acting on the surface of the contact between layers of copper and cuprous oxide causes an electromotive force to be produced. *See* photovoltaic cell.

**barrier-layer rectification**—*See* depletion-layer rectification.

**barrier plate**—A layer of slow-diffusing metal (usually palladium or nickel) placed between two fast-diffusing materials to slow or prevent their interdiffusion.

**barrier region**—*See* depletion region.

**barrier shield**—A wall or enclosure shielding the operator from an area where radioactive material is being used or processed by remote-control equipment.

**barrier strip**—1. A terminal strip with protective barriers between adjacent terminals. 2. A continuous section of dielectric material that insulates electrical circuits from each other or from ground.

**barrier voltage**—The voltage necessary to cause electrical conduction in a junction of two dissimilar materials, such as a pn junction diode.

**bar test pattern**—Special test pattern for adjusting color TV receivers or color encoders. The upper portion consists of vertical bars of saturated colors and white. The lower horizontal bars have black-and-white areas and I and Q signals.

**base**—1. The region between the emitter and collector of a transistor which receives minority carriers injected from the emitter. It is the element that corresponds to the control grid of an electron tube. 2. In a vacuum tube, the insulated portion through which the electrodes are connected to the pins. 3. On a printed circuit board, the portion that supports the printed pattern. 4. A thin, strong, and flexible material, usually a polyester or acetate film, on which is deposited a magnetic formulation to make recording tape. *See also* alkali; backing; positional notation; radix. 5. One of the three regions that form a bipolar transistor. It physically separates the emitter and collector regions. Minority carriers are injected from the emitter into the base, where they subsequently either recombine or diffuse into the collector.

**base address**—A given address from which an absolute address is obtained by combination with a relative address. Also called address constant.

**baseband**—1. The frequency band occupied by the aggregate of the transmitted signals used to modulate a carrier, before they combine with a carrier in the modulation process. 2. In CD-4 records, the left- or right-channel's band containing musical information for the front and back channels, recorded at listening frequencies in the standard sound spectrum (from 30 to 15,000 hertz). 3. The output signal of a video camera, videotape recorder, or satellite TV receiver before remodulation so that it can be viewed on an ordinary TV set. A signal in a satellite TV receiver goes from 4 GHz through the down-converter to become intermediate frequency and then through an FM modulator to become baseband. The American NTSC TV bandwidth is 4.2 MHz at baseband. 4. The basic direct output signal from a television camera, satellite television receiver, or videotape recorder. Baseband signals can be viewed only on monitors. To display the baseband signal on a conventional television set, a "modulator" is required to convert the baseband signal to one of the VHF or UHF television channels that the television set can be tuned to receive.

**baseband frequency response**—Response characteristics over the frequency band occupied by all of the signals that modulate a transmitted carrier.

**baseband signal**—A signal that is not modulated onto a carrier.

**baseband signaling**—A form of transmission that uses discrete pulses, without modulation. Also called baseband transmission.

**baseband transmission**—A method of using low-frequency transmission of signals across coaxial cables for short distances. *See also* baseband signaling.

**baseband video**—Same as composite video (CVS or CVBS). A composite video signal contains video picture information for color, brightness, and synchronization (horizontal and vertical).

**base-coupled logic**—Abbreviated bcl. A circuit configuration designed for subnanosecond propagation delays and rise and fall times; it can be used for a bit rate of more than 1G bit/s. Base-coupled logic circuits consist

of a current-mode switch and emitter followers. Switching is done by means of a base-coupled current-mode switch.

**base electrode**—An ohmic or majority-carrier contact to the base region of a transistor.

**base film**—The plastic substrate that supports the coating of magnetic recording tape. The base film of most instrumentation and computer tapes is made of polyester. For less critical uses, cellulose acetate and polyvinyl chloride are employed.

**basegroup**—1. Designation for a number of carrier channels in a particular frequency range that forms a basic unit (channel bank) for further modulation to a final frequency band. 2. Twelve communication-set paths capable of carrying the human voice on a telephone set; a unit of a frequency-division-multiplexing system's bandwidth allocation.

**base insulator**—Heavy-duty insulator used to support the weight of an antenna mast and to insulate the mast from the ground or some other surface.

**base line**—1. In radar displays, the visual line representing the track of the radar scanning beam. 2. In graphical presentations, the horizontal scale, often representing time, bias, or some other variable.

**base-line break**—In radar, a technique that uses the characteristic break in the base line on an A-scope display due to a pulse signal of significant strength in noise jamming.

**base load**—In a dc converter, the current that must be taken from the base to maintain a saturated state.

**base-loaded antenna**—A vertical antenna the electrical height of which is increased by adding inductance in series at the base.

**base material**—1. An insulating material (usually a copper-clad laminate) used to support a conductive pattern. 2. Rigid or flexible insulating substrate that supports conductive patterns or interconnections. *See also* substrate.

**base metal**—Metal from which connectors, contacts, or other metal accessories are made and on which one or more metals or coatings may be deposited. Sometimes called basis metal.

**base number**—The radix of a number system (10 is the base number, or radix, for the decimal system; 2 for the binary system).

**base-One peak voltage**—The peak voltage measured across a resistor in series with base-One when a unijunction transistor is operated as a relaxation oscillator in a specified circuit.

**base pin**—One of the metal prongs on the base of an electron tube, which makes contact with springs in a tube socket.

**base point**—*See* radix point.

**base region**—In a transistor, the interelectrode region, between the emitter and collector junctions, into which minority carriers are injected.

**base register**—A high-speed computer storage location that contains the address of the first data word or instruction of a segment. All addresses within the segment are referenced to the start of the segment; during execution, the physical address of each memory reference is calculated by simply adding the contents of the base register to the relative addresses contained within the segment. Relocation is easily accomplished by simply moving a segment in memory and placing the new address in the base register.

**base resistance**—Resistance in series with the base lead in the common-T equivalent circuit of a transistor.

**base resistor**—The (external) resistor connected to the base of a bipolar transistor. In a common-emitter circuit, the base resistor is analogous to the grid resistor

of a vacuum-tube amplifier or the gate resistor of a field-effect transistor amplifier.

**base ring**—Ohmic contact to the base region of power transistors; so called because it is ring-shaped.

**base spreading resistance**—In a transistor, the resistance of the base region caused by the resistance of the bulk material of the base region.

**base station**—1. A fixed station used by a dispatcher to communicate with mobile units. 2. The central transmitter in a communications system that acts as the cell hub for communicating with handsets and/or mobile units. 3. A land station, in the land mobile service, carrying on a service with land mobile stations. (A base station may secondarily communicate with other base stations incident to communications with land mobile stations.) Sometimes defined as a station in a land mobile system that remains in a fixed location and communicates with mobile stations.

**base-timing sequencing**—Sharing of a transponder on a time basis between several ground transmitters through the use of coded timing signals.

**base voltage**—The voltage between the base terminals of a transistor and the reference point.

**BASIC**—1. A simplified computer language intended for use in engineering applications. 2. Acronym for beginners all-purpose symbolic introduction code. An interpreter language that is one of the easier languages to learn and use. 3. An easy-to-learn and easy-to-use programming language developed at Dartmouth College. BASIC can be used to solve business problems as well as in scientific applications.

**basic access method**—A method of computer access in which each input/output statement results in a corresponding machine input/output operation.

**basic frequency**—In any wave, the frequency that is considered the most important. In a driven system, it would in general be the driving frequency, whereas in most periodic waves it would correspond to the fundamental frequency.

**basic linkage**—In a computer, a linkage that is used repeatedly in one routine, program, or system and that follows the same set of rules each time it is used.

**basic processing unit**—The principal section for control and data processing within a communications system.

**basic protection**—Fundamental lightning protection measures and/or devices, such as the use of gas tubes or carbon-block protectors, which are applied directly to transmission media at apparatus locations to provide initial voltage limitation.

**basic Q**—See nonloaded *Q*.

**basic radio pager**—A simple one-way communication device that emits audio sounds when it detects the proper sequence of selective tone signals sent by a dispatcher. The recipient must then telephone the signal originator to get a message. A radio pager is capable of receiving and decoding signals radiated from a call-service transmitter but has no transmitting facilities of its own.

**basic rectifier**—A metallic rectifier in which each rectifying element consists of a single metallic rectifier cell.

**basic speed range**—The range over which a motor and control are capable of delivering full load torque without overheating or clogging. It is obtained by armature voltage control.

**basic television service**—In any of the television-delivery services besides broadcasting (which is free), the monthly fee to subscribe to the lowest tier or set of services and programs, as distinguished from the premium services.

**basis metal**—See base metal.

**basket winding**—A coil winding in which adjacent turns are separated except at the points of crossing.

**bass**—Sounds in the low audio-frequency range. On the standard piano keyboard, all notes below middle C (261.63 hertz).

**bass boost**—A deliberate adjustment of the amplitude-frequency response of a system or component to accentuate the lower audio frequencies.

**bass-boosting circuit**—A circuit that attenuates the higher audio frequencies in order that low or bass frequencies will be emphasized by comparison.

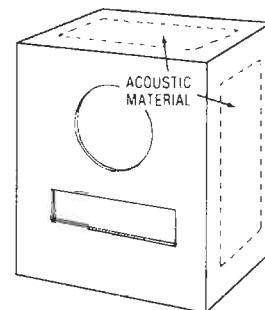
**bass compensation**—Emphasizing the low-frequency response of an audio amplifier at low volume levels to compensate for the lowered sensitivity of the human ear to weak low frequencies.

**bass control**—A manual tone control that has the effect of changing the level of bass frequencies reproduced by an audio amplifier.

**bass half-loudness points**—The low frequency, in hertz, at which the sound power of a speaker rolls off to become half as loud as the rest of the tonal spectrum; a relative measure of a speaker's ability to reproduce low bass sounds.

**bass reflex**—A ported loudspeaker configuration using an acoustically tuned vent, through which low-frequency sound from inside the enclosure passes to strengthen and extend bass response.

**bass-reflex enclosure**—A type of speaker enclosure in which the rear wave from the speaker emerges through an auxiliary opening or port of critical dimensions to reinforce the bass tones. *See also vented baffle.*



Bass-reflex enclosure.

**bass response**—1. The extent to which a speaker or audio-frequency amplifier handles low audio frequencies. 2. The ability of any device to pick up or reproduce low audio frequencies.

**bassy**—Term applied to sound reproduction in which the low-frequency notes are overemphasized.

**BAT**—Abbreviation for battery.

**batch**—1. A group of documents to be processed; an arbitrary subdivision of a job by the supervisor into smaller, more manageable parts. A batch is the smallest group of such documents accessible by name (number) for data entry, data verify, peripheral device transfers, etc. 2. A type of computer operating system in which jobs are processed one at a time and a job must complete its execution before the next is begun. 3. Computer processing mode in which a program is submitted and the result is delivered back. No interactive communication between program and user is possible. 4. The group of

programs considered as a single unit for processing on a computer.

**batch control sample**—A representative batch extracted either at random or at specific intervals from a process or product for quality-control purposes. Results of equivalent tests of the batches are averaged to interpolate the quality of the total process.

**batch environment**—A situation in which a computer receives instructions and program(s) from a terminal or other peripheral device, then executes the requested operations at its own convenience.

**batch file**—A text file that contains operating system and program commands, used for standard procedures performed repetitiously.

**batching**—See batch processing.

**batch mode**—Operational mode in a computer in which input to or output from a process is transmitted as a single set of successive messages. Contrast with *interactive mode*.

**batch process**—A method of fabricating monolithic resistors, capacitors, and diodes with the same process at the same time.

**batch processing**—1. In a computer, a method of processing in which a number of similar input items are grouped for processing during the same machine run. 2. Pertaining to the technique of executing a set of computer programs such that each is completed before the next program of the set is started. Loosely, the execution of computer programs serially. 3. A technique by which items to be processed must be coded and collected into groups prior to processing. 4. A data-processing technique in which input data is accumulated offline and processed in batches.

**bat handle**—Standard form of a toggle-switch lever, having a shape similar to that of a baseball bat.

**bathtub capacitor**—A type of capacitor enclosed in a metal housing having broadly rounded corners like those on a bathtub.

**bathyconductorograph**—A device used from a moving ship to measure the electrical conductivity of seawater at various depths.

**bathythermograph**—A device that automatically plots a graph showing temperature as a function of depth when lowered into the sea.

**Batten system**—A method developed by W. E. Batten for coordinating single words in a computer to identify a document. Sometimes called peek-a-boo system.

**battery**—Abbreviated BAT. 1. A dc voltage source consisting of two or more cells that converts chemical, nuclear, solar, or thermal energy into electrical energy. 2. In communications, a source (not necessarily a storage device) of direct current or the current itself. 3. Two or more cells coupled together in series or parallel. In the former configuration the arrangement gives a greater voltage (two cells give twice the voltage, three cells give three times the voltage, and  $n$  cells give  $n$  times the voltage); the latter arrangement gives the same voltage as the individual cell but a greater current.

**battery acid**—A solution that serves as the electrolyte in a storage battery. In the common lead-acid storage battery, the electrolyte is diluted sulfuric acid.

**battery cable**—A single conductor cable, either insulated or uninsulated, used for carrying current from batteries to the point where power is needed. May also be used for grounding.

**battery capacity**—The amount of energy obtainable from a storage battery, usually expressed in ampere-hours.

**battery charger**—Device used to convert alternating current into a pulsating direct current that can be used for charging a storage battery.

**battery clip**—A metal clip with a terminal to which a connecting wire can be attached, and with spring jaws that can be quickly snapped onto a battery terminal or other point to which a temporary connection is desired.

**battery life**—The number of times that a battery can be charged and discharged. One complete charge and one complete discharge is called a cycle. The number of complete cycles a battery will give depends on construction of the battery, charging procedure, maintenance, and operation.

**battery post adapter**—A device connected to a battery post and used for connecting ammeter leads and simulating a charged battery.

**battery pulses**—Negative potential pulses from the central office battery that are applied to a telephone circuit.

**battery receiver**—A radio receiver that obtains its operating power from one or more batteries.

**battery separator**—An insulator that separates the positive and negative plates in a storage battery.

**battle short**—A switch for short-circuiting safety interlocks and lighting a red warning light.

**bat wing**—An element on an FM or TV transmitting or receiving antenna, so called because of its shape.

**baud**—1. A unit of signaling speed derived from the duration of the shortest code element. 2. A unit of signaling speed equal to the number of discrete conditions or signal events per second. For example, in Morse code 1 baud equals one-half dot cycle per second; in a train of binary signals, 1 baud is 1 bit per second; and in a train of signals, each of which can assume one of eight different states, 1 baud is one 3-bit value per second. 3. A measurement of communication channel capacity as a function of time. For example, a 110-baud line is divided into 110 equal parts. Within each of these parts a certain amount of data can be placed, typically, one bit. This means that a speed of 110 baud is 110 bits per second. 4. The unit of modulation rate (or signaling speed). The reciprocal of the duration of the minimum signaling element (pulse width). 5. The number of times per second the line condition changes. If the line condition represents the presence or absence of a single bit (as in two-state signaling), then the signaling speed in bauds is the same as bits per second. However, if the signaling is not two-state, then bauds are not equal to bits per second. The latter condition exists, for instance, in "di-bit" or four-state signaling, in which the baud rate is equivalent to the number of bits per second times two. 6. In an equal length code, 1 baud corresponds to a rate of one signal element per second. Thus, with a signal element duration of 20 ms, the modulation rate is 50 baud (per second). The term is both singular and plural. 7. A data-communication-rate unit used similarly to bits per second (bps) for low-speed data; the number of signal-level changes per second (regardless of the information the signals contain). 8. A measure of serial data flow between a computer and/or communication devices. One baud is equal to 1 bit per second (1 bps). 9. Unit of signaling speed. The speed in bauds is the number of line changes (in frequency, amplitude, etc.) or events per second. At low speeds, each event represents only one bit condition, and baud rate equals bps. As speed increases, each event represents more than one bit, and baud rate does not truly equal bps. But in common usage, baud rate and bps are often used interchangeably. 10. A variable unit of data transmission speed (as one bit per second). Often confused with bits per second (bps). 11. Signaling rate unit for analog communications. One baud is equal to one change of state per second. Where there are two possible states (e.g., two tone frequencies), 1 baud equals 1 bps. Where there are  $2^n$  possible states (e.g., four

possible phase shifts in a sinusoidal wave), 1 baud equals  $n$  bps. In low-speed transmission, in which modems with frequency-shift keying are used, the terms *baud* and *bps* may be used interchangeably. Otherwise, the two terms are never interchangeable.

**Baudot code**—1. A data-transmission code in which one character is represented by five equal-length bits. This code is used in most dc teletypewriter machines, in which one start element and 1.42 stop elements are added. 2. Five-level code (plus one start and one stop bit) used primarily by amateurs in rtty communication. Only code allowed by the FCC without special waiver. 3. A code of 32 numbers used for alphabetic and symbolic communication. Invented in 1880 by the Frenchman J. M. E. Baudot, the code bears his name; the term *baud* is also derived from it. 4. Data-transmission code in which five bits represent one character. Use of shift letters/figures enables 64 alphanumeric characters to be represented. Baudot is used in many teleprinter systems with one start bit and 1.5 stop bits added.

**baud rate**—1. The number of signal events per second occurring on a communications channel. Although not technically accurate, baud rate is commonly used to mean bit rate. See *bps*. 2. The speed at which data is transmitted, measured in symbols per second. This is not the same as bits per second, since each symbol can carry several bits of information. 3. The number of code elements transferred in one second based on the length of the shortest element. If each element consists of one bit, the baud rate would equal the number of bits per second. 4. Binary speed through a serial interface, traditionally defined as the number of signal elements per second. When each element is one bit, the baud rate equals the number of bits per second. 5. The number of bits transmitted per second in a serial data transmission system. The number of bits per second may also include control bits as well as data bits.

**baud-rate generator**—Oscillator, usually adjustable, that provides clock signals for connection of a peripheral. Typical rates are 110, 300, 9600 bauds and higher.

**bay**—1. A portion of an antenna array. 2. A vertical compartment in which a radio transmitter or other equipment is housed.

**bayonet base**—A base having two projecting pins on opposite sides of a smooth cylindrical base; the pins engage corresponding slots in a bayonet socket and hold the base firmly in the socket.

**bayonet coupling**—1. A quick-coupling device. Connection is accomplished by rotating two parts under pressure. Pins on the side of the male connector engage slots on the side of the female connector. 2. A quick-coupling device for plug and receptacle connectors, accomplished by rotation of a cam operating device designed over a short cylindrical stud or studs to bring the connector halves together.

**bayonet socket**—A socket for bayonet-base tubes or lamps; it has slots on opposite sides and one or more contact buttons at the bottom.

**bazooka**—See *balun*.

**B battery**—The battery that furnishes the required dc voltages to the plate and screen-grid electrodes of the vacuum tubes in a battery-operated circuit.

**BBS**—Abbreviation for bulletin board system. A system by which a group of users with common interests (such as a business, club, or professional society) can share information by posting it to an electronic bulletin board. Some subscriber-based BBSs offer limited Internet

## Baudot code — beacon delay

services. The system allows people to carry on discussions, upload and download files, and make announcements without the people being connected to the computer at the same time. *See also bulletin board*.

**BC**—Abbreviation for bare copper or bell cord.

**BCAS**—Abbreviation for beacon collision avoidance system. An airborne automatic collision-avoidance system.

**BCD**—Abbreviation for binary-coded decimal. 1. A system of representing numerical, alphabetic, and special characters in which individual decimal digits are represented by some binary code. For example, in an 8-4-2-1 BCD notation, 16 might be represented as 001 (for 1) and 0110 (for 6). In pure binary notation, 16 is 10000; the number 23 is represented by 0010 0011 in the BCD notation. 2. A code defined with 6 bits per character and capable, therefore, of representing up to 64 unique values, each representing one of the 26 letters of the English alphabet (uppercase only), a digit (0 to 9), or a special or punctuation character. BCD is no longer used. *See EBCDIC*.

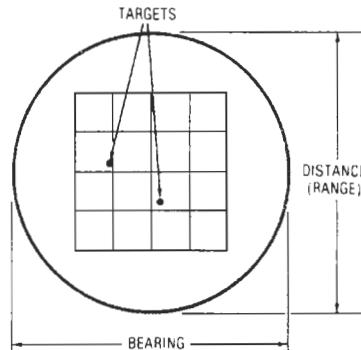
**BCD code**—An eight-bit code (of which one bit is used for odd parity check) used by IBM. It provides 88 characters, plus 16 functions.

**BCD counter**—A counter in which each section consists of four flip-flops or stages, each section of which counts to nine (binary 1001) and then resets to zero (binary 0000). The outputs are in BCD form.

**B channel**—One of two stereo channels, usually the right, together with the microphone, speakers, or other equipment associated with this channel.

**bci**—Abbreviation for broadcast interference, a term denoting interference by transmitters with reception of broadcast signals on standard broadcast receivers.

**B-display**—On a radarscope, a type of presentation in which the target appears as a bright spot. Its bearing is indicated by the horizontal coordinate and its range by the vertical coordinate.



*B-display.*

**beacon**—1. A device that emits a signal for use as a guidance or warning aid. Radar beacons aid the radar set in locating and identifying special targets that may otherwise be difficult or impossible to sense. 2. Low-power carrier transmitted by a satellite that supplies the controlling engineers on the ground with a means of monitoring telemetry data, tracking the satellite, or conducting propagation experiments. This tracking beacon is usually a horn or omni antenna.

**beacon delay**—The amount of inherent delay within the beacon, i.e., the time between the arrival of a signal

and the response of the beacon. In a pulse beacon, delay ordinarily is measured between the leading 3-dB points of the triggering pulse and the reply pulse.

**beacon receiver** — A radio receiver for converting into perceptible signals the waves emanating from a radio beacon.

**beacon skipping** — A term used to describe a condition in which beacon return pulses are missing at the interrogating radar. Beacon skipping can be caused by interference, overinterrogation of the beacon, antenna nulls, or pattern minima.

**beacon station** — 1. A station broadcasting beacon signals for direction finding or navigation. 2. A radar transmitting station.

**beacon stealing** — The loss of beacon tracking by a (desired) radar due to (interfering) interrogation signals from another radar.

**beacon time-sharing** — A technique by which two or more radars may interrogate and track a long-recovery type of beacon without exceeding the duty cycle of the beacon. This technique is accomplished by the proper sequencing of the various radar interrogations. It is necessary to ensure that the total of all interrogations does not exceed the beacon duty cycle and that enough time is allowed for the modulator section of the beacon to recover before it receives the next interrogation.

**beacon transmitter** — A transmitter specially adapted for the transmission of beacon signals.

**beaded coax** — A coaxial cable in which the dielectric consists of beads made of various insulating materials.

**beaded support** — Ceramic and plastic beads used to support the inner conductor in coaxial transmission lines.

**beaded transmission line** — A line using beads to support the inner conductor in coaxial transmission lines.

**bead thermistor** — A thermistor consisting of a small bead of semiconducting material, such as germanium, placed between two wire leads. Used for microwave power measurement, temperature measurement, and as a protective device. The resistance decreases as the temperature increases.

**beam** — 1. A flow of electromagnetic radiation concentrated in a parallel, converging, or diverging pattern. 2. The unidirectional or approximately unidirectional flow of radiated energy or particles. 3. A shaft or column of light, a bundle of rays that may or may not consist of parallel, converging, or diverging rays.

**beam-addressable technology** — The applications of reversible writing with a laser beam on particular storage materials. In one method, an amorphous film is heated and then crystallized for writing. Bubble writing involves the formation of bubbles on the film-glass interface of a glass substrate by the intense light beam.

**beam alignment** — The adjustment of the electron beam in a camera tube (on tubes employing low-velocity scanning) to cause the beam to be perpendicular to the target surface.

**beam angle** — The angle between the directions, on either side of the axis, at which the intensity of the radio-frequency field drops to one-half the value it has on the axis.

**beam antenna** — 1. An antenna that concentrates its radiation into a narrow beam in a definite direction. 2. A directional antenna that radiates or intercepts more energy in one direction than in others.

**beam bender** — See ion trap.

**beam bending** — Deflection of the scanning beam of a camera tube by the electrostatic field of the charges stored on the target.

**beam blanking** — Interruption of the electron beam in a cathode-ray tube by the application of a pulse to the control grid or cathode.

**beam breaker** — A level-measuring device using a light or electrical beam or pneumatic jet between a source and a detector or reflector.

**beam candlepower** — The candlepower of a bare source that, if located at the same distance as the beam, would produce the same illumination as the beam.

**beam convergence** — The converging of the three electron beams of a three-gun color picture tube at a shadow-mask opening.

**beam-coupling coefficient** — In a microwave tube, the ratio of the amplitude, expressed in volts, of the velocity modulation produced by a gap to the radio-frequency gap voltage.

**beam crossover** — The point of overlap of a beam from an antenna that is nutated or rotated about the center line of the antenna radiation direction. The crossover point is normally at the half-power point. The received energy, when commutated into four quadrants, provides the necessary information for the servoamplifier error signal used to align the antenna to a target.

**beam current** — The current carried by the electron stream that forms the beam in a cathode-ray tube.

**beam cutoff** — In a television picture tube or cathode-ray tube, the condition in which the control-grid potential is so negative with respect to the cathode that electrons cannot flow and thereby form the beam.

**beam-deflection tube** — An electron-beam tube in which current to an output electrode is controlled by the transverse movement of an electron beam.

**beam droop** — A form of distortion of the normal rectilinear fan-shaped radiation pattern of a detection radar in which a portion of the fan is at a lower elevation than the rest of the fan.

**beam-forming electrode** — Electron-beam focusing elements in power tetrodes and cathode-ray tubes.

**beam hole** — An opening through a reactor shield and, generally, through the reactor reflector that permits a beam of radioactive particles or radiation to be used for experiments outside the reactor.

**beam-index color tube** — A color picture tube in which the signal generated by an electron beam after deflection is fed back to a control device or element in such a way that an image in color is provided.

**beam lead** — 1. A metal beam deposited directly onto the surface of the die as part of the wafer processing cycle in the fabrication of an integrated circuit. Upon separation of the individual die (normally by chemical etching instead of the conventional scribe-and-break technique), the cantilevered beam is left protruding from the edge of the chip and can be bonded directly to interconnecting pads on the circuit substrate without the need for individual wire interconnections. 2. A long structural member not supported everywhere along its length and subject to the forces of flexure, one end of which is permanently attached to a chip device and the other end intended to be bonded to another material, providing an electrical interconnection or mechanical support or both.

**beam-lead bonding** — 1. A free-bonding technique in which thick gold extensions of the thin-film terminals of semiconductor devices and circuits are electroformed so they extend beyond the edges of the chips. 2. A method of interconnecting ICs in a circuit by bonding beam leads located on the IC chip's back surface to the circuit's conducting paths. 3. A hybrid bonding technique that provides for multiple bonding simultaneously.

**beam-lead device** — An active or passive chip component possessing beam leads as its primary interconnection and means of mechanical attachment to a substrate.

**beam-lead isolation**—The method in which electrical isolation between IC elements is produced by interconnecting the elements with thick gold leads and selectively etching the silicon from between elements without affecting the gold leads. This process leaves the elements as separate units supported by the gold leads.

**beam leads**—1. A generic term describing a system in which flat metallic leads extend from the edges of a chip component much as wooden beams extend from a roof overhang. These are then used to interconnect the component to film circuitry. 2. Techniques for attachment of lead frames to silicon chips, including vacuum and chemical deposition, diffusion thermal-compression techniques, welding, etc.

**beam-lobe switching**—A method of determining the direction of a remote object by comparison of the signals corresponding to two or more successive beam angles at directions slightly different from that of the object.

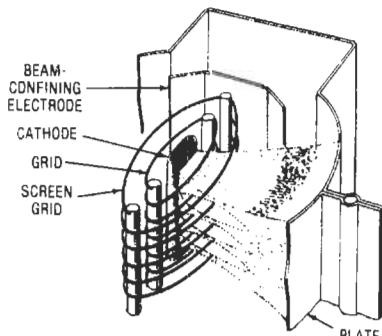
**beam modulation**—See z-axis modulation.

**beam optics**—A discipline within the broad study of optics that is specifically oriented toward the investigation of waves with small angular divergence.

**beam parametric amplifier**—A parametric amplifier in which a modulated electron beam provides a variable reactance.

**beam-positioning magnet**—A magnet used with a tricolor picture tube to influence the direction of one of the electron beams so that it will have the proper spatial relationship with the other two beams.

**beam-power tube**—An electron-beam tube in which directed electron beams are used to contribute substantially to its power-handling capability, and in which the control and screen grids essentially are aligned.



Beam-power tube.

**beam relaxor**—A type of sawtooth scanning-oscillator circuit that generates but does not amplify the current wave required for magnetic deflection in a single-beam-power pentode.

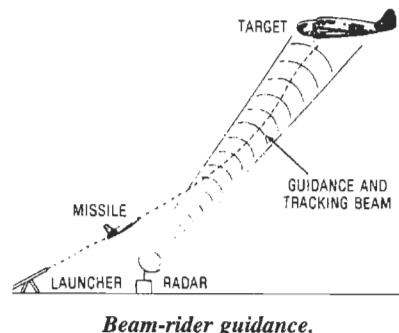
**beam-rider control system**—A system whereby the control station sends a beam to the target, and the missile follows this beam until it collides with the target.

**beam-rider guidance**—A form of missile guidance wherein a missile, through a self-contained mechanism, automatically guides itself along a beam transmitted by a radar.

**beams**—CB radio term for any type of directional antenna.

**beam splitter**—A device used for dividing a light beam (as by a transparent mirror) into two components,

## beam-lead isolation — beam-switching tube



Beam-rider guidance.

one transmitted and the other reflected. 2. An optical device used to divide the beam of light into two beams. Either prisms or partial mirrors.

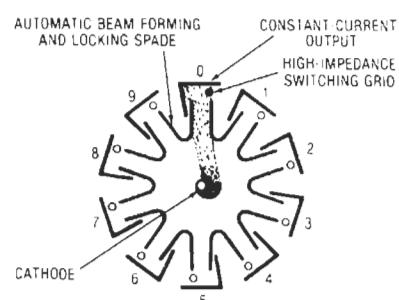
**beam splitting**—A process for increasing the accuracy of locating targets by radar. By noting the azimuths at which one radar scan first discloses a target and at which radar data from it ceases, beam splitting calculates the mean azimuth for the target.

**beam-splitting mirror**—In an oscilloscope camera system, a tilted, transparent mirror that allows rays to pass horizontally from the oscilloscope screen to the camera and also to be reflected vertically to the viewer's eye.

**beam spreader**—An optical element the purpose of which is to impart a small angular divergence to a collimated incident beam.

**beam switching**—A method of obtaining the bearing and/or elevation of an object more accurately by comparing the signals received when the beam is in a direction differing slightly in bearing and/or elevation. When these signals are equal, the object lies midway between the beam axes.

**beam-switching tube**—A multiposition, high-vacuum, constant-current distributor. The beam-switching tube consists of many identical arrays around a central cathode. Each array comprises a spade that automatically forms and locks the electron beam, a target-output electrode that gives the beam current its constant characteristics, and a high-impedance switching grid that switches the beam from target to target. A small cylindrical magnet, permanently attached to the glass envelope, provides a magnetic field. This field, in conjunction with an applied electric field, comprises the crossed fields necessary for operation of this tube. It is used in electronic switching and in distributing, such as counting, timing, sampling, frequency dividing, coding, matrixing, telemetering, and controlling.



Beam-switching tube.

**beam width**—1. The angular width of a radio, radar, or other beam measured between two reference lines. 2. The width of a radar beam measured between lines of half-power intensity. 3. Of a dish antenna, the angle of sky that can be illuminated (picked up or sent out) by the dish. Large dishes have narrow beam widths, which reduce noise from their sides. Small dishes have wider beam widths and are noisier but easier to aim.

**bearing**—1. The horizontal direction of an object, or point, usually measured clockwise from a reference line or direction through 360°. 2. Support for a rotating shaft. 3. The horizontal angle at a given point, measured from a specific reference datum, to a second point relative to another as measured from a specific reference datum.

**bearing cursor**—A mechanical bearing line of a plan-position indicator type of display for reading the target bearing.

**bearing loss**—The loss of power through friction in the bearings of an electric motor (brushes removed and no current in the windings).

**bearing resolution**—The minimum angular separation in a horizontal plane between two targets at the same range that will allow an operator to obtain data on either individual target.

**beat**—Periodic variations that result from the superimposition of waves having different frequencies. The term is applied both to the linear addition of two waves, resulting in a periodic variation of amplitude, and to the nonlinear addition of two waves, resulting in new frequencies, of which the most important usually are the sum and difference of the original frequencies.

**beat frequency**—One of the two additional frequencies produced when two different frequencies are combined. One beat frequency is the sum of the two original frequencies; the other is the difference between them.

**beat-frequency oscillator**—Abbreviated BFO. An oscillator that produces a signal which mixes with another signal to provide frequencies equal to the sum and difference of the combined frequencies.

**beating**—The combining of two or more frequencies to produce sum and difference frequencies called beats.

**beating-in**—Interconnecting two transmitter oscillators and adjusting one until no beat frequency is heard in a connected receiver. The oscillators are then at the same frequency.

**beating oscillator**—*See* local oscillator.

**beat marker**—A marker pip resulting from the beat not between the sweep-generator signal and the signal from a marker oscillator; a marker is visible on an oscilloscope during visual alignment of a tuned circuit.

**beat note**—The difference frequency produced when two sinusoidal waves of different frequencies are applied to a nonlinear device.

**beat reception**—*See* heterodyne reception.

**beats**—1. Beat notes that are generally at a sufficiently low audio frequency that they can be heard or counted. 2. The signal formed when two signals of different frequencies are simultaneously present in a nonlinear device. The frequency of the beat is equal to the difference in frequency of the two primary signals. For example, beats are produced in superheterodyne receivers, where the beat is between the incoming signal and the local oscillator in the receiver. 3. Periodic variations of amplitude that result when two periodic waves having different frequencies are superimposed.

**beat tone**—Musical tone due to beats, produced by the heterodyning of two high-frequency wave trains.

**beaver tail**—A fan-shaped radar beam, wide in the horizontal plane and narrow in the vertical plane. The beaver tail is swept up and down for height finding.

**bed-of-nail tester**—*See* in-circuit-tester.

**bedspring**—A broadside antenna array with a flat reflector.

**before start**—The interval before the starting circuit to a timer has been operated. The timer is fully reset and all contacts are in the precycle position.

**bel**—The fundamental unit in a logarithmic scale for expressing the ratio of two amounts of power. The number of bels is equal to the  $\log_{10} P_1/P_2$ , where  $P_1$  is the power level being considered and  $P_2$  is an arbitrary reference level. The decibel, equal to 1/10 bel, is a more commonly used unit.

**B eliminator**—A power pack that changes the ac power-line voltage to the dc source required by the vacuum tubes. In this way, batteries can be eliminated.

**bell**—1. An electrical device consisting of a hammer vibrated by an electromagnet. The hammer strikes the sides of the bell and emits a ringing noise. The electromagnet attracts an armature or piece of soft iron forming part of the hammer lever. A contact breaker then opens the circuit and cuts off the attraction. A spring draws the hammer back to its original position, closing the circuit and repeating the action. 2. An electromechanical device in which an electrically vibrated clapper repeatedly strikes one or two gongs, which give out a musical tone.

**Bellini-Tosi antenna**—A direction-finding antenna comprising two vertical orthogonal triangular loops installed with their bases over ground and used with a goniometer.

**Bellini-Tosi direction finder**—An early radio direction-finder system consisting of two loop antennas at right angles to each other and connected to a goniometer.

**bellows**—1. A pressure-sensing element consisting of a ridged metal cylinder closed at one end. A pressure difference between its outside and inside will cause the cylinder to expand or contract along its axis. 2. A mechanical pressure-sensing element consisting of a metallic bellows with a plate on one end. Pressure applied to the open end causes the plate to move. The amount of the movement becomes a measure of the applied pressure.

**bellows contact**—A contact in which a multileaf spring is folded. This type provides a more uniform spring rate over the full tolerance range of the mating unit.

**bell-shaped curve**—A statistical curve (so called from its characteristic shape) that exhibits a normal distribution of data. The curve typically describes the distribution of errors of measurement around the real value.

**bell transformer**—A small iron-core transformer; its primary coil is connected to an ac primary line, and its secondary coil delivers 10 to 20 volts for operation of a doorbell, buzzer, or chimes.

**bell wire**—Cotton-covered copper wire, usually No. 18, used for doorbell and thermostat connections in homes and for similar low-voltage work.

**belt drive**—A drive system used to rotate a turntable, in which the motor pulley drives the platter with a belt.

**benchmark**—1. In connection with microprocessors, a frequently used routine or program selected for the purpose of comparing different makes of microprocessors. A flowchart in assembly language is written out for each microprocessor, and the execution of the benchmark by each unit is evaluated on paper. (It is not necessary to use hardware to measure capability by benchmark.) 2. A point of reference from which measurements can be made. 3. A test standard for measuring product performance. 4. A test point for facilitating measurement of a product run on several computers for the purposes of comparing speed, throughput, and ease of conversion. 5. The act of determining a benchmark. 6. Standard measure used to test performance.

**benchmark problem**—A problem used in the evaluation of the performance of computers relative to each other.

**benchmark program**—1. A sample program used to evaluate and compare computers. In general, two computers will not use the same number of instructions, memory words, or cycles to solve the same problems. 2. A specific program written to measure the speed of a computer in a well-defined situation, such as serial transfer and 8-bit by 8-bit multiplication. 3. A set of standards used in testing a software or hardware product or system, from which a measurement can be made. Benchmarks are often run on a system to verify that it performs according to specifications.

**bench test**—A test in which service conditions are approximated, but the equipment is conventional laboratory equipment and not necessarily identical with that in which the product will be employed in normal service.

**bend**—A change in the direction of the longitudinal axis of a waveguide.

**bend loss**—1. A form of attenuation that is caused by bending an optical fiber at a restrictive radius. The term also applies to losses due to minute distortions in the fiber itself caused by bending it. 2. A form of increased attenuation caused by allowing high-order modes to radiate from the side of an optical fiber. The two common types of bend losses are (a) those occurring when the fiber is curved around a restrictive radius of curvature and (b) microbend caused by small distortions of the fiber imposed by externally induced perturbations, such as poor cabling techniques.

**bend radius**—The minimum radius an optical fiber can bend before breaking.

**bend waveguide**—A section of waveguide in which the direction of the longitudinal axis is changed.

**Benito**—A cw navigational system in which the distance to an aircraft is determined on the ground by measuring the phase difference of an audio signal transmitted from the ground and retransmitted by the aircraft. Bearing information is obtained by ground direction finding of the aircraft signals.

**bent gun**—A TV picture-tube neck arrangement with an electron gun that is slanted to direct the undesired ion beam toward a positive electrode and still allow the electron beam to pass to the screen.

**beryllia**—1. Beryllium-oxide ( $\text{BeO}$ ) ceramics that have high thermal conductivity characteristics. Used as substrates in hybrid circuit manufacturing and for thick-film substrates in high-power applications. 2. Beryllium oxide is used in various forms as an insulator and structural element (as in resistor cores).

**beryllium**—An elemental metal whose atomic number is 4. Beryllium is present in various dielectrics and alloys used in electronics.

**beryllium oxide ( $\text{BeO}$ )**—A ceramic material having very high heat conductivity, good thermal shock resistance, and high strength. Used in metal/ceramic packages for higher-power microwave transistors and as substrates in some MIC power amplifiers.

**Bessel function**—A mathematical function used in the design of a filter for maximally constant time delay with little consideration for amplitude response. This function is very close to a Gaussian function.

**best fit**—An algorithm for computer memory allocation that searches the memory-free list for the unused memory block that is closest in size to that needed by the requesting task.

**beta**—Symbolized by the Greek letter *beta* ( $\beta$ ). Also called current-transfer ratio. 1. The current gain of a transistor connected as a grounded-emitter amplifier; it

is the ratio of a small change in collector current to the corresponding change in base current, with the collector voltage constant. 2. A parameter used to express the current gain of a bipolar transistor. There are many versions of beta, but all relate a change in collector current to the corresponding change in base current, with the collector-emitter voltage kept constant. 3. A symbol used to denote B quartz. 4. Brainwave signals whose frequency is approximately 13 to 28 Hz. The associated mental state is irritation, anger, jitteriness, frustration, worry, tension, etc. 5. A prerelease version of software, distributed to a selected group of users to test. By the end of a beta test, all major bugs should have been discovered and repaired.

**beta circuit**—In a feedback amplifier, the circuit that transmits a portion of the amplifier output back to the input.

**beta cutoff frequency**—The frequency at which the beta of a transistor is 3 decibels below the low-frequency value.

**beta particle**—A small electrically charged particle thrown off by many radioactive materials. It is identical with the electron and possesses the smallest negative electrical charge found in nature. Beta particles emerge from radioactive material at high speeds, sometimes close to the speed of light.

**beta ray**—1. A stream of beta particles. 2. Electrons or positrons given off by a radioactive nucleus in the process of decay.

**beta test**—Testing computer software before it is released commercially.

**betatron**—A large doughnut-shaped accelerator that produces artificial beta radiation. Electrons (beta particles) are whirled through a changing magnetic field. They gain speed with each trip and emerge with high energies (on the order of 100 million electron volts in some instances).

**bev**—A billion electron volts. An electron possessing this much energy travels at a speed close to that of light—186,000 miles a second ( $3 \times 10^8$  m/s).

**bevatron**—A very large circular accelerator in which protons are whirled between the poles of a huge magnet to produce energies in excess of one billion electron volts.

**Beverage antenna**—See wave antenna.

**beyond-the-horizon propagation**—See scatter propagation.

**bezel**—1. A holder designed to receive and position the edges of a lens, meter, window, or dial glass. 2. The flange or cover used for holding an external graticule or CRT cover in front of the CRT in an oscilloscope. May also be used for mounting a trace-recording camera or other accessory item.

**BFO**—Abbreviation for beat-frequency oscillator.

**B-H curve**—Curve plotted on a graph to show successive states during magnetization of a ferromagnetic material. A normal magnetization curve is a portion of a symmetrical hysteresis loop. A virgin magnetization curve shows what happens the first time the material is magnetized.

**B-H meter**—A device for measuring the intrinsic hysteresis loop of a sample of magnetic material.

**biamplication**—The technique of splitting the audio-frequency spectrum into two sections and using individual power amplifiers to drive a separate woofer and tweeter. Crossover frequencies for the amplifiers usually vary between 500 and 1600 Hz. Biamplication has the advantages of allowing smaller-power amps to produce a given sound pressure level and reducing distortion effects produced by overdrive in one part of the frequency spectrum affecting the other part.

**bias**—1. The electrical, mechanical, or magnetic force applied to a relay, semiconductor, vacuum tube,

or other device for the purpose of establishing an electrical or mechanical reference level for the operation of the device. 2. Direct-current potential applied to the control grid of a vacuum tube. 3. Bias derived from a direct current, used on signaling or telegraph relays or electromagnets to secure the desired time spacing of transitions from marking to spacing. 4. A method of restraining a relay armature, by means of spring tension, to secure a desired time spacing of transitions from marking to spacing. 5. The average direct-current voltage between the control grid and cathode of a vacuum tube. 6. The effect on teletypewriter signals produced by the electrical characteristics of the line and the equipment. 7. Energy applied to a relay to hold it in a given position. 8. A high-frequency signal applied to the audio signal at the tape recording head to minimize distortion and noise and increase frequency response and efficiency. Although sometimes dc (fixed magnetic polarity) is used, the bias signal is usually above 40 kHz to avoid audible intermodulation distortion. Every tape formulation has slightly different bias requirements. 9. The sideways thrust of a pickup arm. 10. Communication-signal distortion related to bit timing. 11. The departure from a reference value of the average of a set of values.

**bias cell** — A dry cell used in the grid circuit of a vacuum type to provide the necessary C-bias voltage.

**bias compensator** — A device that counteracts the inward bias of a pickup arm as it tracks the record. The compensator exerts an outward force on the arm and generally can be adjusted to have a definite relationship to the playing weight of the pickup.

**bias current** — The current through the base-emitter junction of a transistor. It is adjusted to set the operating point of the transistor.

**bias distortion** — 1. Distortion resulting from operation on a nonlinear portion of the characteristic curve of a vacuum tube, semiconductor, or other device, due to improper biasing. 2. In teletype circuits, the uniform shifting of mark pulses from their proper position in relationship to the start pulses.

**biased induction** — Symbolized by  $B_b$ . The biased induction at a point in a magnetic material that is subjected simultaneously to a periodically varying magnetizing force and biasing magnetizing force is the algebraic mean of the maximum and minimum values of the magnetic induction at the point.

**biased ringer** — A polarized telephone bell whose armature is held at one end of its travel by a small biasing spring so it responds only to pulsating current of one polarity. Current pulses of the opposite polarity will merely attract the armature more strongly to the pole piece of the electromagnet but the bell will not ring.

**bias-induced noise** — The difference between bulk-erased and zero-modulation noise.

**biasing magnetizing force** — Symbolized by  $H_b$ . A biasing magnetizing force at a point in a magnetic material that is subjected simultaneously to a periodically varying magnetizing force and a constant magnetizing force is the algebraic mean of the maximum and minimum values of the combined magnetizing forces.

**bias meter** — A meter used in teletypewriter work for determining signal bias directly in percent. A positive reading indicates a marking signal bias; a negative reading indicates a spacing signal bias.

**bias oscillator** — An oscillator used in magnetic recorders to generate an ac signal in the range of 40 to 80 kHz for the purpose of magnetic biasing to obtain a linear recording characteristic. Usually the bias oscillator also serves as the erase oscillator.

**bias port** — In a fluidic device, the port at which a biasing signal is applied.

**bias resistor** — A resistance connected into a self-biasing vacuum-tube or semiconductor circuit to produce the voltage drop necessary to provide a desired biasing voltage.

**bias-set frequency** — In direct magnetic tape recording, a specified recording frequency employed during the adjustment of bias level for optimum record performance (not the frequency of the bias).

**bias telegraph distortion** — Distortion in which all mark pulses are lengthened (positive bias) or shortened (negative bias). It can be measured with a steady stream of unbiased reversals (square waves having equal-length mark and space pulses). The average lengthening or shortening does not give true bias distortion unless other types of distortion are negligible.

**bias voltage** — 1. A voltage, usually dc, used to set the operating point of a circuit above or below a reference voltage. 2. The base or grid voltage that establishes a semiconductor's or vacuum tube's desired dc operating voltage. 3. A steady voltage that presets the operating threshold or operating point of a circuit or device, such as a transistor or vacuum tube.

**bias windings** — Control windings of a saturable reactor, by means of which the operating condition is translated by an arbitrary amount.

**biax** — Two-hole, orthogonal, cubical ferrite computer memory elements.

**BiCMOS** — Abbreviation for bipolar complementary metal oxide semiconductor. An IC technology combining the linearity and speed advantages of bipolar and the low-power advantages of CMOS on a single IC. BiCMOS can operate at either ECL (emitter-coupled-logic) or TTL (transistor-transistor-logic) levels and is ideal for mixed-signal devices. (BiCMOS may eclipse CMOS, just as CMOS edged out MOS and bipolar circuits.)

**biconical antenna** — An antenna that is formed by two conical conductors, having a common axis and vertex, and excited at the vertex. When the vertex angle of one of the cones is 180°, the antenna is called a discone.



Biconical antenna.

**bidirectional** — 1. Responsive in opposite directions. An ordinary loop antenna is bidirectional because it has maximum response from the opposite directions in the plane of the loop. 2. Refers to a type of computer bus structure in which a single conductor is used to transmit data or signals in either direction between a peripheral device and a central processor or memory. 3. In open-reel or cassette recorders, the ability to play (and, in some cases, record) both stereo track pairs on a tape by reversing the tape's direction of motion without removing and replacing the tape reels or cassette. 4. In microphones, a figure-8 pickup pattern.

**bidirectional antenna** — An antenna having two directions of maximum response.

**bidirectional bus** — 1. In computers, a data path over which both input and output signals are routed. 2. In

a computer, a bus that carries signals in either direction. The bus also carries special signals that tell the devices connected to it which way data is passing. 3. A bus used by any individual device for two-way transmission of messages, that is, both input and output.

**bidirectional bus driver**—A signal-driving device in a microcomputer that permits direct connection of a buffer-to-buffer arrangement on one end (the interface to I/O memories, etc.) and data inputs and outputs on the other. This permits bidirectional signals to pass and provides drive capability in both directions.

**bidirectional current**—A current that is both positive and negative.

**bidirectional data bus**—A data bus in which digital information can be transferred in either direction.

**bidirectional diode thyristor**—A two-terminal thyristor having substantially the same switching behavior in the first and third quadrants of the principal voltage-current characteristic.

**bidirectional lines**—Links between devices in a system that may carry information in either direction, but not both simultaneously.

**bidirectional loudspeaker**—A speaker that delivers sound waves to the front and rear.

**bidirectional microphone**—1. A microphone in which the response predominates for sound incidences of 0° and 180°. 2. A microphone that is equally sensitive to sounds arriving from in front or in back, but discriminates against sounds arriving from the sides.

**bidirectional printer**—A printer that prints from left to right as well as from right to left, avoiding delays caused by carriage returns.

**bidirectional pulses**—Pulses, some of which rise in one direction and the remainder in the other direction.

**bidirectional pulse train**—A pulse train in which some pulses rise in one direction and the remainder in the other direction.

**bidirectional thyristor**—A thyristor that can be made conductive at any instant when the voltage between the main terminals is either positive or negative.

**bidirectional transducer**—See *bilateral transducer*.

**bidirectional transistor**—A transistor that is specified with parameter limits in both the normal and inverted configuration and has substantially the same electrical characteristics when the terminals normally designed as emitter and collector are interchanged. (Bidirectional transistors are sometimes called symmetrical transistors. The term, however, is deprecated because it might give the incorrect impression of an ideally symmetrical transistor.)

**bidirectional triode thyristor**—A three-terminal thyristor having substantially the same switching behavior in the first and third quadrants of the principal voltage-current characteristic.

**bifet**—Linear circuit that combines bipolar transistors with junction field-effect transistors on the same silicon chip and provides broader bandwidth, faster slewing, and higher impedance than standard bipolar devices when incorporated into monolithic operational amplifiers.

**bifilar**—A winding made noninductive by winding two wires carrying current in opposite directions together, side by side, as one wire.

**bifilar resistor**—A resistor wound with a wire doubled back on itself to reduce the inductance.

**bifilar suspension**—A type of galvanometer movement that is highly resistant to overloads, in which a D'Arsonval moving coil is supported at each end by two taut wires. The elimination of the pivot, with its attendant friction, results in superior sensitivity and precision.

**bifilar transformer**—A transformer in which the turns of the primary and secondary windings are wound

together side by side and in the same direction. This type of winding results in near-unity coupling, so that there is a very efficient transfer of energy from primary to secondary.

**bifilar winding**—1. A method of winding non-inductive resistors in which the wire is folded back on itself and then wound double, with the winding starting from the point at which the wire is folded. 2. A winding consisting of two insulated conductors side by side to produce (a) two balanced windings, (b) a resistor with minimum inductance, and (c) maximum coupling between two windings.

**bifurcate**—Describes lengthwise slotting of a flat spring contact, as used in a printed-circuit connector, to provide additional independently operating points of contact. Example: bifurcated contact.

**bifurcated**—Usually fork-shaped. Refers to physical construction of a contact whereby two mating portions make physical contact. Yet, if one tip section of the contact fails, the remaining section maintains the physical and electrical connection.

**bifurcated connector**—A hermaphroditic connector containing fork-shaped mating contacts.

**bifurcated contact**—1. A movable contact that is forked (divided) to provide two contact-mating surfaces in parallel for a more reliable contact. 2. A connector contact (usually a flat spring) that is slotted lengthwise to provide additional, independently operating points of contact.

**bilateral**—Having a voltage-current characteristic curve that is symmetrical with respect to the origin, that is, being such that if a positive voltage produces a positive current magnitude, an equal negative voltage produces a negative current of the same magnitude.

**bilateral amplifier**—An amplifier capable of receiving as well as transmitting signals; it is used primarily in transceivers.

**bilateral antenna**—An antenna, such as a loop, having maximum response in exactly opposite directions (180° apart).

**bilateral bearing**—A bearing that indicates two possible directions of wave arrival. One of these is the true bearing, and the other is a bearing displaced 180° from the true bearing.

**bilateral circuit**—A circuit wherein equipment at opposite ends is managed, operated, and maintained by different services.

**bilateral element**—A two-terminal element, the voltage-current characteristic of which has odd symmetry around the origin.

**bilateral network**—1. A network in which a given current flow in either direction results in the same voltage drop. 2. A network that passes current and signals equally well in both directions.

**bilateral transducer**—1. Also called bidirectional transducer. A transducer capable of transmission simultaneously in both directions between at least two terminations. 2. A device capable of measuring stimuli in both a positive and a negative direction from a reference zero or rest position.

**billboard antenna**—An antenna array consisting of several bays of staked dipoles spaced 1/4 to 3/4 wavelength apart, with a large reflector placed behind the entire assembly. The required spacing of the dipoles tends to make the array inconveniently large at frequencies below the VHF range.

**bimag**—See tape-wound core.

**bimetal**—A union of two dissimilar metals (especially those having a different temperature coefficient of expansion), usually welded together over their entire surface.

**bimetal cold-junction compensation** — Automatic mechanical correction for ambient temperature change at the cold junction of a thermocouple, which would normally cause erroneous readings.

**bimetallic strip** — A strip formed of two dissimilar metals welded together. Because the metals have different temperature coefficients of expansion, the strip bends or curls when the temperature changes.

**bimetallic switch** — A temperature-sensitive switch that uses a bimetallic element.

**bimetallic thermometer** — 1. A device containing a bimetallic strip that expands or contracts as the temperature changes. A calibrated scale indicates the amount of change in temperature. 2. A strip of two metals having different coefficients of expansion bonded together in the form of a spiral or helix. Movement caused by a temperature change becomes a measure of temperature.

**bimetallic wire** — Any wire formed of two different metals joined together (not alloyed). It can include wire with a steel core for high-strength clad wire, or plated or coated wire.

**bimetal mask** — A mask formed by chemically etching openings in a metal film or plate where it is not protected by photoresist or other chemically resistant material.

**bimorph cell** — Two crystal elements (usually Rochelle salt) in rigid combination, arranged to act as a mechanical transducer in headphones, microphones, pickups, and speakers.

**BiMOS** — Abbreviation for bipolar metal oxide semiconductor. A general term to refer to bipolar and metal oxide semiconductors on one chip. Sometimes used interchangeably with *BiCMOS*.

**binary** — 1. A numbering system using a base number, or radix, of 2. There are two digits (1 and 0) in the binary system instead of 10 as in the decimal. 2. Pertaining to a characteristic or property involving a selection, choice, or condition in which there are two possibilities or alternatives. 3. A bistable multivibrator. 4. Two-valued logic using only the values true and false. Represented in a computer circuit by the presence of current (equivalent to 1) or its absence (equivalent to 0). All computer programs are executed in binary form. 5. A counting system in which the value of any digit can only be 1 or 0. As with the decimal system, the right-hand digit denotes the number of units of the next value, etc. In decimal the units can be 0 to 9; in binary, the units are 0 and 1.

**binary arithmetic** — Mathematical operations performed with only the digits 0 and 1.

**binary card** — A card that contains data in column binary or row binary form.

**binary cell** — In an electronic computer, an elementary unit of storage that can be placed in either of two stable states.

**binary chain** — A series of binary circuits, each of which can exist in either one of two states, arranged so each circuit can affect or modify the condition of the next circuit.

**binary channel** — A transmission facility limited to the use of two symbols.

**binary code** — A method of representing numbers in a scale of 2 (on or off, high level or low level, one or zero, presence or absence of a signal) rather than the more familiar scale of 10 used in normal arithmetic. Electronic circuits designed to work in two defined states are much simpler and more reliable than those working in ten such states.

**binary-coded** — Expressed by a series of binary codes (0s and 1s).

**binary-coded character** — A decimal digit, alphabetic letter, punctuation mark, etc., represented by a fixed number of consecutive binary digits.

**binary-coded decimal** — Abbreviated BCD. A coding system in which each decimal digit from 0 to 9 is represented by four binary digits:

<i>Decimal Digit</i>	<i>Binary Code</i>
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

2. The representation of decimal numbers in binary form. It is useful in ADC systems intended to drive decimal displays. Its advantage over decimal is that only four lines are needed to represent 10 digits. The disadvantage of coding digital-to-analog converters or analog-to-digital converters in BCD is that a full 4 bits could represent 16 digits, whereas only 10 digits are represented in BCD. 3. A numbering system used in many computers, in which the basic binary system is used to represent decimal numbers.

**binary-coded digit** — One element of a notation system for representing a decimal digit by a fixed number of binary positions.

**binary-coded octal system** — An octal numbering system in which each octal digit is represented by a three-place binary number.

**binary counter** — See binary scaler.

**binary digit** — 1. A character that represents one of the two digits in the number system that has a radix of 2. Also called bit. 2. Either of the digits, 0 or 1, that may be used to represent the binary conditions on or off. 3. A whole number in the binary scale of notation; this digit may be only 0 (zero) or 1 (one). It may be equivalent to an on or off condition, yes or no, etc.

**binary file** — A file stored in a binary format containing data or program instructions in a computer-readable format. Special software is required to display such a file.

**binary incremental representation** — Incremental representation in which the value of an increment is rounded to plus or minus one quantum and is represented by one binary digit.

**binary magnetic core** — A ring-shaped magnetic material that can be made to take either of two stable states of magnetic polarization.

**binary notation** — See binary number system.

**binary number system** — A number system employed in computers and digital systems, in which successive digits are coefficients of powers of the base 2, rather than the base 10. For example, the decimal number 13 is represented by the binary number  $1101(1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0)$ . Since the only values in the binary system are 0 and 1, quantities, or bits (binary digits), are represented electronically with either of two conditions, typically a high voltage representing a 1 and a low voltage representing a 0. Also called binary notation.

**binary numeral** — The binary representation of a number; for example, 101 is the binary numeral and V is the Roman numeral of the number of fingers on one hand.

**binary phase-shift keying**—Abbreviated BPSK. A modulation scheme that uses two phases to represent data; one phase represents a mark, and the other phase represents a space.

**binary point**—1. The point that marks the place between integral powers of 2 and fractional powers of 2 in a binary number. 2. The radix point in a mixed binary numeral, such as 110.011, separating the fractional part from the integer part. In the binary numeral 110.011, the binary point is between the two 0s.

**binary pulse-code modulation**—A form of pulse-code modulation in which the code for each element of information consists of one of two distinct kinds, e.g., pulses and spaces.

**binary raster data**—Computer data in an on/off format (ones and zeros) that is formed into scan lines that can be used to control a light source, such as a laser, for exposure of light-sensitive material.

**binary scaler**—Also called binary counter. 1. A counter that produces one output pulse for every two input pulses. 2. A counting circuit, each stage of which has two distinguishable states. 3. A flip-flop having a single input (called a T flip-flop). Each time a pulse appears at the input, the flip-flop changes state.

**binary search**—Also called dichotomizing search. 1. A search in which a set of items is divided into two parts; one part is rejected, and the process is repeated on the accepted part until those items with the desired property are found. 2. A search that starts in the middle of a database, first determining if the desired record is above or below the midpoint, then proceeding to the middle of the remaining records, and so on.

**binary signal**—A voltage or current that carries information in the form of changes between two possible values.

**binary signaling**—A communications mode in which information is passed by the presence and absence, or plus and minus variations, of one parameter of the signaling medium.

**binary system**—A system of mathematical computation based on powers of 2.

**binary-to-decimal conversion**—The process of converting a number written in binary notation to the equivalent number written in the ordinary decimal notation.

**binary-to-hexadecimal conversion**—The process of converting a numeral written in base 2 to the equivalent numeral written in base 16.

**binary-to-octal conversion**—The process of converting a numeral written in base 2 to the equivalent numeral written in base 8.

**binary word**—A related grouping of ones and zeros that has a meaning assigned by definition, or that has a weighted numerical value in the natural binary number system.

**binaural**—Two-channel sound in which each channel recorded is heard only through one ear. In recording, microphones are spaced to approximate the distance between a person's own ears. To hear the recording binaurally, the listener must use headphones. Compare with *stereo*.

**binaural disc**—A stereo record with two separate signals recorded in its grooves. Stereophonic sound is obtained by feeding each signal into its own speaker or headphone.

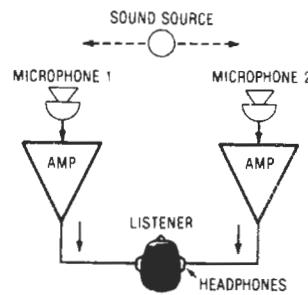
**binaural effect**—The effect that makes it possible for a person to distinguish the difference in arrival time or intensity of sound at his or her ears and thereby determine the direction from which a sound is arriving.

**binaural recorder**—A tape recorder that employs two separate recording channels, or systems, each with

## binary phase-shift keying — biochemical fuel cell

its own microphone, amplifier, recording and playback heads, and earphones. Recordings using both channels are made simultaneously on a single magnetic tape having two parallel tracks. During playback, the original sound is reproduced with depth and realism. For a true binaural effect, headphones are necessary.

**binaural sound**—Sound recorded or transmitted by pairs of equipment so as to give the listener the effect of having heard the original sound.



Binaural sound-reproducing system.

**binder**—1. A substance, such as cement, used to hold particles together and thus provide mechanical strength in, for example, carbon resistors and phonograph records. 2. Materials or substances added to thick-film compositions and unfired substrates to give sufficient strength for prefire handling.

**binding**—The act of assigning absolute addresses to a program.

**binding energy**—The minimum energy required to dissociate a nucleus into its component neutrons and protons. Neutron or proton binding energies are those energies required to remove a neutron or a proton, respectively, from a nucleus. Electron binding energy is that energy required to remove an electron from an atom or a molecule.

**binding post**—1. A bolt-and-nut terminal for making temporary electrical connections. 2. A device for clamping or holding electrical conductors in a rigid position.



Binding post.

**binistor**—A four-terminal controlled rectifier semiconductor that provides bistable negative-resistance characteristics.

**binomial array**—A directional-antenna array used for reducing minor lobes and providing maximum response in opposite directions.

**biochemical fuel cell**—An electrochemical generator of electrical power in which bi-organic matter is used as the fuel source. In the usual electrochemical reaction, air serves as the oxidant at the cathode and microorganisms are used to catalyze the oxidation of the bi-organic matter at the anode.

**bioelectricity**—Electric currents and potential differences that occur in living tissues. Muscle and nerve tissue, for example, are generators of bioelectricity, although the potential registered may be less than 1 millivolt in some cases.

**bioelectric potential**—See bioelectricity.

**bioelectrogenesis**—The practical application of electricity drawn directly from the bodies of animals, including humans, to power electronic devices and appliances.

**bioelectronics**—1. The application of electronic theories and techniques to the problems of biology. 2. The integrated, long-term electronic control of various impaired physiologic systems by means of small, low-power electrical and electromechanical devices. (The pacemaker is therefore a bioelectronic instrument.)

**bioengineering**—See bionics.

**biogalvanic battery**—A device that makes use of reactions between metals and the oxygen and fluids in the body to generate electricity.

**biologic energy**—Energy that is produced by bodily processes and that can be used to supply electrical energy for implanted devices such as electronic cardiac pacemakers, bladder stimulators, etc. The biologic energy can result from muscle movement (such as that of the diaphragm), temperature differences, pressure differences, expansion of the aorta, oxidation of materials within the gastrointestinal tract, or other processes.

**biomedical oscilloscope**—An oscilloscope designed or modified to be used in medical applications. Such oscilloscopes have slow sweep rates and long-persistence screens because of the low frequencies of many biological signals.

**bionics**—Also called bioengineering. 1. The study of living systems so that their characteristics and functions can be related to the development of mechanical and electronic hardware. 2. The reduction of various life processes to mathematical terms to make possible duplication or simulation with systems hardware. 3. The art that treats electronic simulation of biological phenomena. 4. The emulation of biological components, "body parts," with electromechanical ones. 5. The application of observed operational processes of sophisticated living organisms to mechanical and electrical systems in order to analogize capabilities or efficiency.

**BIOS**—Abbreviation for basic input-output system. The software that translates operating system instructions into commands to and from the hardware components in a computer system.

**biotelemetry**—The process of remote measurement or recording of such biological variables as pulse rate, temperature, etc. Typically, the information is transmitted between the patient and the receiving equipment by a radio link.

**biotelescanner**—A device that can analyze and radio data on life forms during space exploration.

**biphase suppressed carrier**—A digital radio modulation scheme that uses one phase of a carrier to signify a 0 and the opposite phase to denote a 1. If the two phases are less than 180° apart, some residual carrier will be transmitted.

**bipolar**—1. Having two poles. 2. Having to do with a device in which both majority and minority carriers are present. In connection with integrated circuits, the term describes a specific type of construction; bipolar and MOS are the two most common types of IC construction. 3. The semiconductor technology employing two-junction transistors. 4. A transistor structure whose electrical properties are determined within the silicon material. Memories using this technology are characteristically high-speed devices. 5. General name for npn

and pnp transistors, since working current passes through semiconductor material of both polarities (p and n). Current in the collector is controlled by a current between base and collector. Also applied to integrated circuits that use bipolar transistors. 6. In bipolar transistors, the working current consists of both positive and negative electrical charges. The first transistor and the first ICs were bipolar types. (Most present-day discrete transistors are also bipolar.) Bipolar IC transistors operate faster than unipolar (MOS) transistors and consume more power. They take up more space on a chip and cost more to manufacture. 7. In meters, the capability of measuring voltages or currents of either polarity—positive or negative—with respect to a reference point or ground. 8. One of several fundamental processes for fabricating ICs. A bipolar IC is made up of layers of silicon with differing electrical characteristics. Current flows between the layers when a voltage is applied to the junction or boundary between the layers. 9. A technology of IC fabrication that uses transistor switching elements based on majority carriers for switching and amplification. 10. Technology using transistors with both negative and positive charge carriers allowing current flow in only one direction (unlike MOS circuits). Bipolar memory is characterized by very fast access times and very high power consumption.

**bipolar complementary metal oxide semiconductor**—See BiCMOS.

**bipolar device**—1. A semiconductor device in which there are both majority and minority carriers. (This is the case in all npn and pnp transistors.) 2. A current-driven electronic device with two poles. Operation relies on the flow of both electrons and holes.

**bipolar electrode**—An electrode without metallic connection with the current supply, one face of which acts as an anode surface and the opposite face as a cathode surface when an electric current is passed through a cell.

**bipolar electrolytic capacitors**—An electrolytic capacitor designed to withstand an alternating voltage and/or a reversal of the applied direct voltage. Also called nonpolar capacitor.

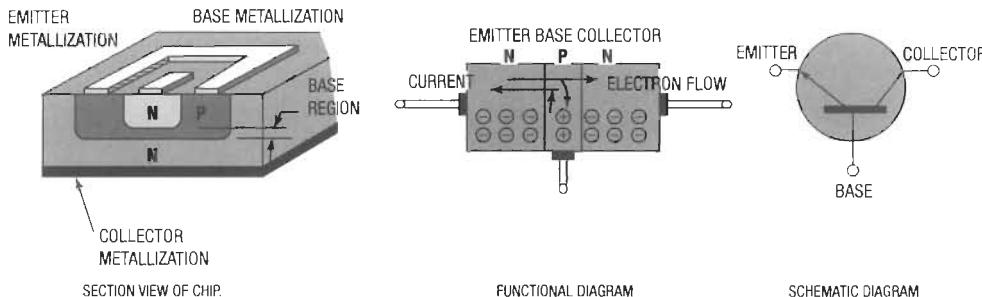
**bipolar ferreed**—A device comprising two sealed reed switches, a permanent magnet, and a winding with a semipermanent magnet. When the winding is pulsed with current in one direction, the reed contacts close; when the winding is pulsed in the opposite direction, the reed contacts open.

**bipolar magnetic driving unit**—A headphone or speaker unit having two magnetic poles acting directly on a flexible iron diaphragm.

**bipolar memory cell**—In a computer, a system comprising a storage latch, a pair of control gates, and an output gate. The control and output gates need not be part of the storage cell, but they usually are included because each latch requires both control and output gating.

**bipolar pulse**—1. A pulse that has appreciable amplitude in both directions from the reference axis. 2. A current or voltage pulse that may be either positive or negative.

**bipolar transistor**—1. A transistor that uses both negative and positive charge carriers. 2. An active semiconductor device formed by two pn junctions whose function is amplification of an electric current. Bipolar transistors are of two types: npn and pnp, depending on the manner in which the two pn junctions are combined. Bipolar transistors have three sections: emitter, base, and collector. Operation of a bipolar transistor depends on the migration of both electrons and holes, in contrast to field-effect transistors, in which only one polarity carrier predominates.

*Bipolar (npn) transistor.*

**biquadratic filter**—A filter transfer function that contains complete quadratic equations in both the numerator and denominator and provides the basis for implementing high-pass, low-pass, and single-frequency notch characteristics as well as band-reject realizations.

**biquinary code**—A mixed-radix notation in which each decimal digit to be represented is considered to be the sum of two digits, the first of which is 0 or 1 with significance 5 and the second of which is 0, 1, 2, 3, or 4 with significance 1.

**biradial**—Having an elliptical cross section. A term used with reference to phonograph styli. See elliptical stylus.

**biradial stylus**—Also called elliptical stylus. A stylus tip that has a small radius where it touches the walls of the record grooves, as distinguished from a conventional stylus, which has a hemispherical top used with lightweight pickup arms to reduce tracking distortion.

**bird**—Jargon or nickname for communication satellites.

**birdcage**—A defect in stranded wire in which the strand in the stripped portion between the covering of an insulated wire and a soldered connection (or an end-time lead) has separated from the normal lay of the strands.

**bird-dogging**—See hunting, 1.

**birdnesting**—Clumping together of chaff dipoles after they have been dropped from an aircraft.

**Birmingham wire gage**—Abbreviated BWG. The Birmingham wire gage was used extensively in Great Britain and the United States for many years, but is now obsolete. Its uses have persisted, however, for certain purposes, including galvanized steel wire for cable armor.

**biscuit**—See preform.

**B-ISDN**—Abbreviation for Broadband Integrated Services Digital Network. An ISDN service requiring a broadband channel operating at speeds greater than a single primary rate interface—34 to as much as 6000 Mbps.

**bislope triggering**—Allows positive- and negative-going signal polarities to initiate waveform storage in both analog and digital oscilloscopes. A triggering threshold or level control on the front panel determines the trigger characteristics.

**bistable**—1. A circuit element with two stable operating states, e.g., a flip-flop in which one transistor is saturated while the other is turned off. It changes state for each input pulse or trigger. 2. A device capable of assuming either one of two stable states. 3. Of or pertaining to the general class of devices that operate in either of two possible states in the presence or absence of the setting input. 4. Element that has two output possibilities and that will hold a given condition until switched.

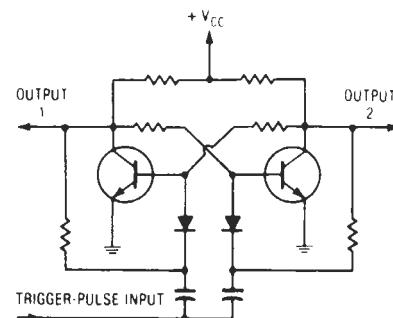
**bistable contacts**—A contact combination in which the movable contact remains in its last operated position until the magnetic polarity of the coil is reversed.

**bistable device**—1. Any device, such as a flip-flop, that has two stable states and may be readily switched from one state to the other. 2. A device with only two stable states, such as on and off.

**bistable display**—A matrix-controlled display that has information storage at the display surface and that requires that an element be addressed only once to ensure that it is on or off.

**bistable latch**—A rudimentary flip-flop that can be enabled to store a logical 1 or a logical 0. One bistable latch device is commonly used in memory and register circuits for the storage of each bit.

**bistable multivibrator (flip-flop)**—A circuit having two stable states; it will stay in either one indefinitely until appropriately triggered, after which it immediately switches to the other state.

*Bistable multivibrator.*

**bistable relay**—A relay that requires two pulses to complete one cycle composed of two conditions of operation. Also called locked, interlocked, and latching relay.

**bistatic radar**—Radar system in which the receiver and transmitter have separate antennas and are some distance apart.

**biswitch**—A two-terminal integrated device that basically performs the function of two npn switches interconnected so as to provide bilateral switching.

**bisynchronous**—1. Data transmission in which synchronization of characters is controlled by timing signals generated at both the sending and receiving stations. 2. Method of transmitting computerized data that allows for multiple error detection.

**bit**—Abbreviation for binary digit. 1. A unit of information equal to one binary decision, or the designation of one of two possible and equally like values or states (such as 1 or 0) of anything used to store or convey information. It may also mean “yes” or “no.” 2. The smallest part of information in a binary notation system. A bit is either a one (1) or a zero (0). In a BCD system, four bits represent one decimal digit. 3. The smallest unit of information, representing either a mark or a space (1 or 0). In data transmission, the common unit of speed is bits per second (bps). 4. In a computer, one bit is enough to tell the difference between yes or no, up or down, on or off, 1 or 0, in short, any two opposites. Computers represent information in the form of bits because their circuits can have only two states: on or off. 5. The bit can take the form of a magnetized spot, an electronic impulse, a positively charged magnetic core, etc. A number of bits together are used to represent a character in a computer (byte, word).

**bit copier**—A program that copies individual data bits on a disk without regard to their information content; it is not affected by improperly formatted data.

**bit density**—The number of bits of information contained in a given area, such as the number of bits written along an inch of magnetic tape.

**bit diddling**—A method of increasing storage efficiency by packing extra information into unused parts of a computer word.

**bit interleave**—A technique in time-division multiplexing in which bits of data are transmitted in one frame.

**bit map**—1. A graphics image consisting of rows and columns of dots. 2. A screen display in which each pixel location corresponds to a unique main memory location accessible by the CPU. Also refers to images intended for display on this type of digital system.

**bit-mapped display**—A method of CRT display that uses a separate area of computer memory to specify the locations of individual pixels, resulting in high-quality images.

**bit-mapped font**—A font with characters formed by a pattern of dots.

**bit parallel**—1. A method of simultaneously moving or transferring all bits in a contiguous set of bits over separate wires, one wire for each bit in the set. 2. Refers to a set of concurrent data bits present on a like number of signal lines used to carry information. Bit-parallel data bits may be acted on concurrently as a group (byte) or independently as individual data bits.

**bit plane**—The circuitry required to make a bit-map display, especially when combinable or stackable to allow more than one bit per pixel. Thus, two bit planes give each pixel four possible colors to select from; five planes yield 32.

**bit rate**—1. The number of binary bits transmitted per unit time; for example, a bit rate of 80 means that 80 binary bits are transmitted per second. 2. The rate at which binary digits, or pulses representing them, pass a given point in a communication line. 3. The rate at which data bits (digital information) are transmitted over a communication path, normally expressed in bits per second (bps). Not to be confused with the data signaling rate (baud), which measures the rate of signal changes transmitted. 4. Informal term for data rate, when it is measured in bits per second. 5. The rate of transfer of information necessary to ensure acceptable reproduction of the information at the receiver.

**bit-rate generators**—Devices that provide the reference frequencies required by serial interfaces (TTY, UART, cassette, modem) and also furnish adjustment-free crystal stability with easily changed, multiple frequencies.

**bit-rate-length product**—The product of the bit rate that a fiber or cable is able to handle and the length for tolerable dispersion at the bit rate, with the product usually stated in units of megabits per kilometer/second. Typical bit-rate-length products for graded index fibers with a numerical aperture of 0.2 is 1000 MB per km/s for research fibers and 200 MB per km/s for production fibers. The product is a good measure of fiber performance in terms of transmission capability.

**bit serial**—A method of sequentially moving or transferring a contiguous set of bits one at a time over a single wire, according to a fixed sequence.

**bit slice**—1. As in a 4-bit slice and a 2-bit slice. A multichip microprocessor in which the control section is contained on one chip, and one or more identical arithmetic and logic unit (ALU) sections and register sections are contained on separate chips called slices. For example, three 4-bit slices connected in parallel with the control section produce a 12-bit word microprocessor. 2. An enhanced subsection of a microprocessor's ALU, embodying an architecture that permits the cascading or stacking of devices to increase word bit size. (Support chips are required to construct a functional MPU.) 3. The arithmetic and logic unit (ALU) within the central processor unit (CPU) of a microcomputer. Circuits capable of handling a few bits—normally four but sometimes less—are stacked in parallel to provide an ALU and registers capable of handling some specific word length. For example, to get the 16-bit word length normally used for numerical control, 4-bit slices can be combined, with each slice on a separate chip. The slice excludes the control section, which must be implemented by external devices. 4. A microprocessor in which the CPU is partitioned into two or more silicon chips, each containing 2- or 4-bit register logic. 5. A microcomputer chip that is a quarter or an eighth of an entire processor. When a CPU is too complex or would dissipate too much heat to be put on a single chip it is sliced into 2- or 4-bit chunks that are then wired together on circuit cards.

**bit-slice processor**—A microprocessor whose word (or byte) capacity is achieved through the use of interrelated smaller-capacity processors, e.g., a 16-bit unit derived from eight 2-bit slices.

**bits per second**—Abbreviated bps. 1. The unit of information rate. It expresses the number of binary digits passed through a channel per second. 2. The speed at which modems send and receive data. For example, a 14.4 modem moves 14,400 bits per second; a 28.8 modem, also known as a V.34, is twice as fast. An earlier term, baud, is considered archaic.

**bit stream**—1. A binary signal without regard to grouping according to character. 2. A continuous series of bits transmitted on a communications link.

**bit string**—A string of binary digits in which each bit position is considered an independent unit.

**bit time**—1. In a serial binary computer, the time during which each bit appears. 2. The amount of time that one bit of information in a digital pattern remains in its 1 or 0 state.

**black**—A signal produced at any point in a facsimile system by the scanning of a selected area of subject copy having maximum density.

**black and white**—See monochrome.

**black-and-white transmission**—See monochrome transmission.

**black area**—An area with only encrypted signal present.

**blackbody**—1. An idealized emitter for which total radiated energy and the spectral distribution of the energy are accurately known functions of temperature. 2. A solid that radiates or absorbs energy with no internal reflection

of the energy at any wavelength. Physically it may be a hollow sphere coated on the side with lampblack and with an opening through which energy may enter or leave. 3. An ideal body that absorbs all incident light and therefore appears perfectly black at all wavelengths. The radiation emitted from such a body when it is hot is called blackbody radiation. The spectral energy density of blackbody radiation is the theoretical maximum for a body in thermal equilibrium. 4. An ideal body that would absorb all radiation incident on it. When heated by external means, the spectral energy distribution of radiated energy would follow curves shown on optical spectrum charts. The ideal blackbody is a perfectly absorbing body. It reflects none of the energy that may be incident on it. It radiates (perfectly) at a rate expressed by the Stefan-Boltzmann law, and the spectral distribution of radiation is expressed by Planck's radiation formula. When in thermal equilibrium, an ideal blackbody absorbs perfectly and radiates perfectly at the same rate. The radiation will be just equal to absorption if thermal equilibrium is to be maintained.

**blackbody luminous efficiency**—The efficiency of an incandescent blackbody as a source of visible light. It is a function of temperature.

**blackbody radiation**—See blackbody.

**black box**—1. A term used loosely to refer to any subcomponent that is equipped with connects and disconnects so that it can be readily inserted into or removed from a specified place in a larger system (e.g., the complete missile or some major subdivision) without benefit of knowledge of its detailed internal structure. 2. A term pertaining to either the functional transformation that acts upon a specified input to give a particular output or to the apparatus for accomplishing this transformation (without regard to the detailed circuitry used). 3. A useful mathematical approach to an electronic circuit which concerns itself only with the input and output and ignores the interior elements, discrete or integrated. 4. An equipment specified only in terms of its performance.

**black compression**—Also called black saturation. The reduction in the gain of a television picture signal at those levels corresponding to dark areas in the picture with respect to the gain at that level corresponding to the midrange light value in the picture. The overall effect of black compression is to reduce contrast in the low lights of the picture.

**blacker-than-black**—1. The amplitude region of the composite video signal below the reference black level in the direction of the synchronizing pulses. 2. That portion of the standard television signal devoted to the synchronizing signal.

**blacker-than-black level**—A voltage value used in an electronic television system for control impulses. It is greater than the value representing the black portions of the image.

**black level**—That level of the picture signal corresponding to the maximum limit of black peaks.

**black light**—1. Invisible light radiation. May be either ultraviolet or infrared radiation, both of which are invisible. 2. A lamp that produces a principal portion of its radiation in the ultraviolet region.

**black-light emitter**—A source of electromagnetic radiation in the ultraviolet or infrared region, just outside the visible spectrum.

**black matrix**—Picture tube in which the color phosphors are surrounded by black for increased contrast.

**black negative**—The television picture signal in which the polarity of the voltage corresponding to black is negative with respect to that which corresponds to the white area of the picture signal.

## blackbody luminous efficiency — blanking

**black noise**—In a spectrum of electromagnetic wave frequencies, a frequency spectrum of predominantly zero power level at all frequencies except for a few narrow bands or spikes, such as might be obtained when scanning a black area in facsimile transmission systems on which there are a few white spots or speckles on the surface.

**blackout**—1. Interruption of radiocommunication due to excess absorption caused by solar flares. During severe blackouts, all frequencies above approximately 1500 kHz are absorbed excessively in the daylight zone. 2. Passive defense that consists of interrupting all forms of communication or identification. 3. A sudden, unexpected loss of all electrical power, typically lasting for many minutes or even hours.

**black peak**—A peak excursion of the picture signal in the black direction.

**black-peak clipping**—Limiting the amplitude of the picture signal to a preselected maximum black level, usually at blanking level.

**black reference**—The blanking level of pulses in a TV signal beyond which the sync pulse is in the blacker-than-black region.

**black saturation**—See black compression.

**black scope**—Cathode-ray tube being operated at the threshold of luminescence with no video signals applied.

**black signal**—Also called picture black. A signal produced at any point in a facsimile system by the scanning of a maximum density area of the subject copy.

**black transmission**—1. In an amplitude-modulation facsimile system, a form of transmission in which the maximum transmitted power corresponds to the maximum density of the copy. 2. In a frequency-modulation system, a form of transmission in which the lowest transmitted frequency corresponds to the maximum density of the copy.

**blade contact**—A flat male contact designed to mate with a tuning fork or a flat-formed female contact. It is used in multiple-contact connectors.

**blank**—1. The result of the final operation on a crystal. 2. To cut off the electron beam of a cathode-ray tube. 3. A code character to denote the presence of no information rather than the absence of information. In the Baudot code, it is composed of all spacing pulses. In paper tape, it is represented by a feed hole without intelligence holes. 4. A no-information condition in a data-recording medium or storage location. This vacancy can be represented by all spaces or all zeros, depending on the medium.

**blank coil**—Tape for perforation in which only the feed holes have been punched.

**blank deleter**—A device used to eliminate the receiving of blanks in perforated paper tape.

**blanked picture signal**—The signal resulting from adding blanking to a picture signal. Adding the sync signal to the blanked picture signal forms the composite picture signal.

**blanketing**—The overriding of a signal by a more powerful one or by interference, so that a receiver is unable to receive the desired signal.

**blank groove**—See unmodulated groove.

**blanking**—1. The process of making a channel or device ineffective for the desired interval. In television, blanking is the substitution, during prescribed intervals, of the picture signal by a signal whose instantaneous amplitude is such as to make the return trace invisible. See also gating. 2. The process whereby the beam in an image pickup tube or CRT is cut off during the retrace period.

**blanking level**—Also called pedestal level. 1. In a composite picture signal, the level that separates the range of the composite picture signal containing picture information from the range containing synchronizing information. 2. Usually referred to as the front porch or back porch. At 0 IRE units, it is the level that will shut off the picture tube, resulting in the blackest possible picture.

**blanking pulse**—A square wave (positive or negative) used to switch off electronically a part of a television or radar set for a predetermined length of time.

**blanking signal**—A wave made up of recurrent pulses related in time to the scanning process and used to effect blanking. In television, this signal is composed of pulses at line and field frequencies, which usually originate in a central sync generator and are combined with the picture signal at the pickup equipment in order to form the blanked picture signal. The addition of a sync signal completes the composite picture signal.

**blanking time**—The length of time the electron beam of a cathode-ray tube is cut off.

**blanking zone**—*See* blanking pulse.

**blank instruction**—*See* no-operation instruction.

**blank record**—A recording disk on which no material has been recorded.

**blank tape**—Also called raw tape or virgin tape. 1. Tape on which nothing has been recorded. 2. Magnetic tape that has never been subjected to the recording process and is therefore substantially free from noise.

**blast filter**—Also called a pop filter. A dense mesh screen on a microphone, which minimizes overload caused by loud, close sounds.

**blasting**—1. Overloading of an amplifier or speaker, resulting in severe distortion of loud sounds. 2. Severe audible distortion due to overloading of sound-reproducing equipment.

**bleeder**—A resistor connected across a power source to improve voltage regulation, provide a current path under no-load conditions, or dissipate stored energy on shut-off.

**bleeder current**—The current drawn continuously from a power supply by a resistor. Used to improve the voltage regulation of the power supply. (A technology no longer in use.)

**bleeder resistor**—1. A resistor used to draw a fixed current. Also used, as a safety measure, to discharge a filter capacitor after the circuit is deenergized. 2. A resistor placed in the power supply of a radio receiver or other electronic device to stabilize the voltage supply.

**bleeding**—1. Migration of plasticizers, waxes, or similar materials to the surface to form a film or bead. 2. In photomasking, poor edge definition or acuity caused by spread of image onto adjacent areas. 3. A condition in which a plated hole discharges process material or solution from crevices or voids. 5. During hybrid circuit manufacturing, the lateral spreading or diffusion of a printed film into adjacent areas beyond the geometric dimensions of the printing screen. This may occur during drying or firing.

**bleeding whites**—An overloading condition in which white areas in a television picture appear to flow into the black areas.

**bleedout**—The tendency of absorbed electrolytes, impurities, base materials, and prelates to diffuse to the surface of gold plating.

**blemish**—1. On the storage surface of a charge-storage tube, an imperfection that produces a spurious output. 2. An area in a fiber or fiber bundle that has a reduced light transmission capability, i.e., increased attenuation, due to defective or broken fibers, foreign substances, or other spoilage.

**blended data**—Q-point that results from the combination of scanning data and tracking data to form a vector.

**blending**—A means of obtaining intermediate viscosities from materials of the same type but different viscosities. This term is also applied to resistive inks that can be blended with each other to achieve intermediate resistivities.

**blind approach**—An aircraft landing approach when visibility is poor, usually made with the aid of instruments and radiocommunication.

**blind approach beacon system**—*See* BABS

**blind landing**—Landing an aircraft entirely by means of instruments and electronic communications.

**blind zone**—An area from which echoes cannot be received; generally, an area shielded from the transmitter by some natural obstruction and therefore from which there can be no return.

**blinking**—1. An ECM technique by which two aircraft separated a short distance and within the same azimuth resolution appear as one target to a tracking radar. The two aircraft alternately spot jam, causing the radar system to oscillate from one target to the other and making it impossible to obtain an accurate solution of the fire-control problem. 2. In pulse systems, a method of providing information in which the signal is modified at its source so that the presentation on the display scope alternately appears and disappears. In loran, this indicates that a station is malfunctioning.

**blip**—Sometimes referred to as pip. 1. On a cathode-ray display, a spot of light or a base-line irregularity representing the radar reflection from an object. 2. A discontinuity in the insulation of a wire.

**blip-frame ratio**—The ratio of the number of computer frames during which radar data was obtained to the total number of computer frames.

**blip-scan ratio**—The ratio between a single recognizable blip on a radarscope and the number of scans necessary to produce it. The blip-scan ratio of any given radar set varies with the range, antenna tilt, level of operator and set performance, target aspect, wind, etc.

**blister**—1. The enclosure housing an airborne radar antenna. 2. A lump or raised section of a conductor or resistor caused by outgassing of the binder or vehicle during firing.

**blistering**—The development, during firing, of enclosed or broken macroscopic vesicles or bubbles in a body or in a glaze or other coating.

**blivet**—An excess of coating material, such as a lump around a dust particle on a wire or a surface. *See also* land, 2.

**Bloch wall**—The transition layer separating adjacent ferromagnetic domains.

**block**—1. A group of computer words considered as a unit because they are in successive storage locations. 2. The set of locations or tape positions in which a block of words is stored. 3. A circuit assemblage that functions as a unit, such as a circuit building block of standard design or the logic block in a sequential circuit. 4. A set of contiguous bits and/or bytes that make up a definable quantity of information. 5. A section of information recorded on magnetic tape or disk. One block may consist of several records, that is, collections of information consisting of one or more related items; or a record may extend over several blocks, depending on the characteristics of the device and the needs of the programmer. 6. A group of consecutive words, characters, or bits that is handled as a single unit, particularly with respect to input/output operations. 7. A group of characters that is written or read as a physical unit as distinct from a logical unit (*see* record). A block may contain one or more

complete records, or part of a record. 8. A string of data elements that is recorded or transmitted as a unit. 9. In word processing, a selected section of characters. In data management, a group of records. In communications, a fixed batch of data that is transferred together.

**block address**—A method of identifying words through use of an address that specifies the format and meaning of the words in the block of information.

**block cancel character**—A character used to signify that the preceding portion of the block is to be disregarded. Also called block ignore character.

**block code**—A special code or character used to separate blocks of data. A block code is used typically on paper tape and generally occurs at both the beginning and end of a block. Thus, the information on a paper tape containing a number of blocks would be started by a block code, there would be a block code between adjacent blocks, and the data would be ended by a block code.

**block diagram**—1. A diagram in which the essential systems units are drawn as blocks, and their relationship to each other is indicated by appropriately connected lines. The path of the signal or energy may be indicated by lines or arrows. 2. In computer programming, a graphical representation of the data-processing procedures within the system. It is used by programmers as an aid to program development. 3. A diagram in which a system or computer program is represented by annotated boxes and interconnecting lines. Synonym: flowchart. 4. A chart that graphically depicts the functional relationships of hardware making up a system. The block diagram serves to indicate the various data and control signal paths between functional units of the system hardware. 5. A drawing in which circuit functions are represented as blocks of various geometries.

**block downconversion**—The process of lowering an entire band of frequencies in one step to some intermediate range to be processed by a receiver. Multiple block downconversion receivers are capable of independently selecting channels because each can process the entire block of signals.

**block downconverter**—1. A device that converts an entire band (e.g., the 3.7–4.2 GHz C-band) down to a lower band of frequencies. 2. A type of downconverter that changes the microwave signal into an IF frequency that contains all the transponder frequencies (channels) of the satellite. The block downconverter allows inexpensive multiple receivers to tune all the channels simultaneously using one central downconverter—an advantage when using multiple receivers with a single antenna.

**blocked impedance**—The input impedance of a transducer when its output is connected to a load of infinite impedance.

## block address — blocking oscillator

**blocked resistance**—Resistance of an audio-frequency transducer when its moving elements are restrained so they cannot move; it represents the resistance due only to electrical loss.

**blockette**—In digital computer programming, a subgroup, or subdivision, of a group of consecutive machine words transferred as a unit.

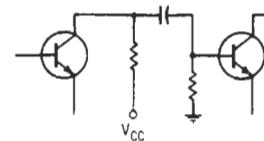
**block gap**—1. An area used to indicate the end of a block or record on a data medium. 2. An absence of data along a specified length of magnetic tape between adjacent blocks of data.

**block-grid keying**—A method of keying a continuous-wave transmitter by operating the amplifier stage as an electronic switch. During the spacing interval when the key is open, the bias on the control grid becomes highly negative and prevents the flow of plate current so that the tube has no output. During the marking interval when the key is closed, this bias is removed and full plate current flows.

**block ignore character**—See block cancel character.

**blocking**—1. Application of an extremely high-bias voltage to a transistor, vacuum tube, or metallic rectifier to prevent current from flowing in the forward direction. 2. Combining two or more records into one block. 3. A condition in a switching system in which no paths or circuits are available to complete a call, resulting in a busy tone returned to the calling party. A denial or busy condition.

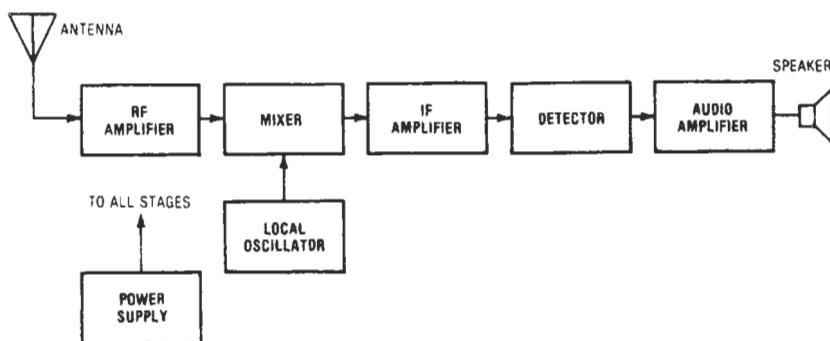
**blocking capacitor**—1. A capacitor that introduces a comparatively high series impedance for limiting the flow of low-frequency alternating and direct current without materially affecting the flow of high-frequency alternating current. 2. A capacitor used to block direct current while allowing an alternating current of certain frequencies to pass.



Blocking capacitor.

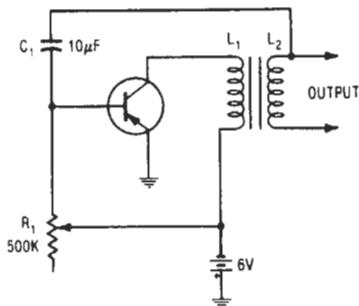
**blocking layer**—See depletion layer.

**blocking oscillator**—Also called squeegging oscillator. 1. An electron-tube oscillator that operates intermittently as its grid bias increases during oscillation to a point



Block diagram, I.

at which the oscillations stop, and then decreases until oscillation resumes. 2. A relaxation oscillator consisting of an amplifier (usually a single stage) whose output is coupled back to the input by means that include capacitance, resistance, and mutual inductance. 3. A relaxation-type oscillator that conducts for a short period of time and is cut off for a relatively long period.



*Blocking oscillator.*

**blocking-oscillator driver**—A circuit that develops a square pulse used to drive the modulator tubes, and which usually contains a line-controlled blocking oscillator that shapes the pulse into the square wave.

**blocking relay**—A device that initiates a pilot signal to block tripping on external faults in a transmission line or in other apparatus under predetermined conditions, or which cooperates with other devices to block tripping or to block reclosing on an out-of-step condition or on power swings.

**block length**—In a computer, the total number of records, words, or characters contained in one block.

**block loading**—In a computer, a form of fetch in which the control sections of a load module are brought into continuous positions of main storage.

**block mark**—A method of indicating the end of one block of data and the start of another on tape or in data transmission. On magnetic tape, the block mark is a block gap; on paper tape it is a block code; in data transmission it is typically a pause or a code.

**block-multiplexer channel**—A computer-peripheral multiplexer channel that interleaves blocks of data.

**block protector**—A rectangular piece of carbon, Bakelite with a metal insert, or porcelain with a carbon insert that, in combination with each other, make one element of a protector. They form a gap that will break down and provide a path to ground for excessive voltages.

**block size**—The number of data elements in a block.

**block sort**—A computer sorting technique in which the file is first divided according to the most significant character of the key, and the separate portions are then sorted one at a time. It is used particularly for large files.

**block transfer**—In a computer, the process of transmitting one or more blocks of data.

**blooming**—1. An increase in the size of the scanning spot on a cathode-ray tube, caused by defocusing when the brightness control is set too high. The result is expansion and consequent distortion of the image. May also be caused by insufficient high voltage. 2. The defocusing of regions of the picture where the brightness is at an excessive level, due to enlargement of spot size and halation of the fluorescent screen of the cathode-ray picture tube.

**blooper**—A radio receiver that is oscillating and radiating an undesired signal.

**blow**—The opening of a circuit because of excessive current, particularly when the current is heavy and a melting or breakdown point is reached and a fuse blows.

**blower**—1. An electric fan used to supply moving air for cooling purposes. *See* fan. 2. A high-pressure device in which a rotating impeller moves an air mass in a spiral direction around the shaft. There are single-stage, dual-stage, and vacuum types.

**blown jacket**—The common term given to an outer covering of insulation of a cable that was applied by the controlled inflation of the cured jacket tube and the pulling of the cable through it.

**blowout coil**—An electromagnetic device used to establish a magnetic field in the space where an electrical circuit is broken and thus displace and extinguish the arc.

**blowout magnet**—A strong permanent magnet or electromagnet used for reducing or deflecting the arc between electrodes or contacts.

**blue-beam magnet**—A small permanent magnet used to adjust the static convergence of the electron beam for blue phosphor dots in a three-gun color picture tube.

**blue glow**—The glow normally seen in vacuum tubes containing mercury vapor; it is due to ionization of the molecules of mercury vapor.

**blue gun**—In a three-gun color picture tube, the electron gun whose beam strikes the phosphor dots emitting the blue primary color.

**blue noise**—In a spectrum of electromagnetic wave frequencies, a region in which the spectral density is proportional to the frequency (sloped) rather than independent of frequency (flat), as in white noise that is more of a uniformly distributed constant-amplitude frequency spectrum.

**blue restorer**—The dc restorer in the blue channel of a three-gun color-television picture-tube circuit.

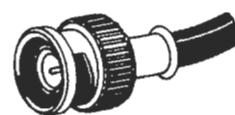
**blue video voltage**—The signal voltage that controls the grid of the blue gun in a three-gun picture tube. This signal is a reproduction of the blue output signal of the color-television camera.

**B-MAC**—A method of transmitting and scrambling television signals. In such transmissions, MAC (multiplexed analog component) signals are time-multiplexed with a digital burst containing digitized sound, video synchronizing, authorization, and information.

**BMEWS**—*See* ballistic-missile early-warning system.

**BNC**—A bayonet-locking connector for miniature coax; BNC is said to be short for bayonet-neil-connector. Contrast with TNC.

**BNC coax connector**—A twist-lock connector for various types of RG-type coaxial cables.



*BNC coax connector.*

**board**—1. A telephone or audio mixer panel containing patch jacks. 2. A circuit board.

**board computer**—A computer in which all electronic components are on a single circuit board.

**board-test simulation**—A testing technique in which the circuit to be tested is modeled, component by

component and node by node, in the test system computer. From this model the system can calculate the correct response to any input pattern, plus predict failure modes and their responses. This allows only those patterns that identify faults to be used as the test pattern stimulus.

**boat**—1. A container for materials to be evaporated or fired. 2. A wafer holder used in a diffusion furnace.

**BOB**—Abbreviation for break-out box.

**bobbin**—1. A small insulated spool that serves as a support for a coil or wirewound resistor. 2. Spool used for taking up drawn wire and subsequently used for pay-out packages in cabling and stranding equipment.

**bobbin core**—See tape-wound core.

**body capacitance**—The capacitance to ground that is introduced into an electric circuit by the proximity of, or contact with, the human body.

**body effect**—Characteristic shift in threshold voltage resulting from bias applied to a semiconductor device's substrate.

**body electrodes**—Electrodes placed on or in the body to couple electrical impulses from the body to an external measuring or recording device.

**baffle**—A speaker enclosure, developed by H. A. Hartley, containing a group of stretched, resilient and sound-absorbing screens.

**bogey**—1. The average, or published, value for a tube characteristic. A bogey tube would be one having all characteristics of a bogey value. 2. An average, published, or nominal value for some characteristic of a device.

**bogey electron device**—An electron device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics that are directly related to the application.

**boilerplate**—1. A full-size model that simulates the weight, size, and shape, but not all of the functional features, of the actual item. 2. That part of the specifications of a component, piece of equipment, system, or the like that defines and describes the set of conditions of the sale.

**boiling point**—The temperature at which a liquid vaporizes when heated. The exact point depends on the absolute pressure at the liquid-vapor surface.

**bolometer**—1. A radiation detector that converts incident radiation into heat, which, in turn, causes a temperature change in the material used in the detector. This change is then measured to give an indication of the amount of incident radiant energy. 2. A very sensitive thermometric instrument used for the detection and measurement of radiant energy. Its essential component is a short, narrow strip that is covered with a dead-black absorbing coating. It is mounted at the lower end of a long, cylindrical tube having a stop across it to exclude unwanted radiation. The electrical resistance of the strip changes with changes in temperature that arise from absorbing varying amounts of radiant energy.

**bolted fault level**—See adjusted circuit.

**Boltzmann's constant**— $1.38 \times 10^{-16}$  J/K. Relates the average energy of a molecule to its absolute temperature.

**bomb**—1. A computer program that fails spectacularly. 2. A programmer can bomb a computer system by deliberately writing a program that will disrupt the system. 3. In a computer, to fail or to crash.

**bombardment**—1. The directing of high-speed electrons at an electrode, causing secondary emission of electrons, fluorescence, disintegration, or the production of X-rays. 2. The process of directing high-speed particles at atoms to cause ionization or transmutation.

**bond**—1. Electrical interconnection made with a low-resistance material between a chassis, metal shield cans, or cable shielding braid, in order to eliminate

undesirable interaction and interference resulting from high-impedance paths between them. 2. To make an electrical bond, an interconnection that performs a permanent electrical and/or mechanical function. 3. A low-resistance electrical connection between two ground connections or between similar parts of two circuits. See valence bond.

**bondability**—Those surface characteristics and conditions of cleanliness of a bonding area that must exist in order to provide a capability for successfully bonding an interconnection material by one of several methods, such as ultrasonic or thermocompression wire bonding.

**bondable wire**—An insulated wire whose surface has been treated to facilitate adherence to other materials, such as potting compounds. The term also could be applied to magnetic wires used in making coils where bonding the turns together is desirable.

**bond deformation**—The change in the form of the lead produced by the bonding tool, causing plastic flow, in making the bond.

**bonded assembly**—An assembly whose supporting frame and metallic noncircuit elements are connected so as to be electrically shorted together.

**bonded-barrier transistor**—A transistor made by alloying the base with the alloying material on the end of a wire.

**bonded cables**—Cables consisting of preinsulated conductors or multiconductor components that are laid in parallel and bonded into a flat cable.

**bonded nr diode**—An n-junction semiconductor device in which the negative resistance arises from a combination of avalanche breakdown and conductivity modulation due to the current through the junction.

**bonded pickup**—See bonded transducer.

**bonded strain gage**—A pressure transducer that uses a pressure-sensing system consisting of strain-gage elements firmly bonded to a pressure-responsive member. Thermal stability and insensitivity to shock and vibration are improved by means of this bonded construction.

**bonded transducer**—Also called bonded pickup. A transducer that employs the bonded strain-gage principle of transduction.

**bonding**—1. Soldering or welding together various elements, shields, or housings of a device to prevent potential differences and possible interference. 2. A method used to produce good electrical contact between metallic parts of any device. Used extensively in automobiles and aircraft to prevent static buildup. Also refers to the connectors and straps used to bond equipment. 3. The means employed to obtain an electromagnetically homogenous mass having an equipotential surface. 4. The attachment of wire to a circuit. 5. The permanent joining of metallic parts to form an electrically conductive part. See ball bonding; die bonding; stitch bond; thermal compression bonding; wedge bonding; wire bond; wobble bond. 6. The process of connecting wires from the package leads to the chip (or die) bonding pads. Part of the assembly process. Alternately, the process of securing a semiconductor die to a lead frame or package.

**bonding area**—The area, defined by the extent of a metallization land or the top surface of the terminal, to which a lead is or is to be bonded. Also called bond site.

**bonding conductor**—1. A conductor that serves to connect exposed metal surfaces together. 2. Device used to connect exposed metal to ground. It normally carries no current but is used to eliminate shock or spark hazards and ensures the operation of circuit protective devices in cases of insulation breakdown.

**bonding island**—See bonding pad.

**bonding pad**—Also called bonding island. 1. A relatively large metallic area at the edge of an integrated circuit chip; this area is connected through a thin metallic

strip to some specific circuit point to which an external connection is to be made. 2. A metallized area at the end of a thin metallic strip to which a connection is to be made. *See also beam lead.*

**bonding wire**—Fine gold or aluminum wire for making electrical connections to a semiconductor die or a hybrid circuit between various bonding pads on the semiconductor device substrate and device terminals or substrate lands.

**bond liftoff**—The failure mode whereby the bonded lead separates from the surface to which it was bonded.

**bond schedule**—The values of the bonding machine parameters used when adjusting for bonding. For example, in ultrasonic bonding, the values of the bonding force, time, and ultrasonic power.

**bond site**—*See bonding area.*

**bond strength**—A measure of the amount of stress required to separate a layer of material from the base to which it is bonded. Peel strength, measured in pounds per inch of width, is obtained by peeling the layer; pull strength, measured in pounds per square inch, is obtained by a perpendicular pull applied to a surface of the layer.

**bond-to-bond distance**—The distance, measured from the bonding site on the die to the bond impression on the post, substrate land, or fingers, that must be bridged by a bonding wire or ribbon.

**bond-to-chip distance**—In beam-lead bonding, the distance from the heel of the bond to the component.

**bone conduction**—The process by which sound is conducted to the inner ear through the cranial bones.

**book capacitor**—A two-plate trimmer capacitor that has its plates hinged together like the pages of a book. The capacitance is varied by changing the angle between the plates.

**Boolean algebra**—1. A system of mathematical logic dealing with classes, propositions, on-off circuit elements, etc., associated by operators such as AND, OR, NOT, EXCEPT, IF ... THEN, etc., thereby permitting computations and demonstration as in any mathematical system. Named after George Boole, famous English mathematician and logician, who introduced it in 1847. 2. Algebraic rules for manipulating logic equations. 3. Shorthand notation for expressing logic functions.

**Boolean calculus**—Boolean algebra modified to include time.

**Boolean equation**—Expression of relations between logic functions.

**Boolean function**—A mathematical function in Boolean algebra.

**Boolean operator**—The symbol or word used to specify the inclusion or exclusion of criteria such as AND, OR, NOT, etc. Same as logical operator.

**boom**—A mechanical support for a microphone, used in a television studio to suspend the microphone within range of the actors' voices but out of camera range.

**boost capacitor**—A capacitor used in the damper circuit of a television receiver to supply a boosted B voltage.

**boost charge**—The partial charge of a storage battery, usually at a high current rate for a short period.

**boosted B voltage**—In television receivers, the voltage resulting from the combination of the B-plus voltage from the power supply and the average value of voltage pulses coming through the damper tube from the horizontal deflection-coil circuit. The pulses are partially or wholly smoothed by filtering. This boosted voltage may be several hundred volts higher than the B-plus voltage.

**booster**—1. A carrier-frequency amplifier, usually a self-contained unit, connected between the antenna

or transmission line and a television or radio receiver. 2. An intermediate radio or TV station that retransmits signals from one fixed station to another. 3. A small, self-contained transformer designed to be connected to a cathode-ray tube socket to increase the filament voltage and thereby extend the life of the tube. 4. A device inserted into a line (or cable) to increase the voltage. Boosting generators are also used to raise the level of a dc line. Transformers are usually employed to boost ac voltages. The term booster also is applied to antenna preamplifiers.

**booster amplifier**—A circuit used to increase the output current of the voltage capabilities of an operational amplifier circuit without loss of accuracy (ideally) or inversion of polarity. Usually employed inside the loop for accuracy.

**booster voltage**—The additional voltage supplied by the damper tube of a television receiver to the horizontal-output, horizontal-oscillator, and vertical-output tubes, resulting in a greater sawtooth sweep output.

**boot**—1. A form placed around the wire termination of a multiple-contact connector for the purpose of containing the liquid potting compound until it hardens. 2. A housing, usually made from a resilient material, used to protect connector or other terminals from moisture. 3. An accessory, usually of a flexible material, designed to be placed around the terminals of a component as a protective housing. 4. To make a computer operate by loading in a program. 5. The initial starting-up of a PC. The operating system is brought into main memory and takes over control. 6. The automatic routine that clears the memory, loads the operating system, and prepares a computer for use. A *cold boot* occurs when the power is first switched on. A *warm boot* refers to restarting a computer that is already turned on (clearing the memory and reloading the operating system) without first switching it off. Also called boot up.

**booting**—Loading a computer's memory with the necessary information so it can function. A cold boot occurs when a computer's power is turned on and there is nothing in memory.

**boot loader**—Also called bootstrap. A program in a minicomputer that usually works on a simple data format called core image. The data format, in this context, is the organization of the data as it appears on the input device from which the program is being loaded. Core image data is binary, bit-for-bit identical to what will appear in memory after loadings. The boot loader is used to bring simple programs into memory and run them immediately.

**bootstrap**—1. A technique or device that brings itself into a desired state through its own action; for example, a routine whose first few instructions are sufficient to cause the rest of the routine to be brought into the computer from an input device. 2. A feedback technique that tends to improve linearity and input impedance of circuits operating over a wide range of input signals. *See boot loader.*

**bootstrap circuit**—A single-stage amplifier in which the output load is connected between the negative end of the plate supply and the cathode, the signal voltage being applied between the grid and cathode. The name *bootstrap* arises from the fact that the change in grid voltage also changes the potential of the input source (with respect to ground) by an amount equal to the output signal.

**bootstrap driver**—An electronic circuit used to generate a square pulse to drive a modulator tube.

**bootstrap loader**—Device for loading first instructions (usually only a few words) of a routine into memory, then using these instructions to bring in the rest of the routine.

**bootstrapping**—A feedback technique that tends to improve the linearity of circuits that operate over a wide input-signal range.

**boresight**—The direction along the principle axis of either a transmitting or a receiving antenna.

**boresight error**—The angular deviation of the electrical boresight of an antenna from its reference boresight.

**boresighting**—The initial alignment of a directional microwave or radar antenna system through use of an optical procedure or a fixed, known target.

**boresight point**—The area of maximum signal strength of a down-link signal from a satellite. The center of the transponder footprint.

**BORSCHT**—Abbreviation for Battery, Overvoltage, Ringing, Supervision, Coding, Hybrid, and Test. 1. An acronym for the function that must be performed in the central office of a telephone system when digital voice transmission occurs. 2. The seven functions (battery feed, overvoltage protection, ringing, supervision (or signaling), coding, hybrid, and testing) that are used in telecommunications and performed by a subscriber line interface circuit (SLIC).

**boss**—See land, 2.

**BOT**—Abbreviation for beginning of tape. See load point.

**BOT/EOT markers**—The reflective markers on the back (nonoxide) side of a magnetic tape, used to locate the beginning of the data (BOT) and provide an early warning of the end of the tape (EOT). Tape-drive sensors optically detect these markers.

**bottom**—To reach a point on an operating or characteristic curve at which a negative change in the independent variable, as, for example, in input, no longer produces a constant change in the dependent variable, as, for example, output.

**bottoming**—1. A condition in which a stylus reaches the bottom of a record groove because its tip radius is smaller than optimum for the groove. Also the opposite of the pinch effect. 2. Excessive movement of the diaphragm of a headphone or the cone of a speaker so that the magnet or supporting structure is struck by the moving coil-piston assembly.

**bottom metallization**—The metallization that may be provided over the back portion of an uncased IC chip, facilitating its face-up attachment.

**bounce**—1. An unnatural, sudden variation in the brightness of a television picture. 2. Sudden variations in a video picture presentation (brightness, size, etc.) independent of scene illumination.

**bounce buffer**—The electronic circuitry used to eliminate the effects of bounce of a mechanical switch.

**boundary**—An interface between p and n material at which donor and acceptor concentrations are equal.

**boundary defect**—In a crystal, the boundary area between two adjacent perfect crystal regions that are tilted slightly with respect to each other.

**boundary-element method**—A procedure for solving electromagnetic field problems by breaking the domains into smaller segments and by using integral equations in which the solution variables are confined within the boundaries.

**boundary-layer photocell**—See photovoltaic cell.

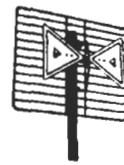
**boundary marker**—A transmitting device installed near the approach end of an airport runway and approximately on the localizer course line.

**bound charge**—On a conductor, the charge which, owing to the inductive action of a neighboring charge, will not escape to ground; residual charge.

**bound circuit**—A circuit designed to limit the excursion of a signal. The limit value it establishes may be nominal when used for protection, or highly precise when used operationally.

**bound electron**—An electron bound to the nucleus of an atom by electrostatic attraction.

**bow-tie antenna**—An antenna generally used for UHF reception. It consists of two triangles in the same plane, usually with a reflector behind them. The transmission line is connected to the points, which form a gap.



**Bow-tie antenna.**

**boxcar**—One of a series of pulses having long duration in comparison with the spaces between them.

**boxcar circuit**—A circuit used in radar to sample voltage waveforms and store the latest value sampled.

**boxcar detector**—A signal recovery instrument that is used either to retrieve the waveform of a repetitive signal from noise or to measure the amplitude of a repetitive pulse buried in noise. The detector has two modes of operation: scan and single-point. The former is used for waveform retrieval and the latter for pulse measurement.

**boxcar integrator**—A signal processor that uses a narrow filter to reduce the noise with little or no effect on the signal bandwidth. A simple integrator consists of a gated switch and a low-pass filter. During the time when the gate is closed, the repetitive input signal is applied to the low-pass filter, which acts as an integrator.

**boxcar lengthener**—A circuit that lengthens a series of pulses without changing their heights.

**box pattern**—A pin arrangement for plug-in packages in which the pins form four rows in either a square or rectangle.

**bpi/cpi**—Bytes per inch (bits per inch per track), the number of bytes per inch written on a magnetic tape, and cpi (characters per inch) are used interchangeably.

**B-plus**—1. Symbol, B+. The positive dc voltage required for certain electrodes of tubes, transistors, etc. 2. The positive terminal of a B power supply.

**B-plus boost**—The positive voltage that is added to the low dc B+ voltage in a TV receiver by the action of the damper tube.

**B power supply**—A power supply that provides the plate and screen voltages applied to a vacuum tube.

**bps**—Abbreviation for bits per second. 1. In serial data transmission, the instantaneous bit speed within one character as transmitted. 2. A measurement of the speed at which data is transmitted and received by a modem. The larger the number, the faster the data is sent and received. Typical rates are 2400, 14,400, 28,800, and 56,000 bps. Often confused with baud, although the terms are not interchangeable.

**BPSK**—See binary phase-shift keying.

**B-quad**—A quad arrangement similar to the S-quad except for a short between the junction of the two sets of series elements. Also called bridge quad or bar quad.

**Bragg's law**—An expression of the conditions under which a system of parallel atomic layers in a crystal will reflect an X-ray beam with maximum intensity.

**braid**—1. A weave of organic or inorganic fiber used as a covering for a conductor or group of conductors. 2. A woven metal tube used as shielding around a conductor or group of conductors. When flattened, it is used as a grounding strap.

**braided wire**—1. A flexible wire made up of small strands woven together. 2. Woven bare or tinned copper wire used as shielding for wires and cables and as ground wire for batteries or heavy industrial equipment. There are many different types of construction.

**brain waves**—The patterns of lines produced on the moving chart of an electroencephalograph as the result of electrical potentials produced by the brain, picked up by electrodes, and amplified in the machine.

**brake**—An electromechanical friction device to stop and hold a load.

**brake wire**—Wires used in automotive and truck trailers to supply current to the electrical braking system.

**braking magnet**—*See* retarding magnet.

**branch**—1. In an electronic network, a section between two adjacent branch points. 2. A portion of a network consisting of one or more two-terminal elements in series. 3. An instruction to a computer to follow one of several courses of action, depending on the nature of control events that occur later.

**branch circuit**—1. That portion of the wiring system between the final overcurrent device protecting the circuit and the outlet. 2. (As applied to appliances) A circuit designed for the sole purpose of supplying an appliance or appliances; nothing else can be connected to this circuit, including lighting. 3. (General purpose) A circuit that supplies lighting and appliances. 4. (Individual) A circuit that supplies just one piece of equipment, such as a motor, an air conditioner, or a furnace. 5. (Multiwire) A circuit consisting of two or more underground conductors with a potential difference between them, and a grounded conductor with an equal potential between it and any one ungrounded conductor. (This may be a 120/240-volt three-wire circuit or a wye-connected circuit with two or more phase wires and a neutral.) It is not a circuit using two or more wires, connected to the same phase, and the neutral.

**branch current**—The current in the branch of a network.

**branch impedance**—In a passive branch, the impedance obtained by assuming a driving force across and a corresponding response in the branch, no other branch being electrically connected to the one under consideration.

**branching**—1. In a computer, a method of selecting, on the basis of the computer results, the next operation to execute while the program is in progress. 2. The function of a computer that alters the logic path depending on some detected condition or data status. For example, the program would branch to a recorder routine when the projected available balance goes negative.

**branching instructions**—In a computer, conditional and unconditional jumping, calling subroutines, and return-looping operations.

**branch order**—An instruction used to link subroutines into the main program of a computer.

**branch point**—1. In an electric network, the junction of more than two conductors. *See also* node, 1, 2. 2. In a computer, a point in the routine where one of two or more choices is selected under control of a routine.

**branch voltage**—The voltage across a branch of a network.

**branch windings**—Forked polyphase transformer windings.

**brass pounder**—Amateur term for a Morse code operator, especially one who spends long hours handling traffic.

**braze bonding**—The joining of similar or dissimilar metals by introducing a braze filler metal at the joint and establishing a conventional brazed joint, and then diffusing the braze filler into the base metals by subsequent heat treating. Melting occurs in the braze filler independent of the base metals. Base-metal fusion is not required.

**brazing**—1. A group of welding processes in which the filler is a nonferrous metal or alloy with a melting point greater than 1000°F (537°C) but lower than that of the metals or alloy to be joined. Brazing is sometimes referred to as hard soldering. 2. Joining two metal parts (usually made of iron or steel) together with a suitable melted copper-alloy metal.

**breadboard**—1. Developmental or prototype version of a circuit. Solderless sockets and bus strips in modular form are often used to create expandable matrices for placement of ICs, capacitors, resistors, and so forth. 2. Perforated substrates that facilitate trial positioning of circuit components and wiring arrangements leading to final circuit construction and packaging. They are used in design, construction, and assembly.

**breadboard circuit**—A circuit simulation using discrete components or partially integrated components to prove the feasibility of a circuit.

**breadboard construction**—An arrangement in which electronic components are fastened temporarily to a board for experimental work.

**breadboard model**—1. An assembly in rough form to prove the feasibility of a circuit, device, system, or principle. 2. An experimental model of a circuit in which the components are fastened temporarily to a chassis or board and electrically tested.

**break**—1. In a communication circuit, the taking control of the circuit by a receiving operator or listening operator. The term is used in connection with half-duplex telegraph circuits and two-way telephone circuits equipped with voice-operated devices. 2. In a circuit-opening device, the minimum distance between the stationary and movable contacts when these contacts are open. 3. An open circuit or on-hook condition as determined by the dial of a telephone set. 4. A signal sent over a backward (secondary) channel by a receiving start-stop terminal on a half-duplex circuit (or, in some cases, over the transmit channel on a full-duplex circuit), usually to indicate a requirement to transmit. 5. The word used to interrupt a conversation on a repeater to indicate there is an emergency.

**break alarm**—1. An alarm condition signaled by the opening or breaking of an electrical circuit. 2. The signal produced by a break alarm condition (sometimes referred to as an open-circuit alarm or trouble signal), designed to indicate possible system failure.

**breakaway panels**—Hardboards held together in a grouping by using breakaway tabs. Breakaway panels make handling easier for automatic insertion and wave soldering. When necessary, boards can be separated by snapping them apart much like a soda cracker.

**break-before-make**—1. The action of opening a switching circuit before closing another associated circuit. 2. Movable contact that breaks one circuit before making the next circuit.

**break-before-make contacts**—Contacts that interrupt one circuit before establishing another.

**break contact**—1. In a switching device, the contact that opens a circuit upon operation of the device (normally closed contact). 2. Contacts that open when a key or relay is operated.

**break distance**—The effective open-gap distance between the stationary and movable contacts.

**breakdown**—1. An electric discharge through an insulator, insulation on wire, or other circuit separator, or between electrodes in a vacuum or gas-filled tube. 2. Phenomenon occurring in a reverse-biased semiconductor diode, the initiation of which is observed as a transition from a region of high dynamic resistance to a region of substantially lower dynamic resistance for increasing magnitude of reverse voltage. Also collector-emitter breakdown, punch-through, secondary breakdown, etc. 3. Initiation of a spark discharge between two electrodes. 4. A disruptive current (discharge) through insulation. 5. Failure of insulation for any reason. 6. A state of a circuit device in which the electric field exceeds a maximum allowed value. A sharp current increase results, which may destroy the device.

**breakdown diode**—See avalanche diode.

**breakdown impedance**—Also called avalanche impedance. The small-signal impedance at a specified direct current in the breakdown region of a semiconductor diode.

**breakdown region**—The entire region of the volt-ampere characteristic beyond the initiation of breakdown due to reverse current in a semiconductor-diode characteristic curve.

**breakdown strength**—See dielectric strength.

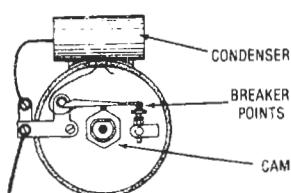
**breakdown torque**—The maximum torque a motor will develop, without an abrupt drop in speed, as the rated voltage is applied at the rated frequency.

**breakdown voltage**—1. That voltage at which an insulator or dielectric ruptures, or at which ionization and conduction take place in a gas or a vapor. 2. The voltage measured at a specified current in the breakdown region of a semiconductor diode at which there is a substantial change in characteristics from those at lower voltages. Also called zener voltage. 3. The voltage required to jump an air gap. 4. The reverse-bias voltage applied to a pn junction for which large currents are drawn for relatively small increases in voltage. 5. The voltage at which a disruptive discharge takes place, either through or over the surface of insulation. 6. The voltage at which the insulation between two conductors will break down.

**break elongation**—The relative elongation of a specimen of recording tape or base film at the instant it breaks after having been stretched at a given rate.

**breakerless ignition**—A semiconductor electronic ignition system that does not use mechanical breaker contacts for timing or triggering purposes, but retains the distributor mechanism for distribution of the secondary voltage.

**breaker points**—1. The low-voltage contacts that interrupt the current in the primary circuit of the ignition system of a gasoline engine. 2. A pair of movable points that are opened and closed to break and make the primary circuit.



Breaker points.

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**bremsstrahlung**—Electromagnetic radiation emitted by a fast-moving charged particle (usually an electron) when it is slowed down (or accelerated) and deflected by the electric field surrounding a positively charged atomic nucleus. X-rays produced in ordinary X-ray machines are bremsstrahlung. (In German, the term means braking radiation.)

**brevity code**—A code that has as its sole purpose the shortening of messages rather than concealment of content.

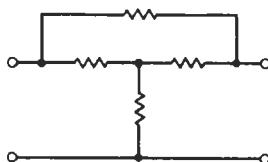
**Brewster angle**—The angle of incidence at which the reflection of parallel-polarized electromagnetic radiation at the interface between two dielectric media equals zero.

**bridge**—1. In a measuring system, an instrument in which part or all of a bridge circuit is used to measure one or more electrical quantities. 2. In a fully electronic stringed instrument, the part that converts the mechanical vibrations produced by the strings into electrical signals. 3. Equipment and techniques used to match circuits to each other, ensuring minimum transmission impairment. Bridging is normally required on multipoint data channels where several local loops or channels interconnect. 4. A device used singly, or with other like devices, to connect two or more similar local area networks (LANs) in order to allow workstations on one network to communicate with resources on the other network or networks as though they resided on the same network. 5. Equipment that connects two or more LANs that use the same protocol, allowing communication between devices on separate LANs.

**bridge circuit**—A network arranged so that, when an electromotive force is present in one branch, the response of a suitable detecting device in another branch may be zeroed by suitable adjustment of the electrical constants of still other branches.

**bridged connection**—A connection of a circuit across, or in parallel with, another circuit.

**bridged T-network**—A T-network in which the two series impedances of the T are bridged by a fourth impedance.



Bridged T-network.

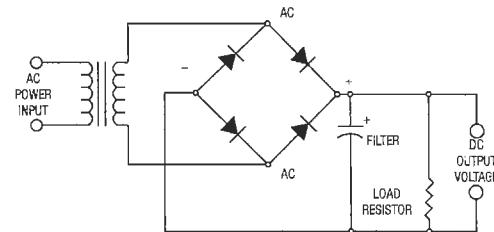
**bridge duplex system**—A duplex system based on the Wheatstone-bridge principle in which a substantial neutrality of the receiving apparatus to the transmitted currents is obtained by an impedance balance. Received currents pass through the receiving relay, which is bridged between the points that are equipotential for the transmitted currents.

**bridge hybrid**—See hybrid junction, 2.

**bridge quad**—See B-quad.

**bridge rectifier**—A full-wave rectifier with four elements connected in the form of a bridge circuit so that dc voltage is obtained from one pair of opposite junctions when an alternating voltage is applied to the other pair of junctions.

**bridge tap**—An unterminated length of line attached (bridged) at some point between the extremities of a communication line; bridge taps are undesirable.



Bridge rectifier.

**bridge transformer**—See bridging transformer.

**bridging**—1. The shunting of one electrical circuit by another. 2. Connecting two electrical circuits in parallel. Usually the input impedances are large enough so as not to affect the signal level.

**bridging amplifier**—An amplifier with an input impedance sufficiently high (at least 10 times) that its input may be bridged across a circuit without substantially affecting the signal level of the circuit.

**bridging connection**—A parallel connection by means of which some of the signal energy in a circuit may be withdrawn with imperceptible effect on the normal operation of the circuit.

**bridging contacts**—1. A set of contacts in which some of the signal energy in a circuit may be withdrawn with imperceptible effect on the normal operation of the circuit. 2. A set of contacts in which the moving contact touches two stationary contacts simultaneously during transfer.

**bridging gain**—Ratio between the power a transducer delivers to a specified load impedance under specified operating conditions and the power dissipated in the reference impedance across which the transducer input is bridged. Usually expressed in decibels.

**bridging loss**—1. Ratio between the power dissipated in the reference impedance across which the input of a transducer is bridged and the power the transducer delivers to a specified load impedance under specified operating conditions. Usually expressed in decibels. 2. The loss resulting from bridging an impedance across a transmission circuit. Unless the impedance is a pure resistance, the loss will vary with frequency.

**bridging transformer**—Also called bridge transformer and hybrid coil. 1. A transformer designed to couple two circuits having at least nominal ohmic isolation and operating at different impedance levels, without introducing significant frequency or phase distortion or significant phase shift. 2. A transformer whose primary impedance is at least 10 times the source impedance of the device that feeds it. The secondary can be lower or higher than the primary impedance.

**brightness**—1. The attribute of visual perception in accordance with which an area appears to emit more or less light. Used with cathode-ray tubes. (*Luminance* is the recommended name for the photometric quantity that has also been called brightness.) 2. See luminance. 3. A surface measurement of light intensity per unit projected area. Usually expressed in footlamberts.

**brightness control**—1. In a television receiver, the control that varies the average brightness of the reproduced image. 2. The manual bias control of a cathode-ray tube that determines both the average brightness and the contrast of a picture.

**brightness of image**—The apparent luminance of an image observed by the eye.

**brightness scale**—A graduated range of stimuli perceived as having equivalent differences of brightness.

**brightness signal**—*See* luminance signal.

**brilliance**—1. The degree of brightness and clarity in a reproduced cathode-ray tube. 2. The degree to which the higher audio frequencies sound like the original when reproduced by a receiver or public-address amplifier.

**brilliance control**—A potentiometer used in a three-way speaker system to adjust the output level of the tweeter for proper relative volume between the treble and the lower audio frequencies produced by the complete speaker system.

**British Standard Wire Gage**—A modification of the Birmingham wire gage; the legal standard of Great Britain for all wires. It is variously known as Standard Wire Gage (SWG), New British Standard (NBS), English Legal Standard, and Imperial Wire Gage.

**British thermal unit**—The energy required to raise the temperature of 1 pound of water 1 degree Fahrenheit.

**broadband**—1. As applied to data transmission, the term denotes transmission facilities capable of handling frequencies greater than those required for high-grade voice communications (higher than 3 to 4 kilohertz). 2. Having an essentially uniform response over a wide range of frequencies. To design or adjust (an amplifier) for bandwidth. 3. A communications channel in which bandwidth is greater than 64 kb/s and that can provide higher-speed data communications than a standard telephone circuit. Also called wideband.

**broadband amplifier**—1. An amplifier that has an essentially flat response over a wide frequency range. 2. An amplifier capable of amplifying a wide band of frequencies with minimal distortion.

**broadband antenna**—1. An antenna that is capable of receiving a wide range of frequencies. 2. An antenna that is not sharply resonant. It provides adequate gain across a relatively wide band of frequencies. Examples: television receiving and log-periodic antennas.

**broadband electrical noise**—Also called random noise. A signal that contains a wide range of frequencies and has a randomly varying instantaneous amplitude.

**broadband interference**—Interference occupying a frequency range that is much greater than the bandwidth of the equipment being used to measure it.

**broadband klystron**—A klystron in which three or more externally loaded, stagger-tuned resonant cavities are used to broaden the bandwidth.

**broadband random vibration**—Single-frequency component vibrations that are random in both phase and amplitude at minute increments of frequency throughout a specified bandwidth. Typically it occurs when intense, high-power-level noise impinges on structures.

**broadband tube (tr and pre-tr tubes)**—A gas-filled, fixed-tuned tube incorporating a bandpass filter suitable for radio-frequency switching.

**broadcast**—1. Radio or television transmission intended for public reception, for which receiving stations make no receipt. 2. To send messages or communicate simultaneously with many or all points in a circuit.

**broadcast band**—Radio frequency range between 530 and 1710 kHz in which all commercial AM broadcasting stations are assigned.

**broadcasting**—The transmitting of speech, music, or visual programs for commercial or public-service motives to a relatively large audience (as opposed to two-way radio, for example, which is utilitarian and is directed toward a limited audience).

**broadcasting-satellite service**—Abbreviated BSS. 1. International designation for direct-to-home satellite transmissions. In the Western Hemisphere, BSS operates in the 12.2- to 12.7-GHz frequency band. 2. A radio-communication service in which signals transmitted or

retransmitted by satellites are used for direct reception by the general public.

**broadcasting service**—A radiocommunication service in which the transmissions are intended for direct reception by the general public. This service may include sound transmissions, television transmissions, or other types of transmissions.

**broadcasting station**—A station in the broadcasting service.

**broadcast receiver**—A receiver intended primarily for picking up standard broadcast stations.

**broadcast teletext**—A one-way system in which textual and graphic information in digital form is placed on unused portions of the television signal and retrieved by the user via a special terminal built into or attached to a TV set. The information is broadcast in a continuous cycle or loop and is retrieved by the user as it passes.

**broadside array**—1. An antenna array whose direction of maximum radiation is perpendicular to the line or plane of the array (depending on whether the elements lie on a line or a plane). A uniform broadside array is a linear array whose elements contribute fields of equal amplitude and phase. 2. A unidirectional antenna array whose individual radiating elements are all in the same plane.

**broad tuning**—A tuned circuit or circuits that respond to frequencies within one band or channel, as well as to a considerable range of frequencies on each side.

**Brownian motion noise**—Also identified as thermal or Johnson noise. A random movement of microscopic particles, in organic or inorganic fluid suspension, caused by collision with surrounding molecules.

**brownout**—1. Refers to low line voltage, which can cause misoperation and possible damage of equipment. For example, a motor trying to start at low voltage can actually be in a lock-rotor condition and overheat. 2. Deliberate lowering of the line voltage by a power company to reduce load demands. 3. A period of low-voltage electrical power due to unusually heavy power demands. Brownouts can cause computers to operate erratically or to crash. 4. A sudden, unexpected reduction in electrical power, usually lasting just a few seconds, but long enough to cause computer equipment to fail from insufficient power levels.

**browse**—To view data.

**browser**—1. A software application that permits viewing and possibly searching of content in an information database, typically text, static images, or graphics, in a random or leisurely fashion at the user's discretion. 2. An application used to view information from the Internet. Browsers provide a user-friendly interface for navigating through and accessing the vast amount of information on the Internet.

**browsing**—1. Exploring an online area, usually on the World Wide Web. 2. To look at files or computer listings in search of something interesting.

**Bruce antenna**—Original name of the rhombic end-fire antenna, which consists of a diamond-shaped arrangement of four wires with the feed line at one end and a resistive termination at the opposite end of the longer diagonal. Bruce's name also is given to a series-fed array of vertically polarized resonant rectangular loops (or half-loops over ground) with one-quarter-wave width and one-half-wave spacing.

**brush**—1. A piece of conductive material, usually carbon or graphite, that rides on the commutator of a motor and forms the electrical connection between it and the power source. 2. A carbon block or metal leaf spring used to make sliding contact with a rotating contact, such as the commutator of a generator.

**brush discharge**—An intermittent discharge of electricity that starts from a conductor when its potential exceeds a certain value but is too low for the formation of an actual spark. It is generally accompanied by a whistling or crackling noise.

**brush-discharge resistance**—*See* corona resistance.

**brush fluxing**—A specialized wave-solder technique. A 360° bristled brush rotates in a foaming flux head to transfer the flux to the board. *See also* spray fluxing; wave fluxing; foam fluxing.

**brush rocker**—A movable rocker, or yoke, on which the brush holders of a dynamo or motor are fixed so that the position of the brushes on the commutator can be adjusted.

**brush station**—In a computer, a position where the holes of a punched card are sensed, particularly when this is done by a row of brushes sweeping electrical contacts.

**brute force**—The use of seemingly inefficient design in order to achieve a desired result. Sometimes this is done in order to avoid involved design procedures, critical adjustments, or the like, but often it is the only possible approach. For example, the miniaturization of low-frequency speakers requires brute force in the form of greatly increased amplifier power.

**brute-force filter**—A type of power-pack filter that depends on large values of capacitance and inductance to smooth out pulsations, rather than on the resonant effects of a tuned filter.

**brute supply**—A power supply that is completely unregulated. It employs no circuitry to maintain the output voltage constant with a changing input line or load variations. The output voltage varies in the same percentage and in the same direction as the input line voltage. If the load current changes, the output voltage changes inversely—an increase in load current drops the output voltage.

**BSC**—Abbreviation for binary synchronous communications. A line-control procedure for communicating, expressed in eight-bit EBCDIC, seven-bit U.S. ASCII, or six-bit transcode. The data code selected must include the required line-control characters, used according to specified rules.

**B-scope**—A type of radarscope that presents the range of an object by a vertical deflection of the signal on the screen, and the bearing by a horizontal deflection.

**"B" service**—FAA service pertaining to transmission and reception by teletype or radio of messages containing requests for and approval to conduct an aircraft flight, flight plans, in-flight progress reports, and aircraft arrival reports.

**B-spline**—A mathematical representation of a smooth curve.

**B-spline surface**—The mathematical description of a three-dimensional surface that passes through a set of B-splines.

**BSS**—*See* broadcasting-satellite service.

**B supply**—A source for supplying a positive voltage to the anodes and other positive electrodes of electron tubes. Sometimes called B+ supply.

**BT-cut crystal**—A piezoelectric plate that is cut from a quartz crystal at an angle of rotation (about the x-axis) of -49°. At approximately 25°C it has a zero temperature coefficient of frequency.

**bubble**—*See* dot, 2.

**bubble logic**—An obsolete form of magnetic logic.

**bubble memory**—1. A bubble-memory chip surrounded by the two orthogonal coils, sandwiched between two permanent-bias magnets, which provide nonvolatility and stable domains. The coils create a rotating magnetic

field that moves bubbles or cylindrical magnetic domains through a film on the chip. Films may consist of magnetic metals or synthetic ferrite or garnet crystals. In addition, control functions are located in aluminum-copper elements on the magnetic film. This entire grouping is then enclosed in a magnetic shield to prevent external magnetic fields (up to about 20 oersteds) from affecting the data. 2. A device that stores data as the absence or presence of tiny right-cylindrical domains of magnetization in a magnetic medium. Bubble memories operate as shift registers with complex control signals for the various magnetic fields required. 3. A nonvolatile storage technique that uses magnetic fields to create regions of magnetization. A pulsed field breaks the regions into isolated bubbles, free to move along the surface of the crystal sheet that contains the regions. The presence or absence of a bubble represents digital (bit, not bit) information. External electromagnetic fields manipulate the bubbles (information) past read/write locations within the memory. 4. Serial-access nonvolatile memory storing data in magnetic domains (bubbles) of opposite polarity from the rest of the cell. It is characterized by very low access times and high cost, but is able to store data after power is removed. This nonvolatility makes it well suited for portable applications in which disk storage is impractical. (Note: Bubble memories are no longer used.)

**bubble sort**—A sorting algorithm for putting the elements of a file in order.

**buck**—To oppose, as one voltage bucking another, or the magnetic fields of two coils bucking each other.

**bucket**—A general term for a specific reference in storage in a computer, such as a section of storage, the location of a word, a storage cell, etc.

**bucket brigade**—1. A shift register that transfers information from stage to stage in response to timing signals. 2. A technique of building a photosensing array using field-effect transistors (FETs). Two FET amplifiers are at each sensing area and are interconnected as an element of a shift register. The charges sensed by the FETs are successively clocked from element to element. The electrical charges representing bits of stored information are transferred from one element to the next by means of clock pulses that raise the level of each element in the correct sequence, in the same way as a firefighting brigade passes a bucket of water down the line.

**bucket curve**—A graphical presentation of noise within a microwave system, displayed in a form that permits separation and identification of the individual idle and intermodulation (IM or cross-modulation) impairments.

**bucking**—Counteracting one quantity (such as a current or voltage) by opposing it with a like quantity of equal magnitude but opposite polarity.

**bucking coil**—A coil connected and positioned in such a way that its magnetic field opposes the magnetic field of another coil. The hum-bucking coil of an electrodynamic speaker is an example.

**bucking voltage**—A voltage that is opposite in polarity to another voltage in the circuit and hence bucks, or opposes, the latter voltage.

**buckling**—The warping of the plates of a battery due to an excessively high rate of charge or discharge.

**buffer**—1. A circuit or component that isolates one electrical circuit from another. Usually refers to electron-tube amplifiers used for this purpose. 2. A vacuum-tube stage used chiefly to prevent undesirable interaction between two other stages. In a transmitter, it generally follows the master-oscillator stage. 3. An isolating circuit used in an electronic computer to avoid reaction of a driven circuit. 4. A storage device used to compensate for a difference in the rate of flow of information or the time

or occurrence of events when transmitting information from one device to another. 5. A computer circuit having an output and a multiplicity of inputs and designed so that the output is energized. Thus, a buffer performs the circuit function equivalent to the logical OR. 6. A noninverting digital circuit element that may be used to handle a large fanout or to invert input and output levels. Normally, a buffer is an emitter follower. 7. A storage device in which data is temporarily stored during data transfers between peripherals and computers. A means of temporarily storing data must be used when a peripheral device inputs data faster than the computer can process it, or when the computer sends data faster than a peripheral can receive it. 8. A soft fiber-optic material that mechanically isolates individual fibers in a fiber-optic cable or bundle from small geometrical irregularities, distortions, or roughness of adjacent surfaces. The buffer has no optical function. 9. A high-speed area of storage in a computer that is temporarily reserved for use in performing the input/output operation, into which data is read or from which data is written. 10. A storage area in a computer for data that is used to compensate for a speed difference when transferring data from one device to another. Usually refers to an area reserved for I/O operations, into which data is read, or from which data is written. 11. A temporary-storage device used to compensate for a difference in data rate and data flow between two devices (typically a computer and a printer). See also spooler.

**buffer amplifier**—1. An amplifier designed to isolate a preceding circuit from the effects of a following circuit. 2. An amplifier stage that is used to isolate a frequency-sensitive circuit from variations in the load presented by following stages. 3. A unity gain amplifier used to isolate the loading effect of one circuit from another.

**buffer capacitor**—A capacitor connected across the secondary of a vibrator transformer, or between the anode and cathode of a cold-cathode rectifier tube, to suppress voltage surges that might otherwise damage other parts in the circuit.

**buffer circuitry**—Circuitry necessary to adapt signals between two systems, e.g., between a test system and a board under test.

**buffer computer**—A computing system provided with a storage device so that input and output data may be stored temporarily to match the slower speed of input/output devices with the higher speed of the computer.

**buffer/driver**—A device used to increase the fanout or drive capability of a digital circuit.

**buffered terminal**—A terminal that contains storage equipment so that the rate at which it sends or receives data over its line does not need to agree exactly with the rate at which the data is entered or printed.

**buffer element**—A low-impedance inverting driver circuit. Because of its very low source impedance the element can supply substantially more output current than the basic circuit. As a consequence, the buffer element is valuable in driving heavily loaded circuits or minimizing rise-time deterioration due to capacitive loading.

**buffer gate**—A logic gate with a high output-drive capability, or fanout; a buffer gate is used when it is necessary to drive a large number of gate inputs from one gate function.

**buffering**—1. Storing data between transfer operations. Data read from a disk is buffered before transfer to a system memory, and data to be written is buffered after transfer from a system memory. 2. The process of temporarily storing data in a software program or in RAM to allow transmission devices to accommodate differences in data transmission rates.

## buffer amplifier — building-out section

**buffer storage**—1. A synchronizing element used between two different forms of storage (usually internal and external). 2. An input device in which information from external or secondary storage is assembled and stored ready for transfer to internal storage. 3. An output device into which information from internal storage is copied and held for transfer to secondary or external storage. Computation continues during transfers from buffer storage to secondary or internal storage or vice versa. 4. A device for the purpose of storing information temporarily during data transfers. 5. See cache.

**buffer storage unit**—A computer unit used for temporary storage of data before transmission to another destination. The unit often is able to accept and give back data at widely varying rates so that data transfer takes place efficiently for each device connected to it; that is, a high-speed device is not slowed by the presence of a slow-speed device in the same system unless the data transfer occurs directly between the two devices.

**buffer stripper**—A device that removes flat cable insulation from conductors; a unit of motorized buffering wheels that scrapes the insulation and brushes it away. Also called an abrasion stripper.

**bug**—1. A semiautomatic telegraph sending key consisting of a lever that is moved to one side to produce a series of correctly spaced dots, and to the other side to produce a dash. 2. A circuit fault due to improper design or construction. 3. An electronic listening device, generally small and concealed, used for commercial or military espionage. 4. To plant a microphone or other sound sensor or to tap a communication line for the purpose of surreptitious listening or audio monitoring; loosely, to install a sensor in a specified location. 5. The microphone or other sensor used for the purpose of surreptitious listening. 6. A device or system used for surreptitiously sensing and removing audio information from a target area. In the sense in which it is usually used, a bug transmits information from the target area to the listening post via radio; however, the information may be transmitted over dedicated wire by varying dc, as in an ordinary telephone circuit, or over power wiring by carrier current, as in a wireless intercom. The sensor in this system (transducer that changes sound into electrical impulses) is normally a microphone, but might be something that has another primary purpose, such as a telephone ringer. 7. A term used to denote a mistake in a computer program or a malfunction in a computer hardware component. 8. A defect in hardware or software that causes a program to malfunction.

**bugging height**—The distance between the hybrid substrate and the lower surface of the beam-lead device that occurs because of deformation of beam leads during beam-lead bonding.

**build**—The increase of diameter due to insulation.

**building-out**—Addition to an electric structure of an element or elements electrically similar to an element or elements of the structure to bring a certain property or characteristic to a desired value.

**building-out circuit**—A short section of transmission line, or a network that is shunted across a transmission line, for the purpose of impedance matching.

**building-out network**—A network designed to be connected to a basic network so that the combination will simulate the sending-end impedance, neglecting dissipation, of a line having a termination other than that for which the basic network was designed.

**building-out section**—A short section of transmission line, either open or short-circuited at the far end, shunted across another transmission line for use on an impedance-matching transformer.

**building wire**—Insulated wires used in buildings for light and power, 60 volts or less. Usually not exposed to outdoor environment.

**bulb**—The glass envelope that encloses an incandescent lamp or an electronic tube.

**bulb-temperature pickup**—A temperature transducer in which the sensing element is enclosed in a metal tube or sheath to protect it against corrosive liquids or other contaminants.

**bulge**—The difference between the actual characteristic and a linear characteristic of the attenuation-frequency characteristic of a transmission line.

**bulk degausser**—*See* bulk eraser.

**bulk effect**—An effect, such as current, resistance, or resistivity, observed in the overall body of a sample of material, as opposed to a region within the material or on its surface.

**bulk-erased noise**—The noise arising when a bulk-erased tape is reproduced with the erase and record heads completely deenergized. Ideally, this noise is governed by the number of magnetic particles that pass by the head in unit time.

**bulk eraser**—Also called bulk degausser or degausser. 1. Equipment for erasing a roll of tape. The roll is usually rotated while a 60-hertz ac erasing field is decreased, either by withdrawing the roll from an electromagnet or by reducing the ac supply to an electromagnet. 2. A device used to erase an entire tape at one time. Bulk erasers are usually more effective than a recorder's erase heads.

**bulk noise**—*See* excess noise.

**bulk resistance**—The portion of the contact resistance that is due to the length, cross section, and material.

**bulk resistivity**—Resistance measured between opposite faces of a cube of homogeneous material.

**bulk resistor**—A resistor made by providing ohmic contacts between two points of a homogeneous, uniformly doped crystal of silicon material.

**bulk storage**—An external device, such as a tape recorder, on which a computer's contents can be recorded to be reloaded into the computer when needed.

**bulletin board**—A computer system operated so that people can access it via telephone lines and leave messages for others to see.

**bump**—A means of providing connections to terminal areas of a device. A small mound is formed on the device (or substrate) pads and is utilized as a contact for face-down bonding.

**bump chip**—A chip that has on its termination pads a bump of solder or other bonding material that is used to bond the chip to external contacts. It allows for simultaneous bonding of all leads, rather than one at a time as in wire bonding.

**bump contacts**—Small amounts of material formed on the chip substrate to register with terminal pads, as when the chip is employed in flip-chip circuits.

**bunched pair**—A group of pairs tied together or otherwise associated for identification.

**buncher**—1. The input resonant cavity in a conventional klystron oscillator. 2. In a velocity-modulated tube, the electrode that concentrates the electrons in the constant-current electron beam into bunches.

**buncher gap**—*See* input gap.

**buncher resonator**—The input cavity resonator in a velocity-modulated tube. It serves to modify the velocity of the electrons in the beam.

**bunching**—1. Grouping pairs together for identification and testing. 2. In a velocity-modulated electron stream, the action that produces an alternating convection-current component as a direct result of the differences of electron transit time produced by the velocity modulation.

**bunching parameter**—One-half of the product of the bunching angle in the absence of velocity modulation and the depth of velocity modulation.

**bunching time**—The time in the armature motion of a relay during which all three contacts of a bridging-contact combination are electrically connected.

**bunching voltage**—The radio-frequency voltage between the grids of the buncher resonator in a velocity-modulated tube such as a klystron. Generally, the term implies the peak value of this oscillating voltage.

**bunch stranding**—1. A method in which a number of wires are twisted together in a common direction and with a uniform pitch to form a finished, stranded wire. 2. A group of wires of the same diameter twisted together without a predetermined pattern.

**bundle**—1. A number of optical fibers grouped together, usually carrying a common signal. 2. A collection of glass or plastic fibers that transmit data in the form of optical energy. 3. A group of optical fibers contained within a single jacket.

**bundle connector**—Fiber-optic connector that joins fiber bundle to fiber bundle. It is used when fiber-optic cables penetrate bulkheads, when new cables are spliced into transmission networks, and for repair of breaks. *See* source connector; detector connector.

**bundled cable**—Individual insulated wires laced together to form a bundle to facilitate handling.

**bundled software**—Software that comes with a computer.

**bundling**—*See* lacing and harnessing.

**buried cable**—Also called direct burial cable. 1. A cable installed underground and not removable except by disturbing the soil. 2. A cable installed directly in the earth without use of underground conduit.

**buried channel**—Because charge trapping can occur at the surface of the Si-SiO<sub>2</sub> interface, a thin doped layer can be introduced in the silicon just below the oxide (typically by ion implantation) to prevent trapping of charges. (MIS technology term.)

**buried layer**—1. A layer of very low resistivity, usually of n+ material, between the high-resistivity n-type collector region and p-type substrate of an integrated-circuit transistor. The buried layer tends to reduce the series collector resistance of the transistor without having an adverse effect on the breakdown voltage. 2. An underlying layer of a silicon IC formed by introducing impurities into the silicon, then covering it with additionally grown silicon.

**buried resistors**—Terminating film resistors deposited on inner layers of multilayer boards in order to reduce conductor lengths.

**burn**—*See* burned-in image.

**burned-in image**—Also called burn. An image that remains in a fixed position in the output signal of a camera tube after the camera has been turned to a different scene.

**burn-in**—1. Operation of a device to stabilize its failure rate. 2. The operation of items prior to their ultimate application, intended to stabilize their characteristics and to identify early failures. 3. Phase of component testing in which infant mortality or early failures are screened out by running the circuit for a specified length of time (such as 168 hours). 4. Subjecting components to a high temperature, normally 125°C, for a specified period under an electrical power stress (normally 80 percent of rated power). The process is designed to accelerate the aging of a device beyond the infant mortality life stage. After an appropriate burn-in, the devices should have a very low failure rate, normally defined by military standards. 5. Operation of a component, module, or system under some increased stress, typically elevated temperature, so as to cause failure at the vendor's rather than at the user's

plant. 6. A test of computer components that runs the system for a day or two to detect defective chips. 7. A test in which a product, such as a chip, is operated prior to its use to detect failures that would otherwise occur in about the first six months of the product's life.

**burning**—Programming a read-only memory chip.

**burn-in period**—The time during which components are operated at predetermined stress conditions prior to their installation in the user's equipment. *See early-failure period.*

**burst**—1. A sudden increase in the strength of a signal. 2. The cosmic-ray effect on matter, causing a sudden intense ionization that gives rise to great numbers of ion pairs at once. 3. A group of events occurring together in time. 4. A number of events that occur within a short period of time. 5. One of a series of successions of bits, frames, or other elements of data, occurring at regular intervals. 6. A pulsed rf envelope, generally 2.3  $\mu$ s (8 cycles) in duration, that appears on the back porch of the horizontal synch pulse. This 3.579545-MHz frequency is used to synchronize the television receiver's regenerated subcarrier color oscillator. 7. *See color burst.*

**burst error**—A series of consecutive errors in data transmission.

**burst noise**—An unwanted signal that is characterized by an excessively large interfering effect that is extended over a relatively short but finite time interval.

**burst pedestal**—A rectangular pulselike television signal that may be part of the color burst. The amplitude of the color-burst pedestal is measured from the alternating-current axis of the sine-wave portion of the horizontal pedestal.

**burst pressure**—The maximum pressure to which a device can be subjected without rupturing.

**burst rate**—The bit rate during the time of transmission from a terminal that transmits TDMA bursts.

**burst separator output**—The amplitude of the chroma reference burst at the output of the gated burst amplifier.

**burst sequence**—An arrangement of color-burst signals in which the polarity of the burst signal is the same at the start of each field so that the stability of color synchronization is improved.

**burst transmission**—Radio transmission in which messages are stored and then released at 10 to 100 or more times the normal speed. The received signals are recorded and returned to the normal rate for the user.

**bus**—1. The term used to specify an uninsulated conductor (a bar or wire); may be solid, hollow, square, or round. 2. Sometimes used to specify a bus bar. 3. The communications path between two switching points. 4. Wire used to connect two terminals inside an electrical unit. A common point for electrical circuits to return. Can be bare, tinned, or insulated. 5. A power line that provides power to a large number of circuits. In computing, a bus is a group of wires that conveys information to a large number of devices. The information may be data, commands, or addresses, or all three in sequence. All the devices in the system are connected to the bus. Each device continually listens for a command addressed to it. Only one device is allowed to transmit over the bus at once. Bus-oriented systems are flexible and easy to expand. 6. A circuit over which data or power is transmitted or received. 7. A power or signal line used in common by several parts of a computer. 8. A signal path to which a number of inputs may be connected for feed to one or more outputs. 9. A group of conductors considered as a single entity that interconnects various parts of a system, e.g., data bus or address bus. 10. Usually a group of wires over which digital information is transmitted from one of several sources to one of several destinations. Commonly found in digital

systems. 11. A group of wires that allows memory, CPU, and I/O devices to exchange words. 12. A connective link between multiple processing sites (colocated only), where any of the processing sites can transmit to any other, but only one way at a time. 13. A mechanical, logical, and electrical interconnection scheme for modular microcomputer circuit elements; provides a common path for data, address, and control information between those modular elements. 14. A group of conductors that provide time-shared communication paths for the transmission of information between equipment units. 15. A common pathway or channel between hardware devices. Can be serial (information travels one bit at a time) or parallel (information travels in groups of bits moving simultaneously along multiple parallel paths). 16. A data path shared by many devices (e.g., multipoint line) with one or more conductors for transmitting signals, data, or power. 17. The physical channel over which electric signals are transferred between the components of a system, along with the protocol rules governing the transfer.

**bus analyzer**—1. A tool that captures the bus signals at a given instant for later analysis. 2. An instrument that analyzes digital data on the bus lines of a microprocessor.

**bus architecture**—A data-communications structure that consists of a common connection among a number of printer/plotter modules.

**busback**—The connection, by a common carrier, of the output portion of a circuit back to the input portion of a circuit. *See also loopback test.*

**bus bar**—1. A heavy copper strap or bar used to carry high currents or to make a common connection between several circuits. 2. A heavy copper (or other metal such as aluminum) strip or bar used on switchboards and in power plants to carry heavy currents. 3. Interconnection device that distributes power from remote power supplies to cabinets or drawers, across connector backpanels, and on PC boards. These flat, rectangular components frequently consist of two or more conductor layers electrically insulated from one another and from other components by thin dielectric layers. Usually, conductor layers are bonded or laminated together to provide a rigid, mechanically and electrically stable package that is mounted with screws, clamps, or foam adhesive. Bus bars mounted on PC boards are typically soldered in place along with other components that are to be mounted on the boards.

**bus driver**—1. An integrated circuit that is added to the data bus system in a computer to facilitate proper drive to the CPU when several memories are tied to the data bus line. Drivers are necessary because of capacitive loading, which slows down the data rate and prevents proper time sequencing of microprocessor operation. 2. A buffering device that increases the driving capability of a microprocessor that itself may be capable of driving no more than a single TTL load. 3. A circuit that amplifies a bus data or control signal sufficiently to ensure valid reception of that signal at the destination.

**bushing**—A mechanical device used as a lining for an opening to prevent abrasion to wire and cable. Also used as a low-cost method of insulating, anchoring, cushioning, and positioning. Usually a nonmetallic material is preferred.

**business data processing**—1. Automatic data processing used in accounting or management. 2. Data processing for business purposes, such as recording and summarizing the financial transactions of a business.

**business machine**—Customer-provided equipment that is connected to the communications services of a common carrier for the purpose of data movement.

**busing**—The joining of two or more circuits together.

**bus master**—In a bus structure, in which control of data transfers on the bus is shared between the central processor and associated peripheral devices, the term bus master refers to the device controlling the current bus transaction.

**bus organization**—The manner in which many circuits are connected to common input and output lines (buses).

**bus reactor**—A current-limiting reactor connected between two different buses or two sections of the same bus for the purpose of limiting and localizing the disturbance due to a fault on either bus.

**bus slave**—In a bus structure, in which control of data transfers on the bus is shared between the central processor and associated peripheral devices, the device currently receiving or transmitting data from or to the bus master is referred to as the bus slave.

**bus system**—A network of paths inside a microprocessor that facilitates data flow. The important buses in a microprocessor are identified as data bus, address bus, and control bus.

**bust this**—Phrase used instead of a normal message ending to indicate that the entire message, including heading, is to be disregarded.

**busy test**—In telephony, a test to find out whether certain facilities that may be desired, such as a subscriber line or a trunk, are available for use.

**busy tone**—Interrupted low tone returned to the calling party to indicate that the called line is busy.

**Butler antenna**—An array antenna in which hybrid junctions are incorporated into the feed system to obtain a plurality of independent beams.

**Butler oscillator**—A two-tube (or transistor) crystal-controlled oscillator in which the crystal forms the positive feedback path when excited in its series-resonant mode.

**butt connector**—*See* butt contact.

**butt contact**—A hemispherically shaped contact designed to mate end to end without overlap, with axes aligned, against a similarly shaped contact. When properly aligned, the two convex surfaces form a reasonably good surface-to-surface contact, usually under spring pressure, with the ends designed to provide optimum surface contact.

**butterfly capacitor**—*See* butterfly resonator.

**butterfly circuit**—Frequency-determining element having no sliding contacts and providing simultaneous change of both inductance and capacitance. It is used to replace conventional tuning capacitors and coils in ultrahigh-frequency oscillator circuits. The rotor of the device resembles the opened wings of a butterfly.

**butterfly resonator**—Also called butterfly capacitor. A tuning device that combines both inductance and capacitance in such a manner that it exhibits resonant properties at very high and ultrahigh frequencies (characterized by a high tuning ratio and  $Q$ ). So called because the shape of the rotor resembles the opened wings of a butterfly.

**Butterworth filter**—A filter network that exhibits the flattest possible response in the passband. The response is monotonic, rolling off smoothly into the stopband, where it approaches a constant slope of 6 dB/octave.

**Butterworth function**—A mathematical function used in designing a filter for maximally constant amplitude response with little consideration for time delay or phase response.

**butt joint**—1. A splice or other connection formed by placing the ends of two conductors together and joining them by welding, brazing, or soldering. 2. A connection between two waveguides that maintains electrical continuity by providing physical contact between the ends.

**button**—1. The metal container in which the carbon granules of a carbon microphone are held. 2. Also called dot. A piece of metal used for alloying onto the base wafer in making alloy transistors.

**button capacitor**—A fixed button-shaped ceramic or silvered-mica capacitor that, because of its disk shape and mode of terminal connection, offers very low internal inductance.

**button-hook contact**—A contact with a curved, hooklike termination, often located at the rear of hermetic headers to facilitate soldering or desoldering of leads.

**buttonhook feed**—A rod shaped like a question mark supporting the feedhorn and LNA. A buttonhook feed for use with commercial-grade antennas is often a hollow waveguide that directs signals from a feedhorn to an LNA behind the antenna.

**buttons**—In a computer, objects that, when clicked once, cause something to happen.

**button silver-mica capacitor**—A stack of silvered-mica sheets encased in a silver-plated brass housing. The high-potential terminal is connected through the center of the stack. The other capacitor terminal is formed by the metal shell, which connects at all points around the outer edge of the electrodes. This design permits the current to fan out in a 360° pattern from the center terminal, providing the shortest possible electrical path between the center terminal and chassis. The internal series inductance is thus kept small.

**button stem**—*See also* pressed stem. In a vacuum tube, the glass base onto which the mount structure is assembled. The pins may be sealed into the glass; if so, no base is needed. In some large tubes, the stiff wires are passed directly into the base pins to give added strength.

**button up**—To close or completely seal any operating device.

**butt splice**—A device for joining two conductors placed end to end with their axes in line (that is, conductors not overlapping).

**buzzer**—A signaling device in which an armature vibrates to produce a raucous, nonresonant sound.

**BV<sub>EBO</sub>**—The reverse-breakdown voltage of the emitter-to-base junction of a transistor with the collector open-circuited.

**BWG**—Abbreviation for Birmingham wire gage.

**BX cable**—Insulated wires enclosed in flexible metal tubing or flexible spiral metal armor used in electrical wiring.



*BX cable.*

**bypass**—1. A shunt (parallel) path around one or more elements of a circuit. 2. A secondary channel that permits routing of data in a computer sample around the data compressor, regardless of the value of the sample, at intervals determined by the operator.

**bypass capacitor**—A capacitor used for providing a comparatively low-impedance ac path around a circuit element.

**bypass filter**—A filter providing a low-attenuation path around some other circuit or equipment.

**bypassing**—Reducing high-frequency current in a high-impedance path by shunting that path with a bypass element (usually a capacitor).

**B-Y signal**—One of the three color-difference signals in color television. The B-Y signal forms a blue primary signal for the picture tube when combined—either inside or outside the picture tube—with a luminance, or Y, signal.

**byte**—1. A single group of bits processed together (in parallel), usually 8 bits. 2. A sequence of adjacent binary digits, usually shorter than a word, operated on as a unit. 3. The number of bits that a computer processes as a unit. This may be equal to or less than the number of bits in a word. For example, both an 8-bit and a 16-bit length computer may process data in 8-bit bytes. 4. The smallest addressable unit of main storage in a computer system. The byte consists of 8 data bits. 5. A byte is universally

used to represent a character. Microcomputer instructions require one, two, or three bytes. A word may be one byte long. One byte has two nibbles. Computers and microprocessors work with words of 4, 8, 12, 16, 24, or 32 bits. 6. A set of bits that represents a single character. Usually there are 8 or 10 bits in a byte, depending on how the measurement is being made. 7. A unit of data equal to 8 bits, and hence capable of storing any one of  $2^8 = 256$  distinct values.

**byte-multiplexer channel**—A channel that interleaves bytes of data from different sources. Contrast with *selector channel*.

**byte-serial**—A sequence of bit-parallel data bytes used to carry information over a common bus.

# C

**C**—1. Symbol for capacitor, capacitance, carbon, coulomb, centigrade or Celsius, transistor collector, and (when lowercase) velocity of light. 2. A general-purpose programming language developed in the 1970s by Dennis Ritchie of AT&T, Bell Labs. Its generality, machine independence, and efficiency have made C popular for many application areas. The UNIX operating system is written in C, and the close linking of UNIX and C has made C the de facto standard language in engineering software development.

**C—(C minus)**—The negative terminal of a C battery, or the negative polarity of other sources of grid-bias voltage. Used to denote the terminal to which the negative side of a grid-bias voltage source should be connected.

**C+ (C plus)**—Positive terminal of a C battery, or the positive polarity of other sources of grid-bias voltage. The terminal to which the positive side of the grid-bias voltage source should be connected.

**C<sup>2</sup> system**—Abbreviation for command and control system.

**C<sup>3</sup>**—Abbreviation for command, control, and communications.

**C<sup>3</sup>I**—Abbreviation for command, control, communications, and intelligence. Includes computers, displays, communications equipment, and other supporting devices that provide the means for communications as well as intelligence-gathering capability at all levels of military command.

**C<sup>3</sup>L**—Abbreviation for complementary contact-current logic.

**C<sup>4</sup>**—Abbreviation for command, control, communications, and computer.

**cabinet**—1. A protective housing for electrical or electronic equipment. 2. An enclosure for mounting equipment. If fabricated of steel, the cabinet helps attenuate electrostatic and electromagnetic radiation noise interference.

**cable**—1. An assembly of one or more conductors, usually within a protective sheath, so arranged that the conductors can be used separately or in groups. 2. A stranded conductor (single-conductor cable) or a combination of conductors insulated from one another (multiple-conductor cable). 3. Jacketed combination of fiber bundles with cladding and strength-reinforcing components. 4. An assembly of insulated conductors into a compact form that is covered by a flexible, waterproof protective covering.

**cable armor**—In cable construction, a layer of steel wire or tape, or other extra-strength material, used to reinforce the lead wall.

**cable assembly**—A cable with plugs or connectors on each end for a specific purpose. It may be formed in various configurations.

**cable attenuation**—Reduction of signal intensity along a cable, usually expressed in decibels per foot, hundred feet, kilometer, mile, etc.

**cable clamp**—A device used to give mechanical support to the wire bundle or cable at the rear of a plug or receptacle.

**cable complement**—A group of cable pairs that have some common distinguishing characteristic.

**cable core**—That portion of an insulated cable lying under the protective covering or jacket.

**cable coupler**—A device used to join lengths of similar or dissimilar cable having the same electrical characteristics.

**cable fill**—The ratio of the number of pairs in use to the total number of pairs in a cable.

**cable filler**—Material used in multiple-conductor cables to occupy the spaces between the insulated conductors.

**cable messenger**—A stranded cable supported at intervals by poles or other structures and employed to furnish frequency points of support for conductors or cables.

**cable modem**—A device that enables a user to connect a computer to existing cable TV networks at Ethernet speeds and access Internet and/or online services. This device can be much faster than a telephone modem, operating at 14.4 kbs, 28.8 kbs, or higher.

**cable Morse code**—A three-element code used mainly in submarine-cable telegraphy. Dots and dashes are represented by positive and negative current impulses of equal length, and a space by the absence of current.

**cable-ready television**—A television receiver that can receive unscrambled cable television without the use of a converter.

**cable run**—The path occupied by a cable on cable racks or other support from one termination to another.

**cable sheath**—A protective covering of rubber, neoprene, resin, or lead over a wire or cable core.

**cable splice**—A connection between two or more separate lengths of cable. The conductors in one length are individually connected to conductors in the other length, and the protecting sheaths are so connected that protection is extended over the joint.

**cable terminal**—A means of electrically connecting a predetermined number of cable conductors in such a way that they can be individually selected and extended by conductors outside the cable.

**cable TV**—1. Television system in which programs are received by a local central antenna and distributed by cable to individual homes. The term does not apply to a system serving fewer than 50 subscribers or serving only subscribers in one or more multiple-unit buildings under common ownership, control, or management. 2. Linking a TV set via cable to a system

operator that, for a monthly fee, provides the viewer with typically 30 to 75 or more channels of programming. 3. A system for distributing television programming by a cable network rather than by electromagnetic radiation.

**cable vault**—A vault in which the outside plant cables are spliced to the tipping cables.

**cabling**—1. The assembly of wire bundles extended from one physical structure to another to interconnect the circuits within structures. Cabling differs from wire jumpers in that it is understood to be external to the physical structures and may include tubing sheaths, zipper tubing, or rubber jackets. 2. Twisting together two or more insulated conductors by machine to form a cable. This also is a term loosely applied to bundling wires together, such as in the forming of wire harnesses. 3. In fiber optics, a method by which a group of fibers or bundle of fibers is mechanically assembled.

**cache**—1. A small, fast memory built into a processor to give faster access to the data and instructions that a program uses repeatedly (also called cache memory, buffer storage). 2. A small, fast storage area interposed between the main memory and CPU to improve memory-transfer rates and processor efficiency. The name is derived from the fact that the memory is hidden from or transparent to the programmer. 3. A storage area for frequently accessed information. Retrieval of the information is faster from the cache than the original source. There are many types of cache, including RAM cache, secondary cache, disk cache, and cache memory, to name a few. 4. In a computer system, a small but very high-speed memory buffer situated between the processor and main memory. It operates on the principle that certain memory locations tend to be accessed very often (normally for reads). Thus, when a main memory location is read, it is stored in the cache at the same time.

**cache memory**—1. A high-speed, low-capacity computer memory similar to a scratch-pad memory except that it has a larger capacity. 2. The fastest portion of the overall memory, which stores only the data that the computer may need in the immediate future. 3. A high-speed buffer memory used between the central processor and main memory. The cache is filled at medium speed from the main memory. Instructions and programs can operate at higher speed if found in the cache. If not found, a new segment is loaded. The cache contains the instruction or sequence of instructions most likely to be executed next. 4. A special, extra-fast part of RAM in which frequently accessed information is stored. Same as memory cache and RAM cache. 5. See cache. 6. A fast random-access memory system designed to store the most frequently accessed data in RAM.

**cactus needle**—A phonograph needle made from the thorn of a cactus plant.

**CAD**—Abbreviation for computer-aided design. 1. Use of a computer to aid in the design of complex MSI or LSI circuit arrays. CAD is especially useful for custom IC fabrication. 2. Man/computer interactions for the design and testing of customer MSI/LSI arrays and other complex engineering designs in a reasonable time frame. 3. Any system or process using a computer to aid in the creation or modification of a design. 4. High-performance design workstations that enable designers to manipulate parts diagrams and simulate operations, among other things. Can be linked to computer-aided manufacturing systems.

**CADAM**—Computer-augmented design and manufacturing system for design and analysis functions, developed by Lockheed for the aerospace industry and licensed by IBM.

## cable vault — calculator mode

**CAD/CAM**—Computer-aided design/computer-aided manufacturing. Two highly specialized technical applications of a computer to improve the productivity of the engineer.

**cadmium**—A metallic element widely used for plating steel hardware or chassis to improve its appearance and solderability and to prevent corrosion. It is also used in the manufacture of photocells.

**cadmium cell**—A standard cell used as a voltage reference; at 20°C its voltage is 1.0186 volts.

**cadmium selenide photoconductive cell**—A photoconductive cell that uses cadmium selenide as the semiconductor material. It has a fast response time and high sensitivity to longer light wavelengths, such as those emitted by incandescent lamps and some infrared light sources.

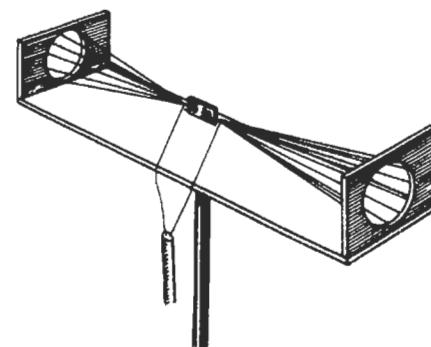
**cadmium sulfide cell**—See cadmium sulfide photoconductive cell.

**cadmium sulfide photoconductive cell**—A photoconductive cell in which a small wafer of cadmium sulfide is used to provide an extremely high dark-light resistance ratio. Some of the cells can be used directly as a light-controlled switch operated from the 120-volt ac power line.

**CAE**—Abbreviation for computer-aided engineering. The use of general-purpose computers and special application software to automate routine, iterative hardware engineering tasks.

**cage**—1. A completely shielded enclosure. 2. A screened room that is covered with a grounded fine-mesh conductive screen on all sides to allow measurements within the cage without any influence or interference from extraneous signals.

**cage antenna**—An antenna comprising a number of wires connected in parallel and arranged in the form of a cage. This arrangement reduces the copper losses and increases the effective capacity.



Cage antenna.

**calculating**—Computing a result by multiplication, division, addition, or subtraction or by a combination of these operations. A data-processing function.

**calculating punch**—A punched-card machine that reads data from a group of cards and punches new data in the same or other cards.

**calculator**—1. A device capable of performing arithmetic. 2. A calculator as in definition 1 that requires frequent manual intervention. 3. Generally and historically, a device for carrying out logical and arithmetical digital operations of any kind.

**calculator mode**—Also called fast answerback. An interactive computer system that has a mode which allows

the terminal to be used like a desk calculator. The user types an expression, and the computer evaluates it and returns the answer immediately.

**calendar age**—Age of an item or object measured in terms of time elapsed since it was manufactured.

**calendar life**—That period of time, expressed in days, months, or years, during which an item may remain installed and in operation, but at the end of which the item should be removed and returned for repair, overhaul, or other maintenance.

**calibrate**—To ascertain, by measurement or by comparison with a standard, any variations in the readings of another instrument, or to correct the readings.

**calibrated triggered sweep**—In a cathode-ray oscilloscope, a sweep that occurs only when initiated by a pulse and that moves horizontally at a known rate.

**calibration**—1. The process of comparing an instrument or device with a standard to determine its accuracy or to devise a corrected scale. 2. Taking measurements of various parts of electronic equipment to determine the performance level of the equipment and whether it conforms to technical order specifications. 3. Comparison of the performance of an item of test and measuring equipment with a reference standard traceable to the National Bureau of Standards or some other authoritative source or specification. 4. A test during which known values of measure are applied to a transducer, and its corresponding output readings are recorded.

**calibration accuracy**—Finite degree to which a device can be calibrated (influenced by sensitivity, resolution, and reproducibility of the device itself and the calibrating equipment). Expressed as a percentage of full scale.

**calibration curve**—A smooth curve connecting a series of calibration points.

**calibration marker**—On the screen of a radar indicator, the markings that divide the range scale into accurate intervals for range determination or checking against mechanical indicating dials, scales, or counters.

**call**—1. A transmission made for the purpose of identifying the transmitting station and the station for which the transmission is intended. 2. To transfer control to a specified closed subroutine. 3. In communication, the action performed by the calling party, or the operations necessary in making a call, or the effective use made of a connection between two stations.

**call accounting**—Daily and monthly accounting reports for individual callers and for hierarchical groupings of callers in a communication system.

**call announcer**—Device for accepting pulses from an automatic telephone office and reproducing the corresponding number with speechlike sounds.

**callback device**—A device on the receiving end of a communications network that assures the authenticity of the sender by calling the sender back.

**call circuit**—A communication circuit between switching points used by traffic forces for transmitting switching instructions.

**call diverter**—A device that intercepts a call directed to a telephone subscriber and diverts it to another number.

**caller ID**—A telephone company service that provides the name and number of the caller from the phone company's information network. A caller ID device translates that data into usable form by displaying it on a screen. It works on standard telephones only.

**call forwarding**—A service available in some dial offices whereby a subscriber can have calls to his or her number forwarded to another phone by dialing the forwarding number to the equipment. All incoming calls are then forwarded automatically. The forwarding can

be discontinued at will, by command from the base telephone.

**calligraphic display**—Also known as a vector stroke or vector refresh. A refresh graphic system that draws the picture on the screen vector by vector. The monitor is driven by X and Y signals that control the beam's position for drawing. A vector list is continually processed and converted to the analog X and Y signals. The rate at which the picture is refreshed need not be synchronized to the ac line. Calligraphic displays draw smooth and very high-resolution lines. Since the display is refreshed from a vector list, any changes in this list immediately appear on the screen, creating dynamic displays. The main disadvantage is that increasingly complex pictures take longer to refresh, causing flicker.

**call in**—To transfer control of a digital computer temporarily from a main routine to a subroutine, which is inserted in the sequence of calculating operations to fulfill a subsidiary purpose.

**call indicator**—Device for accepting pulses from an automatic switching system and displaying the corresponding called number before an operator.

**calling device**—Apparatus that generates the pulses used to control the establishment of connections in an automatic telephone switching system.

**calling mode**—The ability to originate and/or answer on the dial-up network. A central-site modem normally has auto-call capability, meaning it can automatically dial a specific number through an automatic calling unit.

**calling party control**—*See CPC.*

**calling sequence**—In a computer, a sequence of instructions required to enter a subroutine. It may contain information required by the subroutine.

**call letters**—A series of government-assigned letters, or letters and numbers, that identify a transmitting station.

**call number**—In computer operations, a set of characters that identifies a subroutine and contains information with respect to parameters to be inserted in the subroutine or information related to the operands.

**call-setup time**—The overall length of time required to establish a switched call between pieces of data-terminal equipment.

**call sign**—1. Any combination of characters or pronounceable words that identifies a communication facility, a command, an authority, an activity, or a unit; used primarily for establishing and maintaining communications. 2. The station identification assigned to a licensee by the FCC.

**call word**—A call number that is exactly the size of one machine word.

**calomel electrode**—An electrode consisting of mercury in contact with a solution of potassium chloride saturated with mercurous chloride (calomel). *See also glass electrode.*

**calorimeter**—An apparatus for measuring quantities of heat. Used to measure microwave power in terms of heat generated.

**calorimeter system**—A precision rf watt-meter as well as an efficient dummy load able to absorb energy at any frequency band. It can absorb and measure any level of microwave energy, and functions by circulating a known amount of liquid through a suitably designed low VSWR load. The load is located in a waveguide or coaxial section that mates to the terminal of the rf energy source being measured or absorbed.

**CAM**—Abbreviation for content addressable memory. 1. A computer memory in which information is retrieved by addressing the content (the data actually

stored in the memory) rather than by selecting a physical location. *See also* associative storage. 2. Abbreviation for computer-aided manufacturing. The use of computer technology in manufacturing processes. It includes numerical and programmable controls, factory information management, robot controls, materials handling, and storage-and-retrieval systems.

**cam actuator**—An electromechanical device in which a switch is closed when the high spot of a rotating cam, or eccentric, is in a certain position.

**camera**—*See* television camera.

**camera cable**—A cable or group of wires that carry the picture signal from the television camera to the control room.

**camera chain**—A television camera, associated control units, power supplies, monitor, and connecting cables necessary to deliver a picture for broadcasting.

**camera signal**—The video-output signal of a television camera.

**camera tube**—1. An electron-beam tube in which an electron current or charge-density image is formed from an optical image and scanned in a predetermined sequence to provide an electric signal. 2. The electron-beam tube of a television camera that converts an optical image into a pattern of electrostatic charges and then scans the pattern to produce a corresponding electric signal for transmission.

**camera tube target**—The storage surface of an electron-beam tube that is scanned by an electron beam to generate an output signal current corresponding to the charge-density pattern stored.

**camp-on**—Also called clamp-on. A method of holding a call for a line that is already in use and of signaling when the line becomes free.

**can**—1. A metal shield placed around a tube, coil, or transformer to prevent electromagnetic or electrostatic interaction. 2. A metal package for enclosing a device, as opposed to a plastic or ceramic package.

**Canadian Standards Association**—Abbreviated CSA. In Canada, a body that issues standards and specifications prepared by various voluntary committees of government and industry.

**canal ray**—Also called positive ray. Streams of positive ions that flow from the anode to the cathode in an evacuated tube.

**candela**—Abbreviated cd. 1. Formerly candle. The unit of luminous intensity. The luminous intensity of 1/60th of 1 square centimeter of projected area of a blackbody radiator operating at the temperature of solidification of platinum (2046 K). Values for standards having other spectral distributions are derived by the use of accepted spectral luminous efficiency data for photopic vision. 2. International unit of luminous intensity, also called new candle. Prior to 1948, the standard was a specific type of candle and was termed candle, candle power, or international candle.

**candela/cm<sup>2</sup>**—Luminance unit called a stilb.

**candle**—The unit of luminous intensity. One candle is defined as the luminous intensity of 1/60th square centimeter of a blackbody radiator operating at the solidification temperature of platinum.

**candlepower**—1. Luminous intensity expressed in terms of standard candles. 2. A measure of the intensity of light produced by a source. This standard of measurement is used in France, Britain, and the United States. One candlepower corresponds approximately to the light produced in the horizontal direction by an ordinary sperm candle weighing six to the pound and burning at the rate of 120 gr/hr. 3. The luminous intensity of a source of light expressed in candelas.

**candoluminescence**—1. A phenomenon that produces white light without need for very high temperatures. 2. The luminescence of an incandescent material.

**canned cycle**—The use of preparatory functions on a punched tape to initiate a complete machining sequence; the need for much repetitive information in the program is thereby eliminated.

**cannibalization**—A method of maintenance or modification in which the required parts are removed from one system or assembly for installation on a similar system or assembly.

**cantilever**—The rod, or tube, that supports the stylus of a phonograph cartridge at its free end, is pivoted at or near its other end, and that transfers the stylus motion to the generating elements of the cartridge. Usually made of aluminum, but beryllium is used in some recent cartridges. Also known as the shank.

**cantilevered contact**—A spring contact in which the contact force is provided by one or more cantilevered springs. It permits more uniform contact pressure and is used almost exclusively in printed circuit board connectors.

**capacitance**—Abbreviated C. 1. Also called capacity. In a capacitor or a system of conductors and dielectrics, that property which permits the storage of electrically separated charges when potential differences exist between the conductors. The capacitance of a capacitor is defined as the ratio between the electric charge that has been transferred from one electrode to the other and the resultant difference in potential between the electrodes. The value of this ratio is dependent on the magnitude of the transferred charge. 2. Capacitance opposes any change in circuit voltage. A voltage change is delayed until the stored charges can be altered through current. The unit of capacitance is the farad. 3. The property of an electric system—comprised of conductors and associated dielectrics—that determines (a) the displacement currents in the system for a given rate of potential difference change between the conductors and (b) how much electrical charge will be stored in the dielectric for a given potential difference between the conductors.

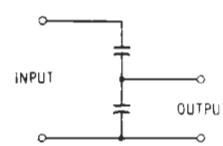
**capacitance alarm system**—An alarm system in which a protected object is electrically connected as a capacitance sensor. The approach of an intruder causes sufficient change in capacitance to upset the balance of the system and initiate an alarm signal. Also called a proximity alarm system.

**capacitance between two conductors**—The ratio between the charge transferred from one conductor to the other and the resultant difference in the potentials of the two conductors when insulated from each other and from all other conductors.

**capacitance bridge**—A four-arm ac bridge for measuring capacitance by comparison against a standard capacitor.

**capacitance detector**—*See* capacitance sensor.

**capacitance divider**—A circuit made up of capacitors and used for measuring the value of a high-voltage pulse by making available only a small, known fraction of the total pulse voltage for measurement.



Capacitance divider.

**capacitance level detector**—A device with single or multiple probes that operates based on the fact that a change in capacitance level causes a change in probe capacitance.

**capacitance meter**—An instrument for measuring capacitance. If the scale is graduated in microfarads, the instrument is usually designated a microfaradmeter.

**capacitance-operated intrusion detector**—A boundary alarm system in which the approach of an intruder to an antenna wire encircling the protected area (a few feet above ground) changes the antenna-to-ground capacitance and thereby sets off the alarm.

**capacitance ratio**—The ratio of maximum to minimum capacitance, as determined from a capacitance characteristic, over a specified voltage range.

**capacitance relay**—An electronic circuit incorporating a relay that responds to a small change in capacitance, such as that created by bringing the hand or body near a pickup wire or plate.

**capacitance sensor**—A sensor that responds to a change in capacitance in a field containing a protected object or in a field within a protected area. Also called capacitance detector.

**capacitance switch**—A keyboard switch in which two pads on the circuit board under each keyswitch serve as capacitor plates connected to the drive and sense circuits. Depression of the key causes an increase in the series capacitance, coupling the two elements and creating an analog signal in the sense circuit.

**capacitance tolerance**—The maximum percentage deviation from the specified nominal value (at standard or stated environmental conditions) specified by the manufacturer.

**capacitive coupling**—Also called electrostatic coupling. The association of two or more circuits with one another by means of mutual capacitance between them. For example, between stages of an amplifier, that type of interconnection that employs a capacitor in the circuit, between the plate of one tube and the grid of the following tube or the collector of one transistor and the base of the following transistor.

**capacitive diaphragm**—A resonant window placed in a waveguide to provide the effect of capacitive reactance at the frequency being transmitted.

**capacitive-discharge ignition**—Also called capacitor-discharge ignition. An electronic ignition system used on internal combustion engines to provide nearly constant high voltage regardless of engine speed. A dc-to-dc step-up converter charges a capacitor when the distributor breaker points are closed; when they are open, the capacitor discharges through the ignition coil, thereby generating the ignition voltage.

**capacitive divider**—Two or more capacitors placed in series across a source, making available a portion of the source voltage across each capacitor. The voltage across each capacitor will be inversely proportional to its capacitance.

**capacitive feedback**—The process of returning part of the energy in the plate or output circuit of a vacuum tube to the grid, or input, circuit by means of a capacitance common to both circuits.

**capacitive load**—A predominantly capacitive load, that is, one in which the current leads the voltage.

**capacitive post**—A metal post or screw extending at right angles to the  $E$  field in a waveguide. It provides capacitive susceptance in parallel with the waveguide for purposes of tuning or matching.

**capacitive reactance**—Symbolized by  $X_C$ . The impedance a capacitor offers to ac or pulsating dc. Measured in ohms and equal to  $1/2\pi fC$ , where  $f$  is in hertz and  $C$  is in farads.

**capacitive speaker**—See electrostatic speaker.

**capacitive storage welding**—A particular type of resistance welding whereby the energy is stored in banks of capacitors, which are then discharged through the primary of the welding transformer. The secondary current generates enough heat to produce the weld.

**capacitive transduction**—Conversion of the measurand into a change in capacitance.

**capacitive tuning**—Tuning by means of a variable capacitor.

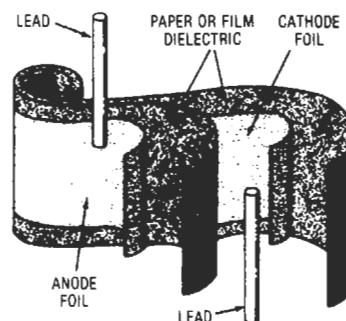
**capacitive voltage divider**—A combination of capacitors connected in series to form a capacitive voltage dividing device for application with ac voltages.

**capacitive welding**—An electronic welding system in which energy stored in a capacitor is discharged through the joint to be welded. The resulting current develops the heat necessary for the operation.

**capacitive window**—A conductive diaphragm extended into a waveguide from one or both sidewalls to introduce the effect of capacitive susceptance in parallel with the waveguide.

**capacitivity**—See dielectric constant.

**capacitor**—1. A device consisting essentially of two conducting surfaces separated by an insulating material or dielectric such as air, paper, mica, glass, plastic film, or oil. A capacitor stores electrical energy, blocks the flow of direct current, and permits the flow of alternating current to a degree dependent essentially on the capacitance and the frequency. 2. An electrical energy storage device used in the electronics industry for varied applications, notably as elements of resonant circuits, in coupling and bypass application, blockage of dc current, as frequency determining and timing elements, as filters and delay-line components, and in voltage transient suppression.



Capacitor (internal construction).

**capacitor antenna**—Also called condenser antenna. An antenna that consists of two conductors or systems of conductors and the essential characteristic of which is its capacitance.

**capacitor bank**—A number of capacitors connected together in series, parallel, or in series-parallel.

**capacitor braking**—A means of stopping an induction motor. The capacitor or capacitors can be applied to the winding after shut-off.

**capacitor color code**—Color dots or bands placed on capacitors to indicate one or more of the following: capacitance, capacitance tolerance, voltage rating, temperature coefficient, and the outside foil (on paper or film capacitors).

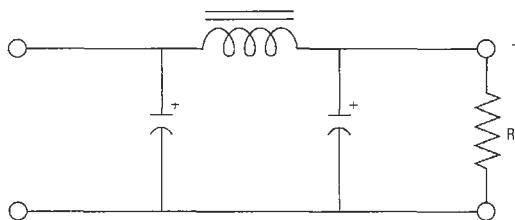
**capacitor-discharge ignition**—See capacitive-discharge ignition.

**capacitor discharge system**—An ignition system that stores its primary energy in a capacitor.

**capacitor electrolyte**—A current-conducting material (nonsolid or solid) serving as the cathode in an electrolytic capacitor.

**capacitor filtering**—A method for improving the form factor of a direct current by means of a parallel capacitor. Also, a means for increasing the magnitude of a rectified voltage.

**capacitor-input filter**—A power-supply filter in which a capacitor is connected directly across, or in parallel with, the rectifier output.



*Capacitor-input filter.*

**capacitor losses**—The active power dissipated by a capacitor.

**capacitor microphone**—See electrostatic microphone.

**capacitor motor**—A single-phase induction motor with the main winding arranged for direct connection to the power source, together with an auxiliary winding connected in series with a capacitor.

**capacitor pickup**—A phonograph pickup that depends for its operation on the variation of its electrical capacitance.

**capacitor-run motor**—A single-phase induction motor using a capacitor in series with a second primary winding displaced 90° from the first. This winding remains in the circuit full time, converting the machine to polyphase operation.

**capacitor series resistance**—An equivalent resistance in series with a pure capacitance that gives the same resultant losses as the actual capacitor. The equivalent circuit does not represent the variation in capacitor losses with frequency.

**capacitor speaker**—See electrostatic speaker.

**capacitor-start motor**—1. An ac split-phase induction motor in which a capacitor is connected in series with an auxiliary winding to provide a means of starting. The auxiliary circuit opens when the motor reaches a predetermined speed. 2. A type of motor that provides greater starting torque for a split-phase induction motor by connecting a capacitor in series with the auxiliary starting winding to provide a leading current vector of 90°, which momentarily converts the motor to a polyphase induction motor.

**capacitor voltage**—The voltage across the terminals of a.

**capacity**—1. The current-output capability of a cell or battery a period of time. Usually expressed in ampere-hours (amp-hr). 2. Capacitance. 3. The limits, both upper and lower, of the items or numbers that may be processed in a computer register, in the accumulator. When quantities exceed the capacity, a computer interrupt develops and requires special handling. 4. The total quantity of data that a part of a computer can hold or handle, usually expressed as words per unit of time. 5. The capability of a

## capacitor discharge system — carbon arc

specific system to store data, accept transactions, process data, and generate reports. 6. In a calculator, the maximum number of digits that can be entered as one factor or obtained in a result. In most machines, the capacity is equivalent to the number of digits in the display. In a few machines, it is larger than the number of digits in the display and the flip-flop key is used to show the full result. 7. The maximum number of bits that a system can process, or transmit, per second; e.g.,  $C = H/T$ , where  $T$  is time required for the processing or transmission and  $H$  is information content in bits.

**capillary tool**—A tool used in bonding; the wire is fed to the bonding surface of the tool through a bore located along the long axis of the tool.

**capstan**—1. The driven spindle or shaft in a tape recorder—sometimes the motor shaft itself—that rotates against the tape (which is backed up by a rubber pressure or pinch roller), pulling it through the machine at a constant speed during recording and playback modes of operation. The rotational speed and diameter of the capstan thus determine the tape speed. 2. A revolving shaft or flangeless pulley that drives the tape by squeezing it against a pinch roller, and that controls the rate at which tape passes over the heads of the tape recorder or deck. 3. A rotating shaft that is connected to the motor in a tape recorder. It moves the tape at constant speed across the heads. The tape is pressed against the capstan by a pinch roller.

**capstan idler**—See pressure roller.

**captive screw**—Screw-type fastener that is retained when unscrewed and cannot easily be separated from the part it secured.

**capture area**—The area of the antenna elements that intercept radio signals.

**capture bandwidth**—The frequency range over which an unlocked, free-running oscillator can be brought into lock by either phase- or injection-locking techniques.

**capture effect**—1. The selection of the stronger of two frequency-modulated signals of the same frequency, with the complete rejection of the weaker signal. If both signals are of equal strength, both may be accepted and no intelligible signal will result. 2. An effect occurring in a transducer (usually a demodulator) whereby the input wave having the largest magnitude controls the output.

**capture range**—The range of frequencies over which a phase-locked loop can detect a signal on the input and respond to it. This is sometimes called the lock-in range. See acquisition range.

**capture ratio**—1. The ability of a tuner to reject unwanted FM stations and interference on the same frequency as a desired one, measured in dB. The lower the figure, the better the performance of the tuner. 2. The power ratio of two signals in the same channel required to keep the signal/interference ratio to a value of 30 dB referred to 100-percent modulation and 1-mV input signal level. The ratio of the powers of the two input signals is expressed in decibels; the smaller the dB number the better the capture ratio. Topflight tuners have a value as low as 1 dB, but 4.5 dB is usually sufficient. 3. A measure of an FM tuner's ability to discriminate against weaker signals arriving on the same frequency as the desired one.

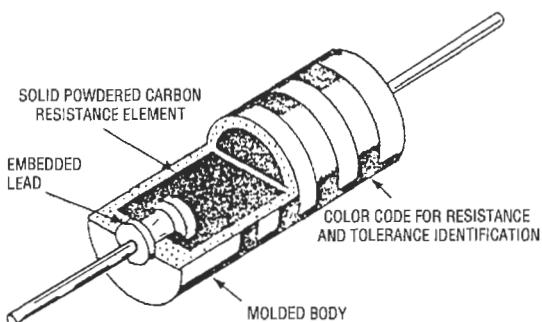
**carbon**—One of the elements, consisting of a non-metallic conductive material occurring as graphite, lampblack, diamond, etc. Its resistance is fifty to several hundred times that of copper and decreases as the temperature increases.

**carbon arc**—An electric discharge between two carbon rods that are touched together to start the arc and then separated slightly. The light comes from the heated

carbon vapor. High-intensity arcs use cored carbons, the core being filled with the oxides of thorium and cerium, which radiate brightly when heated.

**carbon brush**—A current-carrying brush made of carbon, carbon and graphite, or carbon and copper.

**carbon-composition resistor**—Hot- or cold-molded fixed resistor made from mixtures of granulated carbon and ceramic binder. In some versions the composition forms a monolithic structure; in others the composition is thickly applied to a ceramic core. Hot-molded carbon-composition resistors are specified where low-cost, reliable resistors with tolerances of  $\pm 5$  and  $\pm 10$  percent are acceptable.



*Carbon-composition resistor.*

**carbon-contact pickup**—A phonograph pickup that depends for its operation on the variation in resistance of carbon contacts.

**carbon-film resistor**—1. A resistor formed by vacuum-depositing a thin carbon film on a ceramic form. 2. Carbon-film resistors are general-purpose, low-cost types with axial leads. Specification characteristics generally match those of carbon-composition resistors but at a lower cost.

**carbonize**—To coat with carbon.

**carbonized filament**—A thoriated-tungsten filament treated with carbon. A layer of tungsten carbide formed on the surface slows down the evaporation of the active emitting thorium and thus permits higher operating temperatures and much greater electron emission.

**carbonized plate**—An electron-tube anode that has been blackened with carbon to increase its heat dissipation.

**carbon microphone**—A microphone that depends for its operation on the variation in resistance of carbon contacts.

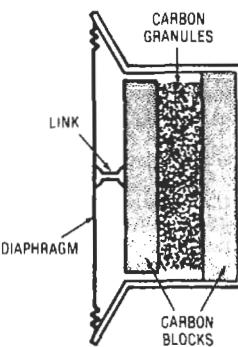
**carbon-pile regulator**—An arrangement of carbon discs whose series resistance decreases as more pressure or compression is applied.

**carbon resistor**—Also called composition resistor. A resistor consisting of carbon particles that are mixed with a binder molded into a cylindrical shape, and then baked. Terminal leads are attached to opposite ends. The resistance of a carbon resistor decreases as the temperature increases.

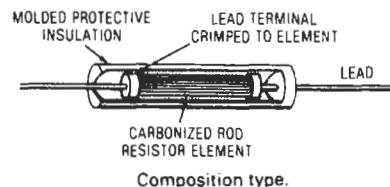
**carbon transfer recording**—A type of facsimile recording in which carbon particles are deposited on the record sheet in response to the received signal.

**Carborundum**—A compound of carbon and silicon used in crystals to rectify or detect radio waves.

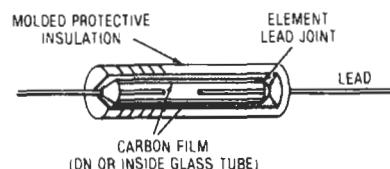
**carcinotron**—A voltage-tuned, backward-wave oscillator tube used to generate frequencies ranging from UHF up to 100 GHz or more.



*Carbon microphone.*



*Composition type.*



*Deposited-film type.*

*Carbon resistor.*

**card**—Nonpreferred term for printed circuit board. See printed circuit board.

**card bed**—A mechanical device for holding punch cards to be transported past the punching and reading stations.

**card code**—An arbitrary code in which holes punched in a card are assigned numeric or alphabetic values.

**card column**—One of 20 to 90 single-digit columns in a tabulating card. When punched, a column contains only one digit, one letter, or one special code.

**card-edge connector**—Also called edgeboard connector. A connector that mates with printed wiring leads running to the edge of a printed circuit board.

**Cardew voltmeter**—The earliest type of hot-wire instrument. It consisted of a small-diameter platinum-silver wire sufficiently long to give a resistance high enough to be connected directly across the circuit being measured. The wire was looped over pulleys and it expanded as current flowed, causing the pointer to rotate.



*Cardew voltmeter.*

**card face**—The printed side of a punched card if only one side is printed.

**card feed**—A mechanism that moves punch cards, one at a time, into a machine.

**card field**—On a punch card, the fixed columns in which the same type of information is routinely entered.

**card hopper**—*See* card stacker.

**cardiac monitor**—An instrument that usually has an oscilloscope display of the heart wave, and combines the features of several cardiac instruments, such as an electrocardiograph, cardiograph, etc. May also allow upper and lower limits to be set and trigger audible and/or visual alarms when these limits are exceeded.

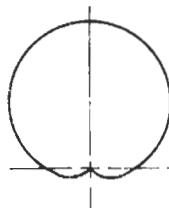
**cardiac pacemaker**—1. A device that controls the frequency of cardiac contractions. 2. A device that stimulates the heart and controls its rhythm by means of electrodes placed on the chest wall or implanted under the skin.

**cardiac stimulator**—Also called a pacemaker. An electronic device (sometimes implanted in the patient) that supplies electric pulses to stimulate regular heart action.

**card image**—1. A representation in storage of the holes punched in a card, in such a manner that the holes are represented by one binary digit and the unpunched spaces are represented by the other binary digit. 2. In machine language, a duplication of the data contained in a punch card.

**cardiograph**—An instrument (or recording of instruments) for measuring the form or force of heart motion.

**cardioid**—1. A heart-shaped polar response pattern, with strong rejection to signals arriving from the rear. 2. The quasi-heart-shaped sensitivity pattern of most unidirectional microphones. Hypercardioid and supercardioid microphones have basically similar patterns, but with longer, narrower areas of sensitivity at the front and slightly increased rear sensitivity. 3. A heart-shaped pattern that is typical of some directional antennas or microphones.



Cardioid diagram.

**cardioid microphone**—A microphone that has a heart-shaped response pattern that gives nearly uniform response for a range of about 180° in one direction and a minimum response in the opposite direction.

**cardiostimulator**—A device used to stimulate the heart and/or regulate its beat. *See also* pacemaker; defibrillator.

**cardiotachometer**—A measuring instrument that provides a meter reading proportional to the rate at which the heart beats.

**card jam**—A pile-up of cards in a machine.

**card machine**—A machine used to transfer information from or to punched cards.

**card programmed**—The capability of being programmed by punched cards.

## card face — carrier chrominance signal

**card punch**—1. A device to record information in cards by punching holes in the cards to represent letters, digits, and special characters. 2. Device used in data handling systems to enter data on cards according to a desired code.

**card reader**—1. A device designed to read information from punched cards and convert each hole into an electrical impulse for use in a computer system. 2. Device used in data handling systems to sense data on punched cards via a mechanical or photoelectric technique. 3. Equipment that takes a stack of punched cards and reads the information on them into the computer's memory or onto magnetic tape or disk for future reference. 4. A system that generally uses a photodetector to read punched cards for information by sensing the light transmitted through the punched holes.

**card row**—On a punched card, one of the horizontal lines of punching positions.

**card sensing**—The process of sensing or reading the information in punched cards and converting this information, usually into electrical pulses.

**card stacker**—A mechanism that stacks cards in a pocket or bin after they have passed through a computer. Also called card hopper.

**card-to-tape**—Having to do with equipment that transfers information directly from punched cards to punched tape or magnetic tape.

**carillon**—A bell tower designed to play from a keyboard. In an organ, this may be achieved by tube synthesis of bell-like tones struck with felt hammers, or completely electronically.

**Carnot theorem**—A thermodynamic principle that states that a cycle continuously operating between a low temperature and a high temperature can be no more efficient than a reversible cycle operating between the same temperatures.

**carriage tape**—*See* control tape.

**carrier**—1. A wave of constant amplitude, frequency, and phase that can be modulated by changing amplitude, frequency, or pulse. 2. An entity capable of carrying an electric charge through a solid (e.g., holes and conduction electrons in semiconductors). 3. A wave that has at least one characteristic that can be varied from a known reference value by a modulation process. 4. That part of the modulated wave that corresponds to the unmodulated wave in a specified way. 5. A frequency on which a second, information-carrying signal is impressed. 6. Holder for electronic parts and devices that facilitates handling during processing, production, imprinting, or testing operations and protects such parts under transport. 7. An analog signal at a fixed amplitude and frequency that combines with an information-bearing signal in the modulation process to produce an output signal suitable for transmission. 8. A continuous signal modulated with a second, information-carrying signal.

**carrier-amplitude regulation**—The change in amplitude of the carrier wave in an amplitude-modulated transmitter when symmetrical modulation is applied.

**carrier band**—In CD-4 discs, the left- or right-channel's band that contains musical information recorded at very high frequencies (in the 20–45 kilohertz range). In playback, the demodulator recovers those frequencies, which have been frequency modulated.

**carrier beat**—In facsimile transmission, an undesirable heterodyne of signals, each synchronous with a different stable oscillator, causing a pattern in received copy. When one or more of the oscillators is fork controlled, this is called fork beat.

**carrier chrominance signal**—In color television, sidebands of a modulated chrominance subcarrier, plus

any unsuppressed subcarrier, added to the monochrome signal to convey color information.

**carrier color signal** — In color television, sidebands of a modulated chrominance subcarrier, plus the chrominance subcarrier, if not suppressed, that are added to the monochrome signal to convey color information.

**carrier concentration** — The number of carriers in a cubic centimeter of semiconductor material.

**carrier control** — A control by the presence or absence of an rf carrier.

**carrier current** — 1. The current associated with a carrier wave. 2. High-frequency alternating current superimposed on ordinary telephone, telegraph, or power-line frequencies. The carrier may be tone modulated to operate switching relays or transmit data.

**carrier-current communication** — The superimposing of a high-frequency alternating current on ordinary telephone, telegraph, and power-line frequencies for telephone communication and control.

**carrier-current control** — Remote control in which the receiver and transmitter are coupled together through power lines.

**carrier-current transmitter** — A device that transmits signals via the standard ac power lines.

**carrier frequency** — 1. The frequency (hertz) of the wave modulated by the intelligence wave; usually a radio frequency (rf). 2. The reciprocal of the period of a periodic carrier. 3. The frequency of the unmodulated fundamental output from a radio transmitter.

**carrier-frequency interconnection** — In the formation of carrier networks, the transfer of groups of channels between terminals of wire-line cable or radio carrier systems at carrier frequencies.

**carrier-frequency peak-pulse power** — The power averaged over one carrier-frequency cycle that occurs at the maximum pulse of power (usually half the maximum instantaneous power).

**carrier-frequency pulse** — A carrier that is amplitude modulated by a pulse. The amplitude of the modulated carrier is zero before and after the pulse.

**carrier-frequency range** — The continuous range of frequencies within which a transmitter may normally operate. A transmitter may have more than one carrier-frequency range.

**carrier-frequency stereo disc** — A stereo disc with two laterally cut channels. One channel is cut in the usual manner. The second channel is employed to frequency modulate a supersonic carrier frequency. The playback cartridge delivers the signal for one channel plus the carrier frequency containing the other channel. The latter must then be demodulated to obtain the second channel.

**carrier injection** — The process whereby light is emitted at the junction of n- and p-type semiconductors when an external electric source is applied to drive the electrons and the holes into the junction.

**carrier-isolating choke coil** — An inductor inserted in series with a line on which carrier energy is applied to impede the flow of carrier energy beyond that point.

**carrier leak** — The carrier-frequency signal remaining after suppression in a suppressed carrier system.

**carrier level** — The strength, expressed in decibels, of an unmodulated carrier signal at a particular point in a system.

**carrier lifetime** — The time required for excess carriers doped into a semiconductor to recombine with other carriers of the opposite sign.

**carrier line** — A transmission line used for multiple-channel carrier communications.

**carrier loading** — The insertion of additional lump inductance in a cable section of a transmission line

utilized for carrier transmission up to about 35 kHz. Loading serves to minimize impedance mismatch between cable and open wire and to reduce the cable attenuation.

**carrier mobility** — The average drift velocity of carriers per unit electric field in a homogeneous semiconductor. The mobility of electrons is usually different from that of holes.

**carrier noise** — Undesired variation of a radio-frequency carrier signal in the absence of intended modulation. Also called residual modulation.

**carrier noise level** — Also called residual modulation. The noise level produced by undesired variations of a radio-frequency signal in the absence of any intended modulation.

**carrier on microwave** — A means of transmitting many voice messages on one microwave radio channel. Transmission is point to point by microwave antennas mounted on towers or tall buildings.

**carrier on wire** — A means widely used by the telephone companies to transmit many voice messages on a single pair of wires. Circuits involving one or more carrier links never evidence dc continuity.

**carrier-operated anti-noise device** — A device whose purpose is to mute the audio output of a receiver during standby or intervals of no carrier.

**carrier power** — The rf power output of an AM transmitter when not modulated.

**carrier power output rating** — The power available at the output terminals of a transmitter when the output terminals are connected to the normal load circuit or to a circuit equivalent thereto.

**carrier repeater** — An assembly, including an amplifier (or amplifiers), filters, equalizers, level controls, etc., used to raise the carrier signal level to a value suitable for traversing a succeeding line section while maintaining an adequate signal-to-noise ratio.

**carriers** — Entities that carry an electrical charge and are also able to move relatively freely through a crystal lattice. The two most commonly encountered carriers are conduction band electrons, which are negatively charged, and valence band holes, which are positively charged.

**carrier shift** — 1. The transmission of radio teletype-writer messages by shifting the carrier frequency in one direction for a marking signal and in the opposite direction for a spacing signal. 2. The condition resulting from imperfect modulation, whereby the positive and negative excursion of the envelope pattern are unequal, thus effecting a change in the power associated with the carrier.

**carrier signaling** — In a telephone system, the method by which ringing, busy signals, or dial-signaling relays are operated by the transmission of a carrier-frequency tone.

**carrier storage time (of a switching transistor)** — The time interval between the beginning of the fall of the pulse applied to the input terminals and the beginning of the fall of the pulse generated by charge carriers at the output terminals. (The time is generally measured between the 90-percent values of the two pulse amplitudes.)

**carrier suppression** — The method of operation in which the carrier wave is not transmitted.

**carrier swing** — The total deviation of a frequency- or phase-modulated wave from the lowest to the highest instantaneous frequency.

**carrier system** — A means of obtaining a number of channels over a single wideband communication path by modulating each channel on a different carrier frequency at the originating end and demodulating at the receiving point to restore the signals to their original form.

**carrier tap choke coil** — A carrier-isolating choke coil inserted in series with a line tap.

**carrier tap transmission choke coil**—An inductor inserted in series with a line tap to control the amount of carrier energy flowing into the tap.

**carrier telegraphy**—The form of telegraphy in which the transmitted signal is formed by modulating the alternating current, under control of the transmitting apparatus, before supplying it to the line.

**carrier telephony**—Ordinarily applied only to wire telephony. That form of telephony in which carrier transmission is used, the modulating wave being at an audio frequency.

**carrier terminal**—Apparatus at one end of a carrier transmission system, whereby the processes of modulation, demodulation, filtering, amplification, and associated functions are effected.

**carrier-to-noise ratio (C/N)**—1. Ratio of the magnitude of the carrier to the magnitude of the noise after selection and before any nonlinear process such as amplitude limiting and detection. This ratio is expressed in many different ways—for example, in terms of peak values in the case of impulse noise, and in terms of root-mean-square values in the case of random noise. 2. The ratio of the received carrier power to the noise power in a given bandwidth. The C/N is an indicator of how well an earth receiving station will perform in a particular location and is calculated from satellite power levels, antenna gain, and the combined antenna and LNA noise temperature.

**carrier-transfer filter**—A group of filters arranged to form a carrier-frequency crossover or bridge between two transmission circuits.

**carrier transmission**—1. That form of electrical transmission in which a single-frequency wave is modulated by another wave containing the information. 2. A system for transmitting many voice channels over a common telephone circuit.

**carrier-type dc amplifier**—An amplifier system that converts a dc input to modulated ac, amplifies, and synchronously detects to provide amplifier dc output.

**carrier wave**—1. The single-frequency transmitted wave that is modulated by another wave containing the information. 2. The basic frequency or pulse repetition rate of a signal, bearing no intrinsic intelligence until it is modulated by another signal that does bear intelligence. A carrier may be amplitude, phase, or frequency modulated.

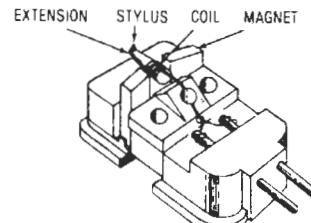
**carry**—1. A signal or expression produced in an electronic computer by an arithmetic operation on a one-digit place of two or more numbers expressed in positional notation and transferred to the next higher place for processing there. 2. A signal or expression—as defined in (1)—that arises when the sum of two digits in the same digit place equals or exceeds the base of the number system in use. If a carry into a digit place will result in a carry out of the same digit place and the normal adding circuit is bypassed when this new carry is generated, the result is called a high-speed or stand-on-nines carry. If the normal adding circuit is used, the result is called a cascade carry. If a carry resulting from the addition of carries is not allowed to propagate, the process is called a partial carry; if it is allowed to propagate, it is called a complete carry. A carry generated in the most significant digit place and sent directly to the least significant place is called an end-around carry. 3. In direct subtraction, a signal or expression—as defined in (1)—that arises when the difference between the digits is less than zero. Such a carry is frequently called a borrow. 4. The action of forwarding a carry. 5. The command directing a carry to be forwarded.

**carry look-ahead**—A circuit that predicts the final carry from propagate and generate signals supplied by partial adders. Used to speed up binary addition

significantly by eliminating the carry propagation (or ripple) delay.

**carry time**—The time required for a computer to transfer a carry digit to the next higher column and add it there.

**cartridge**—1. The electromechanical transducer of a phonograph pickup head that converts stylus vibrations to an electrical signal. It is generally detachable and fits into the head shell of a pickup. Most cartridges are either magnetic or piezoelectric types. 2. Generally, any enclosed package containing a length of magnetic tape and its basic winding receptacles, designed to eliminate the need for handling or threading the tape. Specifically, the word *cartridge* is used to describe that variety of package that contains a continuous (endless) loop of tape on a single reel. 3. A film or tape magazine containing only one spool. 4. A plastic container that holds recording tape for easy loading into a matching recorder or player, especially the eight-track cartridge.



Cartridge.

**cartridge fuse**—1. A tubular fuse whose end caps are enclosed in a glass or composition insulating tube to confine the arc or vapor when the fuse blows. 2. A short tube of fiber containing a fusible link or wire that is connected to metallic ferrules at the ends of the tube. Serves to interrupt excessive currents by melting of the fusible link.

**cascadable counter**—A logic counting block that has available the necessary connections to permit more than one counter to be operated in series, thus increasing the modulus of the counter subsystem.

**cascade**—Also called tandem. An arrangement of two or more similar circuits or amplifying stages in which the output of one circuit provides the input of the next.

**cascade amplification**—In a series of amplifiers, amplification by each of the preceding output.

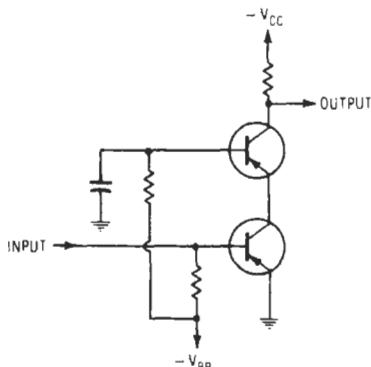
**cascade amplifier**—1. A multiple-stage amplifier in which the output of each stage is connected to the input of the next stage. 2. A multistage amplifier whose stages are forward coupled in succession.

**cascade-amplifier klystron**—A klystron that has three resonant cavities to provide increased power amplification and output. The extra resonator is located between the input and output resonators and is excited by the bunched beam energizing from the first resonator gap, thereby producing further bunching of the beam.

**cascade connection**—Two or more similar component devices arranged in tandem, with the output of one connected to the input of the next.

**cascade control**—Also called piggyback control. An automatic control system in which the control units, linked in chain fashion, feed into one another in succession. Each unit thus regulates the operation of the next in line.

**cascaded carry**—In a computer a system of executing the carry process in which carry information cannot



Cascade amplifier.

be passed on to place  $(N + 1)$  unless the  $N$ th place has received carry information or produced a carry.

**cascaded feedback canceler**—Also called velocity-shaped canceler. A sophisticated moving-target indicator canceler that provides clutter and chaff rejection.

**cascaded systems**—Multistorage operations; the input to each stage is the output of a preceding stage, thereby causing interdependence among the stages.

**cascaded thermoelectric device**—A thermoelectric device having two or more stages that are arranged thermally in series.

**cascade image tube**—An image tube that functions in low-light-level conditions by virtue of its series of stacked sections wherein the output of one section becomes the input for the next.

**cascading**—The connecting of two or more circuits in series so that the output from one provides the input to the next.

**cascode amplifier**—An amplifier using a neutralized grounded-cathode input stage followed by a grounded-grid output stage. The circuit has high gain, high input impedance, and low noise.

**CASE**—Abbreviation for computer-aided software engineering. A working environment consisting of programs and development tools that help automate the design and implementation of programs and procedures for business, engineering, and scientific computer systems.

**case**—In a computer, a set of data for use in a particular program.

**case pressure**—The total differential pressure in the internal cavity of a transducer and the ambient pressure. The term is commonly used to summarize the limiting combined differential and/or line-pressure capabilities of differential transducers.

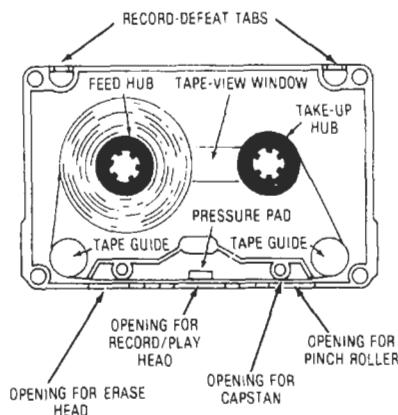
**case temperature**—The temperature on the surface of the case at a designated point.

**Cassegrain antenna**—1. An antenna whose feed is positioned near the vertex of the reflector, with a small subreflector placed near the focal point. The feed illuminates the subreflector, and the subreflector redirects the waves toward the main reflector, which then forms the radiated beam (called the secondary beam or pattern). The shapes of the subreflector and main reflector are so chosen that the secondary rays will emerge parallel to the main-reflector axis. 2. An antenna that utilizes a subreflector at the focal point that reflects energy to or from a feed located at the apex (center) of the main reflector.

**Cassegrain feed**—1. A method of feeding a reflector antenna in which a waveguide located in the center of the main reflector feeds energy to a small reflector, which

reflects it in turn to the main reflector. 2. An antenna feed design that includes a primary reflector, the dish, and a secondary reflector that redirect microwaves via a waveguide to a low-noise amplifier.

**cassette**—1. A thin, flat, rectangular enclosure that contains a length of narrow magnetic recording tape permanently affixed to two flangeless floating reels that wind and unwind the tape while it passes an external recording and/or playback head. 2. A flat enclosure that contains two flangeless reels that link a narrow magnetic tape. 3. A sealed instant-load cartridge containing a length of tape and separate supply and takeup reels or hubs. Cassettes, unlike continuous-loop cartridges, can be rewound as well as fast-forwarded. 4. A film or tape magazine containing two spools. 5. Most commonly applied to the compact cassette developed by Philips, but also to a variety of micro and mini cassette systems that are not mutually compatible. 6. Recently applied to mass storage requirements of microcomputers and minicomputers. A digital cassette is certified for digital recording, which differs from the audio recording requirements. 7. A miniature reel-to-reel tape system retaining the flexibility and freedom of back-and-forth tape movement provided by a reel system; it eliminates the inconvenience of tape threading. 8. An open metal or plastic carrier used on IC production lines for moving groups of wafers.



Cassette.

**cassette recorder**—A magnetic tape recording and playback device for entering or storing programs.

**casting-out-nines check**—A partial verification of an arithmetical operation on two or more numbers. It involves casting out nines from the number and from the results.

**CAT**—Abbreviation for computer-aided tomography, computer-assisted tomography, and computerized axial tomography. Literally, section graphics—the graphic display of a cross section of a piece of material or of the human body. Unlike ordinary X-ray photographs, which are produced directly by X-ray radiation on a photosensitive film (resulting in shadows on the film) computer-aided tomography displays are created by a computer after it processes the sensed X-ray signals. The big advantage of CAT is that a given display is not influenced by material in front of or behind the plane of interest, as is the case with ordinary X-ray photos. In fact, a three-dimensional picture can be obtained from multiple CAT displays, each displaced a small, finite distance from the adjacent one.

**cata dioptic**—Optical process using both reflection and refraction of light.

**catalog**—An ordered compilation of descriptions of items, including sufficient information to afford access to the items. *See also* directory.

**catalog search**—A computerized data retrieval technique involving the search of keywords stored as key nouns or characteristics of the product. A display shows all items from the database with the specified keywords.

**catalytic converter**—A device that enhances certain chemical reactions that help to reduce the levels of undesirable exhaust gases.

**cata phoresis**—The migration toward the cathode of particles suspended in a liquid; movement of the particles is caused by the influence of an electrostatic field.

**cata strophic failure**—1. A sudden failure without warning, as opposed to degradation failure. 2. A failure the occurrence of which can prevent the satisfactory performance of an entire assembly or system.

**catcher**—In a velocity-modulated vacuum tube, an electrode on which the spaced electron groups induce a signal. The output of the tube is taken from this element.

**catching diode**—A diode connected to act as a short circuit when its anode becomes more positive than its cathode; the diode then tends to prevent the voltage of a circuit terminal from rising above the voltage at the cathode.

**categorization**—The process by which multiple addressed messages are separated to form individual messages for single addresses.

**catena**—A chain or connected series.

**catenate**—*See* concatenate.

**cathamplifier**—A push-pull vacuum-tube amplifier in which the push-pull transformer is in the cathode circuit.

**cathode**—1. In an electron tube, the electrode through which a primary source of electrons enters the interelectrode space. 2. General name for any negative electrode. 3. The lower-potential electrode of a corrosion cell, in which the action of the corrosion current may reduce or eliminate corrosion, or the negatively charged metallic parts of an impressed current system. 4. When a semiconductor diode is biased in the forward direction, that terminal of the diode that is negative with respect to the other terminal. 5. The negative electrode of a polar capacitor. 6. The negative pole of a plating apparatus at which positively charged ions leave the plating solution. A metal is deposited on the cathode. *See* anode. 7. In electrolytic plating, the workpiece being plated.

**cathode activity**—Measure of the efficiency of an emitter. The mathematical relationship between two values of emission current measured under two conditions of cathode temperature.

**cathode bias**—A method of biasing a vacuum tube by placing the biasing resistor in the common cathode-return circuit, thereby making the cathode more positive—rather than the grid more negative—with respect to ground.

**cathode-coupled amplifier**—A cascade amplifier in which the coupling between two stages is accomplished by a common cathode resistor.

**cathode coupling**—The use of an input or output element in the cathode circuit for coupling energy to another stage.

**cathode current**—*See* electrode current.

**cathode-current density**—The current per square centimeter of cathode area, expressed as amperes or milliamperes per centimeter squared.

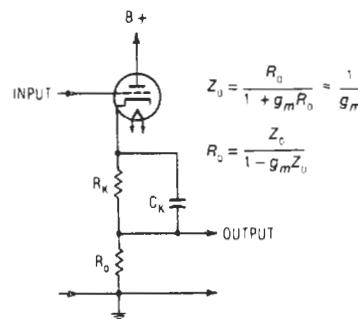
**cathode dark space**—Also called Crookes' dark space. The relatively nonluminous region between the

## cata dioptic — cathode-ray instrument

cathode and negative glow in a glow-discharge cold-cathode tube.

**cathode emission**—The process whereby electrons are emitted from the cathode structure.

**cathode follower**—Also called grounded-plate amplifier. A vacuum-tube circuit in which the input signal is applied to the control grid, and the output is taken from the cathode. Electrically, such a circuit possesses a high input impedance and a low output impedance characteristic and a gain of less than unity. The equivalent circuit using a transistor is called an emitter follower.



Cathode follower.

**cathode glow**—The apparent luminosity or glow that immediately envelops the cathode in a gas-discharge tube when operating at low pressures. The glow increases as the pressure decreases.

**cathode guide**—The element of a glow tube used in switching the neon glow from one indicated number to the next.

**cathode heating time**—The time required for the cathode to attain a specified condition, for example, a specified value of emission or a specified rate of change in emission.

**cathode interface**—A resistive and capacitive layer formed between the nickel sleeve and oxide coating of an indirectly heated cathode. Raising the cathode temperature will largely nullify the layer.

**cathode keying**—A method of keying a radiotelegraph transmitter by opening the plate return lead to the cathode or filament center tap.

**cathode luminous sensitivity (of a multiplier phototube)**—The photocathode current divided by the incident luminous flux.

**cathode modulation**—A form of amplitude modulation in which the modulating voltage is applied to the cathode circuit.

**cathode pulse modulation**—Modulation produced in an amplifier or oscillator by applying externally generated pulses to the cathode circuit.

**cathode radiant sensitivity**—The current leaving the photocathode divided by the incident radiant power of a given wavelength.

**cathode ray**—A stream of electrons emitted, under the influence of an electric field, from the cathode of an evacuated tube or from the ionized region nearby.

**cathode-ray charge storage tube**—A charge storage tube in which the desired information is written by means of a cathode-ray beam.

**cathode-ray instrument**—*See* electron-beam instrument.

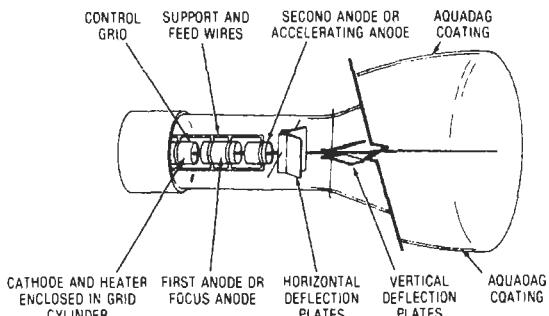
**cathode-ray oscillosograph** — An apparatus capable of producing, from a cathode-ray tube, a permanent record of the value of an electrical quantity as a function of time.

**cathode-ray oscilloscope** — Abbreviated CRO. 1. A test instrument that, when properly adjusted, makes possible the visual inspection of alternating-current signals. It consists of an amplifier, time-base generating circuits, and a cathode-ray tube for transformation of electrical energy into light energy. 2. A system wherein a supplied signal causes deflection of a CRT electron beam, thus forming a visible trace on the phosphor CRT screen that allows examination of electrical quantities.

**cathode-ray output** — A term used in data processing to describe a cathode-ray tube that displays graphic or character data.

**cathode-ray storage** — An electrostatic data storage device in which a cathode-ray beam provides access to the data.

**cathode-ray tube** — Abbreviated CRT. 1. A vacuum tube in which its electron beam can be focused to a small cross section on a luminescent screen and can be varied in position and intensity to produce a visible pattern. 2. A vacuum tube with an electron gun at one end and a fluorescent screen at the other. Electrons emitted from a heated cathode are accelerated by a series of annular anodes at progressively higher positive voltages. The electron beam is then deflected by two pairs of electrostatically charged plates between the gun and the screen. Electromagnets are often used in place of the deflector plates.



Cathode-ray tube.

**cathode-ray-tube display** — Abbreviated CRT display. 1. A device in which controlled electron beams are used to present data in visual form. 2. The data presentation produced by such a device. 3. In a calculator, a type of display resembling a small television tube. Usually, two to four rows of digits can be displayed simultaneously. 4. A high-speed device, similar to a television picture tube, that provides a visual nonpermanent display of system input/output data, such as instructions as they are being developed and data in storage. 5. A device, used to present data (alphanumeric, graphical, or a combination of the two), that incorporates a cathode-ray tube as the presenting element.

**cathode-ray tuning indicator** — Commonly called magic eye. A small-diameter cathode-ray tube that visually indicates whether an apparatus such as a radio receiver is tuned precisely to a station.

**cathode resistor** — A resistance connected in the cathode circuit of a tube so that the voltage drop across it will supply the proper cathode-biasing voltage.

**cathode spot** — On the cathode of an arc, the area from which electrons are emitted at a current density of thousands of amperes per square centimeter and where the temperature of the electrode is too low to account for such currents by thermionic emission.

**cathode sputtering** — The method of disintegrating the substance of the cathode by bombarding it with ions and then depositing it on another electrode or electron-tube envelope. *See also sputtering, 1.*

**cathodic protection** — Corrosion inhibition employed in protecting underground (or underwater) metal from electrochemical corrosion; it involves making the metal cathodic (negative) to a buried (or immersed) anode. Two methods are available for the required polarization: a dc power supply applying a positive polarity to a stainless steel or platinum plated titanium anode, or a dc self-generating sacrificial anode of zinc, magnesium, or aluminum alloy.

**cathodofluorescence** — Fluorescence that results from a material's exposure to cathode rays.

**cathodoluminescence** — Luminescence produced by the bombardment with high-energy electrons of a metal in a vacuum. Small amounts of the metal are vaporized in an excited state by the bombardment and emit radiation characteristic of the metal.

**cation** — 1. A positive ion that moves toward the cathode in a discharge tube, electrolytic cell, or similar equipment. The corresponding negative ion is called an anion. 2. An atom with a deficiency of electrons and therefore having a positive charge.

**CATV** — Abbreviation for community antenna television or cable television. A system of distributing TV signals to homes by cable.

**catwhisker** — A small, pointed wire used to make contact with a sensitive area on the surface of a crystal or semiconductor.

**Cauer-elliptic filter** — Also known as an elliptic or elliptical filter. A transfer function having an extremely high rate of attenuation (a very fast rolloff) near the corner frequency. Exhibits passband ripple and a renewal of gain beyond the stopband.

**cavitation** — The production of gas-filled cavities in a liquid when the pressure is reduced below a certain critical value with no change in the temperature. Ordinarily this is a destructive effect because the high pressures produced when these cavities collapse often damage mechanical components of hydraulic systems, but the effect is turned to advantage in ultrasonic cleaning.

**cavitation noise** — The noise produced in a liquid by the collapse of the bubbles created by cavitation.

**cavity** — A metallic enclosure that can be made to resonate at a desired microwave frequency. Primarily used to describe a cavity filter, which is a highly selective tuning element at microwave frequencies that may be used as the frequency-determining element of an oscillator or as a low-pass, bandpass, or highpass filter. Generally of fixed frequency, or may be mechanically tunable over a very limited frequency range.

**cavity filter** — A selective tuned device having the proper coupling means for insertion into a transmission line to produce attenuation of unwanted off-frequency signals.

**cavity impedance** — The impedance that appears across the gap of the cavity of a microwave tube.

**cavity magnetron** — A magnetron having a number of resonant cavities forming the anode; used as a microwave-transmitting oscillator.

**cavity oscillator** — Abbreviated CO. An oscillator in which the primary frequency-determining element is either a waveguide or coaxial cavity. Oscillator frequency

can be mechanically tuned and voltage tuned (via a tuning varactor) over a relatively narrow band.

**cavity radiation**—The radiation (heat) emerging from a small hole leading to a constant-temperature enclosure. Such radiation is identical with blackbody radiation at the same temperature, no matter what the nature of the inner surface of the enclosure.

**cavity resonator**—1. A space that is normally bounded by an electrically conducting surface and in which oscillating electromagnetic energy is stored; the resonant frequency is determined by the geometry of the enclosure. 2. A section of coaxial line or waveguide completely enclosed by conducting walls; it is often made variable for use as a wavemeter.

**cavity resonator frequency meter**—A cavity resonator used for determining the frequency of an electromagnetic wave.

**cavity-tuned, absorption-type frequency meter**—A device used for measuring frequency. Its operation depends on the use of an enclosure with a conductive inner wall; the resonant frequency of the wall is determined by its internal dimensions.

**cavity-tuned, heterodyne-type frequency meter**—A device for measuring frequency. Its operation depends on the use of an enclosure with a conductive inner wall; the resonant frequency of the wall is determined by its internal dimensions.

**cavity-tuned, transmission-type frequency meter**—A device for measuring frequency. Its operation depends on the use of an enclosure with a conductive inner wall; the resonant frequency of the wall is determined by its internal dimensions.

**C-band**—1. Microwave band in which the wavelengths are at or near 5.6 cm. It includes the top two sidebands of the S-band and the bottom three sidebands of the X-band. 2. The band of frequencies between 4 and 8 GHz, with the 6- and 4-GHz band being used for satellite communications. Specifically, the 3.7 to 4.2 GHz satellite communication band is used as the downlink frequencies in tandem with the 5.925 to 6.425 GHz band that serves as the uplink.

**CBASIC**—A version of BASIC that runs on the CP/M operating system. It is a structured language often preferred by programmers working in BASIC.

**C battery**—Also called grid battery. The energy source that supplies the voltage for biasing the grid of a vacuum tube.

**CBC**—Canadian Broadcasting Corporation. The government radio and television organization of Canada.

**C-bias**—See grid bias.

**CCD**—Abbreviation for charged-coupled device. 1. A semiconductor storage device in which an electrical charge is moved across the surface of a semiconductor by electrical control signals. Zeros or ones are represented by the absence or presence of a charge. A charge transfer system in which charges created by either an input diode or by an impinging photon are contained in MOS (metal-oxide semiconductor) or MIS (metal-insulated semiconductor) capacitors fabricated on a single crystal wafer. By varying electrode voltages successively, charge packets are moved from capacitor to capacitor to a single output amplifier. 2. Large buffer memory for minicomputer systems, interfacing between the magnetic storage disks or tape drives and the RAM, or as plug-compatible disk replacements. 3. A shift register formed by a string of closely spaced MOS capacitors. A CCD can store and transfer analog-charge signals—either electrons or holes—that may be introduced electrically or optically. The storing and transferring of charge occurs between potential wells at or near a silicon-silicon dioxide interface. The MOS capacitors, pulsed by a multiphase clock voltage, form these wells. For a three-phase, *n*-channel

CCD, the charges transferred between potential wells are electrons. 4. Functionally, a shift-register memory for either analog or digital information in which the data is represented as stored charges. The charges in a CCD are stored in a linear array of potential wells, with the potential of each well controlled by a voltage applied to an isolated metal-oxide semiconductor (MOS) capacitor above the well. By applying a traveling voltage wave to this linear array of capacitors, any charges within the wells are pushed along from well to well. For a digital memory, the potential wells are either uncharged or fully charged to represent 0 and 1. To implement an analog memory, the charge is varied linearly in proportion to the sampled input voltage. Thus, analog delay lines as well as digital memories are implementable with CCD technology. Also known as a bucket brigade device because of the way charge is transferred from one cell to another in a recirculating fashion. 5. For imaging devices, a self-scanning semiconductor array that utilizes MOS technology, surface storage, and information transfer by digital shift register techniques.

**CCIF**—Abbreviation for International Telephone Consultative Committee.

**CCIR**—Abbreviation for International Radio Consultative Committee.

**CCITT**—1. Abbreviation for Comité Consultatif International Télégraphique et Téléphonique. The original French name of the committee that published international communications standards. Replaced by ITU. 2. Abbreviation for Consultative Committee for International Telephone and Telegraph. An international standards group that is a part of the International Telecommunications Union (ITU).

**CCS**—Abbreviation for continuous commercial service. Refers to the power rating of transformers, tubes, resistors, etc. Used for rating components in broadcasting stations and some industrial applications.

**CCTV**—Abbreviation for closed-circuit television.

**CCTV camera**—That part of a closed-circuit TV system that captures the picture and produces the video (picture) signal.

**CCTV monitor**—That part of a closed-circuit TV system that receives the picture from the CCTV camera and displays it on the picture tube.

**ccw**—Abbreviation for counterclockwise.

**CD**—Abbreviation for compact disc.

**CD-4**—1. A record-playback system for discrete discs. Invented by the Victor Co. of Japan (JVC) and developed by JVC and RCA Records, the system needs a demodulator and special cartridge with a special stylus for discrete four-channel playback. The system is not compatible with matrix quad discs and is not used for FM broadcasting. Also called quadradisc. 2. A recording and playback system similar in some respect to FM multiplex stereo broadcast and reception. Each wall of the record groove carries a single channel of information—left front plus left rear on the inner wall and right front plus right rear on the outer wall of the groove. In addition, each groove wall carries a 30-kHz FM subcarrier that is modulated by the front-minus-back difference signals that are needed to decode or demodulate the quadraphonic signal into four discrete channels. 3. A discrete four-channel disc recording and playback system, using a frequency-modulated 30-kHz carrier to convey additional information that can be combined with the audio output of the cartridge to produce four essentially independent program channels. Requires a cartridge frequency response to at least 45 kHz and a special demodulator.

**CD-4 capability**—The ability of a cartridge to reproduce the ultrasonic signals necessary for discrete four-channel disc reproduction using a CD-4 demodulator.

**cdi**—Abbreviation for collector-diffusion isolation.

**CD-I**—Abbreviation for compact disc-interactive. A home entertainment system based on a player that connects to any TV and stereo system, with information stored digitally on compact disc. It was introduced by Philips Consumer Electronics in 1991.

**C-display**—A type of radar display in which the signal is a bright spot, with the bearing as the horizontal coordinate and the elevation angle as the vertical coordinate.

**CDMA**—Abbreviation for code-division multiple access. Digital cellular system multiple-access standard that allows for higher capacity and greater security. Stations use spread-spectrum modulations and orthogonal codes to avoid interfering with one another. *See also* code-division multiple access.

**CDPD**—Abbreviation for Cellular Digital Packet Data. A standards-based technology for wireless communication of data.

**CD-R**—Abbreviation for compact disc-recordable (recordable CD). Same as CD-WO. CD format is compatible with CD-ROM and can be written to once and read many times.

**CD-ROM**—Abbreviation for compact disc-read-only memory. 1. A compact disc with a format for storing different types of information digitally, which can be played on a CD-ROM drive connected to a personal computer. 2. A compact 5-1/4-inch optical disc, typically used to store text, images, audio, video, and programs that can run on suitably equipped computers. CD-ROM drives come in single, double, and quad speeds (150 kbs, 300 Kbs, and 600 kbs, respectively). 3. A read-only optical disc capable of storing large amounts (up to 250,000 pages) of data.

**CD-ROM drive**—A peripheral device attached to a computer that allows it to read/play a CD-ROM disc. All CD-ROM players can also play back audio CDs, but require external headphones or speakers to hear them.

**CD-WO**—Compact disc-write once. Recordable compact disc. Same as CD-R.

**ceiling**—The maximum voltage that may be attained by an exciter under specified conditions.

**celestial guidance**—A system of guidance in which star sightings that are automatically taken during the flight of a missile provide position information used by the guidance equipment.

**cell**—1. A single unit that produces a direct voltage by converting chemical energy into electrical energy. 2. A single unit that produces a direct voltage by converting radiant energy into electrical energy; for example, a solar or photovoltaic cell. 3. A single unit that produces a varying voltage drop because its resistance varies with illumination. 4. Elementary unit of storage. 5. In corrosion processes, a source of electric potential that is responsible for corrosion. It consists of an anode and a cathode immersed in an electrolyte and electrically bonded together. The anode and cathode may be separate metals or dissimilar areas on the same metal. The different metals will develop a difference in potential that is accompanied by corrosion of the anode. When this cell involves an electrolyte, as it does in corrosion processes, it is referred to as an electrolytic cell. 6. The geographic area served by a single low-power transmitter/receiver. A cellular system's service area is divided into multiple cells.

**cell counter**—An electronic instrument used to count white or red blood cells or other very small particles.

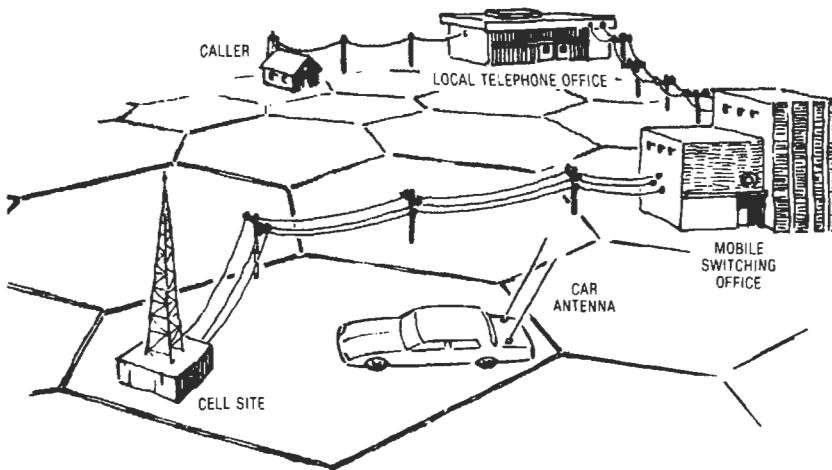
**cell-type enclosure**—A prefabricated basic shielded enclosure of double-walled copper-mesh construction. The original screen-room design.

**cell-type tube (tr, atr, and pre-tr tubes)**—A gas-filled radio-frequency switching tube that operates in an external resonant circuit. A tuning mechanism may be incorporated into the external resonant circuit or the tube.

**cellular**—Type of mobile telephone service in which the geographic serving area is divided into subregions (cells), each with its own antenna and switching node.

**cellular radio**—The terrestrial mobile telephone technology that increases the number of available channels by dividing an area into cells; each cell may use the same frequencies as other cells, except that adjacent cells may not use the same frequencies.

**cellular system**—1. A mobile telephone system that divides large service areas into small cells, each with its own low-power transmitter. A telephone call is switched by computers from one transmitter to the next without interrupting the signal as a vehicle moves from cell to cell. Calls can be divided and frequencies reused over shorter intervals. 2. Method of mobile telephone service that divides radio communication service areas into small cells, or districts. The cellular approach



Cellular telephone system.

utilizes low-power transmitters that allow uninterrupted communications through sophisticated switching equipment linking the cells. This system, by reusing frequencies and standardizing service and equipment, has substantially improved mobile telephone service.

**cellulose acetate**—An inexpensive transparent plastic film used as the backing material for many recording tapes.

**cellulose-nitrate disc**—*See* lacquer disc.

**Celsius temperature scale**—Also called centigrade temperature scale. A temperature scale based on the freezing point of water defined as 0°C and the boiling point defined as 100°C, both under conditions of normal atmospheric pressure (760 mm of mercury).

**cent**—A measure of frequency, defined as equal to 100th of a semitone.

**center-fed antenna**—An antenna in which the feeder wires are connected to the center of the radiator.

**center feed**—1. Attaching feeder wires or a transmission line to the center of the radiator of an antenna. 2. Connection of signal input terminals to the center of a coil.

**center frequency**—Also called resting frequency. 1. The average frequency of the emitted wave when modulated by a symmetrical signal. 2. The frequency at the center of a spectrum display (for linear frequency scanning). It is usually tunable. 3. Also called free-running frequency. The frequency at which a phase-locked loop operates when not locked onto an incoming (input) signal.

**centering control**—One of two controls used to shift the position of the entire image on the screen of a cathode-ray tube. The horizontal-centering control moves the image to the right or left, and the vertical-centering control moves it up or down. *See also* framing control.

**centering diode**—A clamping circuit used in some types of plan-position indicators.

**centering magnet**—A magnet that centers the televised picture on the face of the tube. Also called framing magnet.

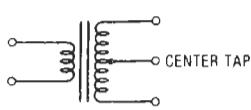
**center of gravity**—A point inside or outside a body and around which all parts of the body balance each other.

**center of mass**—On a line between two bodies, the point around which the two bodies would revolve freely as a system.

**center poise**—Scale of viscosity for insulating varnishes.

**center ring**—The part that supports the stator in an induction-motor housing. The motor end shields are attached to the ends of the center ring.

**center tap**—A connection at the electrical center of a winding, or midway between the electrical ends of a resistor or other portion at a circuit.



*Center tap.*

**center-tapped inductor**—An inductor that has a tap at half the total inductance.

**center wire**—A fine loop of wire used in proportional counters as an anode. A high voltage is applied to it to set the conditions for radiation measurement.

**center-zero meter**—A dc meter that has its zero point at the center of the scale, e.g., a dc galvanometer.

## cellulose acetate — centripetal force

**centi-**—One hundredth ( $10^{-2}$ ) of a specific quantity or dimension.

**centigrade temperature scale**—The older name for a Celsius temperature scale in the English-speaking countries. Officially abandoned by international agreement in 1948, but still in common usage.

**centimeter waves**—Microwave frequencies between 3 and 30 GHz, corresponding to wavelengths of 10 to 1 centimeters.

**central battery exchange**—Manual telephone exchange in which a battery situated at the exchange is the source of current for operating supervisory signals, for subscribers' calling signals, and for the current required to enable a subscriber to speak over his or her line.

**central office**—The facility at which a communications common carrier terminates customer lines and locates the equipment for interconnecting those lines.

**central-office equipment**—Apparatus used in a telephone central office to furnish communication services.

**central-office line**—*See* subscriber line.

**central processing unit**—Also called central processor; abbreviated CPU. 1. The part of a computer system that contains the main storage, arithmetic unit, and special register groups. Performs arithmetic operations, controls instruction processing, and provides timing signals and other housekeeping operations. 2. A group of registers and logic that form the arithmetic/logic unit plus another group of registers with associated decoding logic that form the control unit. Most MOS devices are single-chip CPUs, in that the registers hold as many bits as the word length of the unit. With bit-slice devices, however, central processing units of any bit width can be assembled essentially by connecting the bit-slice parts in parallel. Externally, a bit-slice device will appear to be a coherent single CPU capable of handling words of the desired bit length. 3. That part of a computer system that controls the interpretation and execution of instructions. In general, the CPU contains the following elements: arithmetic and logic unit (ALU), timing and control, accumulator, scratch-pad memory, program counter and address stack, instruction register, and I/O control logic. 4. That unit of a computing system that fetches, decodes, and executes programmed instructions and maintains the status of results as the program is executed.

**central processor**—*See* central processing unit; CPU.

**central station**—A control center to which alarm systems in a subscriber's premises are connected, where circuits are supervised and where personnel are maintained continuously to record and investigate alarm or trouble signals. Facilities are provided for the reporting of alarms to police and fire departments or to other outside agencies.

**central station alarm system**—An alarm system, or group of systems, the activities of which are transmitted to, recorded in, maintained by, and supervised from a central station. This differs from proprietary alarm systems in that the central station is owned and operated independently of the subscriber.

**centrex**—1. A service offered by telephone companies. It uses central-office equipment to provide features comparable with those provided by a PBX. 2. An improved PBX system that also provides direct inward dialing (DID) and automatic number identification (ANI) of the calling PBX station.

**centrifugal force**—The force that acts on a rotating body and that tends to throw the body farther from the axis of its rotation.

**centripetal force**—The force that compels a rotating body to move inward toward the center of rotation.

**Ceracircuits**—A trademark of the Sprague Electric Company for hybrid thick-thin film integrated circuits that consist of discrete passive and semiconductor active elements attached to precision resistor substrates to form functional electronic modules.

**ceramic**—1. A claylike material, consisting primarily of magnesium and aluminum oxides, that after molding and firing is used as an insulating material. It withstands high temperatures and is less fragile than glass. When glazed, it is called porcelain. 2. Pertaining to or made of clay or other silicates. 3. Piezoelectric part of a pickup, speaker, or microphone that acts as a transducer. It has characteristics that are similar to a crystal transducer, but it is more robust. 4. Nonmetallic and inorganic material, e.g., alumina, beryllia, or steatite, formed through heat processing, used in microelectronic substrates and component parts.

**ceramic amplifier**—An amplifier that makes use of the piezoelectric properties of ceramics such as barium titanate and the pieoresistive properties of semiconductors such as silicon. An ac signal applied through electrodes to a barium titanate bar produces deformation of the bar and the attached silicon strip, thereby producing a corresponding variation in resistance. This resistance change causes the load current to vary. The device is essentially a current amplifier with extremely high input impedance and low output impedance.

**ceramic-based microcircuit**—A microminiature circuit printed on a ceramic substrate. Usually consists of combinations of resistive, capacitive, or conductive elements fired on a waferlike piece of ceramic.

**ceramic capacitor**—A capacitor whose dielectric is a ceramic material such as steatite or barium titanate, the composition of which can be varied to give a wide range of temperature coefficients. The electrodes are usually silver coatings, fired on opposite sides of the ceramic disc or slab, or fired on the inside and outside of a ceramic tube. After connecting leads are soldered to the electrodes, the unit is usually given a protective insulating coating.

**ceramic dielectric**—1. One of a great variety of ceramic materials used as a dielectric in capacitors; some typical materials are barium titanate, barium strontium titanate, and titanium dioxide. Different ceramic dielectrics provide the desired temperature coefficient of capacitance and medium-to-dielectric constants. 2. A ceramic such as isolantite, porcelain, or steatite, used as an insulator.

**ceramic filter**—Electrically coupled, two-terminal piezoelectric ceramic resonators in ladder and lattice configurations. Monolithic filters with ceramic substrates are also called ceramic filters.

**ceramic microphone**—1. A microphone with a ceramic cartridge. 2. A transducer that uses a piezoelectric ceramic pickup element (barium titanate) to convert sound to electrical energy.

**ceramic permanent magnet**—A permanent, nonmetallic magnet made from pressed and sintered mixtures of metallic-oxide powders, usually oxides of barium and iron.

**ceramic pickup**—1. A phonograph pickup with a ceramic cartridge. 2. A pickup whose generator system is based on piezoelectricity produced by the stressing of natural and man-polarized crystals.

**ceramic transducer**—See piezoelectric transducer.

**CERDIP**—1. Abbreviation for *ceramic dual-inline package*. A package assembled with the leadframe sandwiched between two ceramic layers and sealed by firing a glass frit. 2. A ceramic dual-inline package for ICs.

**Cerenkov counter**—An instrument that detects high-energy charged particles by an analysis of the Cerenkov radiation emitted.

**Cerenkov radiation**—1. Light emitted when charged particles pass through a transparent material at a velocity greater than that of light in that material. It can be seen, for example, as a blue glow in the water around the fuel elements of pool reactors. P. A. Cerenkov was the Russian scientist who first explained the origin of this light. 2. The radiation produced when a charged particle traverses a medium that has a refraction index considerably greater than unity.

**Cerenkov rebetron radiator**—A device in which a tightly bunched velocity-modulated electron beam is passed through a hole in a dielectric. The reaction between the higher velocity of the electrons passing through the hole and the slower velocity of the electromagnetic energy passing through the dielectric results in radiation at some frequency higher than the frequency of modulation of the electron beam.

**cermet**—1. A metal-dielectric mixture used in making thick-film resistive elements. The first half of the term is derived from *ceramic* and the second half from *metal*. 2. A solid homogeneous material usually consisting of a finely divided admixture of a metal and ceramic in intimate contact. Cermets thick films are normally combinations of dielectric materials and metals.

**cermet potentiometer**—A potentiometer in which the resistive element is made by combining very fine particles of ceramic or glass with precious metals.

**CERT**—Abbreviation for character error-rate testing. Checking a data line with test characters.

**certification**—Verification that specified testing has been performed, and required parameter values have been attained.

**certified magnetic tape**—Magnetic tape that has been tested and is certified to be free from error over its entire recording surface.

**cesium**—A chemical element having a low work function. Used as a getter in vacuum tubes and in cesium-oxygen-silver photocell cathodes.

**cesium-oxide cell**—A photoemissive detector sensitive to wavelengths up to 1 micrometer. It has one sharp maximum of sensitivity at 350 nanometers and a broad maximum at 800 nanometers.

**cesium-vapor lamp**—A low-voltage arc lamp for producing infrared radiation.

**cev**—See corona extinction voltage.

**CGA**—Abbreviation for color graphics adapter. A color graphics system for IBM PCs and compatibles. Provides less resolution than EGA or VGA monitors.

**C<sub>gk</sub>**—Symbol for grid-cathode capacitance in a vacuum tube.

**CGM**—Abbreviation for computer graphics metafile. A standard file format that stores object-oriented graphics in device-independent form, enabling them to work in different systems and programs.

**C<sub>gp</sub>**—Symbol for grid-plate capacitance in a vacuum tube.

**cgs**—Abbreviation for centimeter-gram-second. These quantities of space, mass, and time are the basis of absolute units.

**cgs electromagnetic system of units**—A coherent system of units for expressing the magnitude of electrical and magnetic quantities. The most common fundamental units of these quantities are the centimeter, gram, and second. Their unit of current (abampere) is of such a magnitude that if maintained constant in two straight parallel conductors having an infinite length and negligible circular sections and placed 1 centimeter apart

in a vacuum, a force equal to 2 dynes per centimeter of length will be produced.

**cgs electrostatic system of units**—A coherent system of units for expressing the magnitude of electrical and magnetic quantities. The most common fundamental units of these quantities are the centimeter, gram, and second. Their unit of electrical charge (stacoulomb) is of such a magnitude that two equal unit point charges 1 centimeter apart in a vacuum will repel each other with a force of 1 dyne.

**chad**—The piece of material removed when a hole or notch is formed in a storage medium such as punched tape or punched cards.

**chadless**—Pertaining to tape in which the data holes are deliberately not punched through and a flap of material remains attached to the tape.

**chadless tape**—A type of punched paper tape in which each chad is left fastened by about a quarter of the circumference of the hole. Chadless punched paper tape must be sensed by mechanical fingers, because chad interferes with reliable electrical or photoelectrical reading.

**chad tape**—Tape used in printing telegraph or teletypewriter operation, in which the perforations are severed from the tape to form holes that represent characters. Normally, the characters are not printed on chad tape.

**chaff**—A general name applied to radar-confusion reflectors that consist of thin, narrow, metallic strips of various length and frequency responses used to reflect radar echoes.

**chain**—A series of processing locations through which information must pass on a store-and-forward basis to reach a subsequent location.

**chain calculations**—In a calculator, series of continued operations in a single mode. Example:  $118 \times 94 \times 116 \times 395$ .

**chained list**—A list in which the items may be dispersed but in which each item contains an identifier for locating the next item to be considered.

**chaining**—1. In a computer, a system of storing records such that each record belongs to a list or group of records and has a linking field for tracing the chain. 2. If a computer program is too big to fit into the memory, it can be written in a series of segments. The computer works on one segment at a time and continues operating this way until the program is finished. 3. The ability of an executing program to call another program that resides on a disk.

**chaining search**—A search technique in which each item contains an identifier for locating the next item to be considered.

**chain printer**—In a computer, a high-speed printer having type slugs carried on the links of a revolving chain.

**chain radar beacon**—A radar beacon with a very fast recovery time, so that simultaneous interrogation and tracking of the beacon by a number of radars is possible.

**chain radar system**—A radar system comprising a number of radars or radar stations located at various sites along a missile flight path. These radar stations are linked together by data and communication lines for target acquisition, target positioning, and/or data-recording purposes. The target-acquisition link makes it possible for any radar to position any other radar on target.

**challenger**—*See* interrogator.

**chance failure**—*See* random failure.

**changer**—A device that plays several phonograph records in sequence automatically. It consists of a turntable, an arm, and a record stacking and dropping mechanism.

## cgs electrostatic system of units — channeling

**channel**—1. A portion of the spectrum assigned for the operation of a specific carrier and the minimum number of sidebands necessary to convey intelligence. 2. A single path for transmitting electric signals. (Note: The word *path* includes separation by frequency division or time division. *Channel* may signify either a one-way or two-way path, providing communication in either one direction only or in two directions.) *See also* alternate channel. 3. In electronic computers, that portion of a storage medium which is accessible to a given reading station. 4. The path along which information, particularly a series of digits or characters, may flow. 5. In computer circulating storage, one recirculating path containing a fixed number of words stored serially by word. 6. An area, under the silicon dioxide of a planar surface, that has been changed from one type of conductivity to the opposite type. A channel is the conductive path between the source and drain in an IGFET. Generally, channels are undesirable in other instances. Thick oxides or heavily doped regions called channel stoppers are used to prevent channels. 7. A complete sound path. A single-channel, or monophonic, system, has one channel. A stereophonic system has at least two full channels designated as left (A) and right (B). Monophonic material may be played through a stereo system; both channels will carry the same signal. Stereo material, if played on a monophonic system, will mix and emerge as monophonic sound. 8. The conducting charge layer between source and drain induced by the applied gate voltage. The charge layer is holes in a p-type device, and electrons in n-types. 9. An independent signal path. Stereo recorders have two such channels, quadraphonic ones have four. 10. A thin semiconductor layer between the source region and the drain region, whose conductance is controlled by the gate voltage. 11. The band of frequencies (including the assigned carrier frequency) within which a radio system must operate in order to prevent interference with stations on adjacent channels. 12. The part of a communications system that connects a message source to a message link; a path for electrical transmission between two or more points.

**channel balance**—Equal response on both left and right channels.

**channel bank**—1. The part of a carrier multiplex terminal in which are performed the first step of modulation of the voice frequencies into a higher-frequency band and the final step in the demodulation of the received higher-frequency band into voice frequencies. 2. Communication equipment that multiplexes, typically used for multiplexing voice-grade channels.

**channel capacity**—1. The maximum number of elementary digits that can be handled per unit time in a particular channel. 2. The maximum possible rate of information transmission through a channel at a specified error rate. It may be measured in bits per second or bauds. 3. The total number of individual channels in a system.

**channel designator**—A number assigned for reference purposes to a channel, tributary, or trunk. Also called channel sequence number.

**channel diffusion stops**—A narrow doped region beside each sensing channel in a CCD that prevents excess charges generated within a particular light-sensing site from spreading sideways.

**channel effect**—Current leakage over a surface path between the collector and emitter of some types of transistors.

**channel frequency**—The band of frequencies that must be handled by a carrier system to transmit a specific quantity of information.

**channeling**—The utilization of a modulation-frequency band for the simultaneous transmission from two

or more communication channels in which the channel separation is accomplished by the use of carriers or subcarriers, each in a different discrete frequency band forming a subdivision of the main band. This term covers a special case of multiplex transmission.

**channel interval** — The time allocated to a channel, including on and off time.

**channelization** — The assignment of circuits to channels, and the arrangement of those channels into separate groups and supergroups.

**channelizing** — The process of subdividing wideband transmission facilities for the purpose of putting many different circuits requiring comparatively narrow bandwidths on a single wideband facility.

**channel pulse** — A telemetering pulse that, by its time or modulation characteristics, represents intelligence on a channel.

**channel pulse synchronization** — Synchronization of a local-channel rate oscillator by comparison and phase lock with separate channel-synchronizing pulses.

**channel reliability** — The percentage of time that the channel meets the arbitrary standards established by the user.

**channel reversal** — Shifting the outputs of a stereo system so the channel formerly heard from the left speaker now comes from the right and vice versa.

**channel-reversing switch** — A switch that reverses the connections of two speakers in a stereo system with respect to the channels, so that the channel heard previously from the right speaker is heard from the left and vice versa.

**channel sampling rate** — The number of times per second that individual channels are sampled. This is different from comutation rate, since it is possible for more than one channel to be applied to a given commutator input (with subcommutation).

**channel selector** — A switch or dial used for selecting a desired channel.

**channel separation** — 1. In stereo, the electrical or acoustical difference between the left and right channels. Inadequate separation can lessen the stereo effect; excessive separation can exaggerate it beyond natural proportions. 2. The degree to which the two signals in a stereo system are electrically isolated. Usually expressed as a ratio in decibels. 3. The amount of stereo program material from one channel appearing in the cartridge output for the other channel. Expressed in decibels relative to the desired channel output, with values of 20 to 30 dB (the higher figure being preferable) through most of the audible frequency range being typical of good cartridges. 4. The degree to which the signal in one amplifier is kept separate from an adjacent undriven amplifier. Channel separation for FM stereo decoders is typically 40 dB, whereas phono cartridge channel separation is typically between 20 and 30 dB.

**channel sequence number** — See channel designer.

**channel shift** — The interchange of communications channels; for example, the shift from a calling frequency to a working frequency.

**channel shifter** — A radiotelephone carrier circuit by means of which one or two voice-frequency channels are shifted from normal channels to higher voice-frequency channels as a means of reducing crosstalk between channels. At the receiving end, the channels are shifted back by a similar circuit.

**channel stop** — A barrier put in place during the manufacture of a semiconductor to prevent small leakage paths going to the outside of the chip.

**channel strip** — An amplifier or other device having a sufficiently wide bandpass to amplify one television channel.

**channel subcarrier** — The channel required to convey telemetric data involving a subcarrier band.

**channel synchronizing pulse separator** — A device for separating channel synchronizing pulses from commutated signals.

**channel-to-channel connection** — A device for rapid data transfer between two computers. A channel adapter is available that permits the connections between any two channels on any two systems. Data is transferred at the rate of the slower channel.

**channel-utilization index** — In a computer, the ratio between the information rate (per second) through a channel and the channel capacity (per second).

**channel wave** — Any elastic wave propagated in a sound channel because of a low-velocity layer in the solid earth, the sea, or the atmosphere.

**character** — 1. In electronic computers, one of a set of elementary symbols that may be collectively arranged in order to express information. These symbols may include the decimal digits 0 through 9, the letters A through Z, punctuation and typewriter symbols, and any other single symbol that a computer may read, store, or write. 2. One of a set of symbols used to present information on a display tube. 3. Part of a computer word that has a meaning in itself. For example, six bits recorded across a magnetic tape make up a character and signify a number or letter symbol. 4. A combination of holes punched in a line. 5. A letter, digit, or other symbol that is used as part of the organization, control, or representation of data. A character is often in the form of a spatial arrangement of adjacent or connected strokes. 6. A symbol, mark, or event that a data-processing machine can read, write, or store. It is used to represent data to a machine. 7. An alphabetic, numeric, or special graphic symbol. Each character is represented in its set by a unique binary code. 8. A letter, number, or sign made up of a specific number of bits. Nonprinting characters may be used for control functions. 9. A language unit consisting of bits. 10. A letter, digit, or other symbol that is the representation of data. A connected sequence of characters is called a character string.

**character boundary** — In character recognition, the largest rectangle having a side parallel to the document reference edge, each of the sides of which is tangent to a given character outline.

**character check** — Verification of the observance of rules for character formation.

**character code** — A special way of using a group of bits to represent a character. Different codes may be used in different equipment according to the internal design.

**character crowding** — Also called packing. The effect of reducing the time interval between subsequent characters read from tape. It is caused by a combination of mechanical skew, gap scatter, jitter, amplitude variation, etc.

**character density** — A measure of the number of recorded characters per unit of length or area.

**character display tube** — A form of cathode-ray tube in which the cathode-ray beam can be shaped, either by electrostatic or electromagnetic deflection or by passing the beam through a mask, into symbols or letters.

**character emitter** — In a computer, an electromechanical device that puts out coded pulses.

**character generator** — 1. A unit that accepts input in the form of one of the alphanumeric codes and prepares the electrical signals necessary for its display in the proper position on a dot matrix, TV system, or CRT. 2. That part of the display controller that draws alphanumeric

characters and special symbols for the screen. A character is automatically drawn and spaced every time a character code is interpreted. 3. A hardware or software device that provides the means for formulating a character font and that also may provide some controlling function during printing. 4. A circuit that generates the letters or numbers on a display or printer. 5. A device that superimposes text over a video image, such as program credits at the end of a program.

**character-generator cathode-ray tube** — A cathode-ray tube that generates symbols for use in other displays. Basically, the tube operates by scanning specific characters on the target and generating them as video signals to other cathode-ray systems.

**character-graphics color system** — A system that can address color only to a block of pixels (character cell); all pixels within this block have the same color.

**character interleave** — Also byte interleave. A technique in time-division multiplexing in which bytes of data are transmitted in one frame.

**characteristic** — 1. An inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electromagnetic, or nuclear; it can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values (usually in graphical form). 2. The integral part of a logarithm to the base 10; also, the power of 10 by which the significant digits of a floating-point number are multiplied.

**characteristic curve** — 1. A graph plotted to show the relationship between changing values. 2. A plot of how any value changes with respect to another in a component or circuit: for example, a plot of how current changes as voltage is changed on a component or circuit.

**characteristic distortion** — 1. Displacement of signal transitions due to the persistence of transients caused by preceding transitions. 2. Repetitive displacement or disruption peculiar to specific parts of a teletypewriter signal. The two types of characteristic distortion are line and equipment.

**characteristic frequency** — The frequency that can be easily identified and measured in a given emission.

**characteristic impedance** — Also called surge impedance. 1. The driving-point impedance of a line if it were of infinite length. 2. In a delay line, the value of terminating resistance that provides minimum reflection to the network input and output. 3. The ratio of voltage to current at every point along a transmission line on which there are no standing waves. 4. The square root of the product of the open-and short-circuit impedance of the line. 5. The ratio of the applied voltage to the steady-state current that flows when a transmission line is terminated in a pure resistance that is equal to the characteristic impedance value of the cable. 6. That value of pure resistance which, when connected to the output terminals of a transmission line, makes the cable appear infinitely long; i.e., no signal is reflected back up the cable toward the source. 7. The ratio of voltage to current in a propagating wave, i.e., the impedance that is offered to this wave at any point of the line. In printed wiring, its value depends on the width of the conductor, the distance from the conductor to the ground plane(s) and the dielectric constant of the media between them. 8. A property of antenna transmission lines that is determined primarily by the diameter of the conductors and the spacing between them.

**characteristic impedance of free space** — The relationship between the electric and magnetic intensities of space due to the expansion of the impedance concept to electromagnetic fields.

**characteristic spread** — The range between the minimum and maximum values for a given characteristic that is considered normal in any large group of tubes or other devices.

**characteristic telegraph distortion** — Distortion that does not affect all signal pulses alike. Rather, the effect on each transition depends on the signal previously sent, because remnants of previous transitions or transients persist for one or more pulse lengths.

**characteristic wave impedance** — The ratio of the transverse electric vector to the transverse magnetic vector at the point it is crossed by an electromagnetic wave.

**character parity** — Adding an overhead bit to a character code to provide error-checking capability.

**character reader** — A computer input device that can directly recognize printed or written characters; they need not first be converted into punched holes in cards or paper or into polarized magnetic spots.

**character read-out systems** — Photoelectrically controlled, alphanumeric reading devices that convert characters to audible or sorting signals that can be fed to a computer, electric typewriter, tape punch, or other machine.

**character recognition** — The automatic identification of graphic, phonic, or other characters. *See also* magnetic-ink character recognition; optical character recognition.

**character sensing** — To detect the presence of characters optically, magnetically, electrostatically, etc.

**character set** — 1. An ordered group of unique representations called characters, such as the 26 letters of the English alphabet, 0 and 1 of the Boolean alphabet, the signals in the Morse code alphabet, the 128 characters of the U.S. ASCII alphabet, etc. 2. All the letters, numbers, and symbols used by a device or language.

**character string** — Two or more alphanumeric characters or special symbols (math, Greek, etc.) aligned in a textual format on the screen.

**character subset** — A selection from a character set of all characters having a specified common feature; for example, in the definition of a character set, the digits 0 through 9 are a character subset.

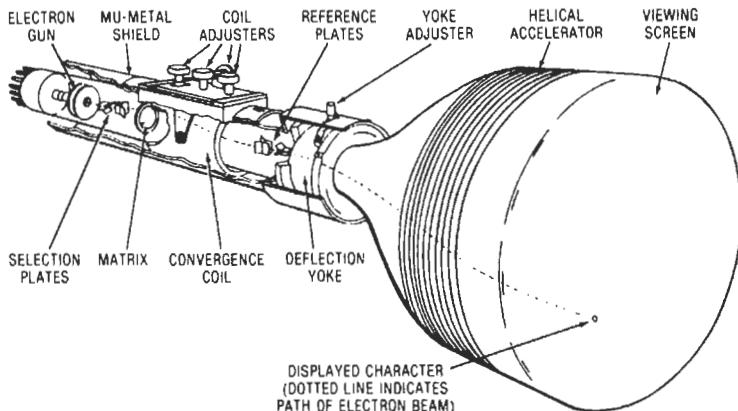
**Charactron** — Trade name of General Dynamics/Electronics for a specially constructed cathode-ray tube used to display alphanumeric characters and other special symbols directly on its screen.

**charge** — 1. The electrical energy stored in a capacitor or battery or held in an insulated object. 2. The quantity of electrical energy in (1) above. 3. In electrostatics, the amount of electricity present on any substance that has accumulated electric energy.

**charge amplifier** — 1. An operational amplifier with capacitive feedback. The output voltage that results from a charge signal input is returned to the input circuit through the feedback capacitor in the direction necessary to maintain the input circuit voltage at or near zero. Thus, the net charge input is stored in the feedback capacitor, producing a potential difference across it equal to the value of charge divided by the value of capacitance. This potential difference determines the relationship of the output voltage signal magnitude to the input charge signal magnitude. The transfer characteristic of the amplifier depends on the value of the feedback capacitor. 2. An amplifier whose output voltage is proportional to the input charge from a piezoelectric transducer.

**charge carrier** — A mobile hole or conduction electron in a semiconductor.

**charge-coupled device** — Abbreviated CCD. Semiconductor device arrayed so that the electric charge at the output end produces a stimulus to the next device.

*Charactron.*

**charge density**—The charge per unit area on a surface, or charge per unit volume in space.

**charged particle**—An ion, an elementary particle that carries a positive or negative electric charge.

**charge injection device**—See CID.

**charge injection imaging device**—See CID.

**charge offset**—During the sample-to-hold transition of a sample/hold circuit, the charge transferred to the holding capacitor because of the switching process. It is usually expressed in millivolts.

**charger**—A device used to convert alternating current into a pulsating direct current that can be used for charging a storage battery.

**charge retention**—The ability of a battery to hold its energy once it has been charged.

**charge-storage tube**—A storage tube that retains information on its surface in the form of electric charges.

**charge transfer**—The process in which an ion takes an electron from a neutral atom of the same type, with a resultant transfer of electronic charge.

**charging**—1. The process of converting electrical energy to stored chemical energy. 2. The process of storing electrical energy in a capacitor.

**charging current**—The current produced when a dc voltage is first applied to a capacitor. This current decreases exponentially with time.

**charging rate**—1. The rate of current flow used in charging a battery. 2. The rate at which charging current flows into a capacitor or capacitance-resistance circuit. Expressed in amperes, milliamperes, or microamperes.

**chart recorder**—A data recorder that provides a record of the values of a physical parameter, in the form of a graph on a piece of chart paper, either with respect to time or to some other variable. The recording system consists of essentially three elements: a transducer to convert the variable to be measured (temperature, pressure, rpm, etc.) into an electrical signal, a signal conditioner to process the signal into a form such that it may be recorded, and the recording device.

**chaser**—1. An array of elements similar to a ring except that as each successive element is switched to the “on” condition, the others remain on as well; when all stages are on, the next pulse turns them all off and the process generally repeats. 2. A repeat-cycle flasher with three or more outputs each operating in sequence to the other. Normally used on signs or displays to create a moving effect.

**chassis**—1. A sheet-metal box, frame, or simple plate on which electronic components and their associated

circuitry can be mounted. 2. The entire equipment (less cabinet) when so assembled. *See also* printed circuit board.

**chassis ground**—A connection to the metal structure that supports the electrical components that make up the unit or system.

**chat rooms**—Areas on an online service, BBS, or the Internet that allow real-time, typed-in communication with other people.

**chatter**—1. A sustained rapid opening and closing of contacts due to variations in the coil current. 2. The vibration of a cutting stylus in a direction other than the direction in which it is driven.

**chattering**—Rapid audible cyclic action within an electromechanical device.

**chatter time**—The interval of time from initial actuation of a contact to the end of chatter.

**cheater cord**—An extension cord used to conduct power to a piece of equipment (especially a TV) by temporarily bypassing the safety interlock connector.

**check**—The partial or complete verification of the correctness of equipment operations, the existence of certain prescribed conditions, and/or the correctness of results.

**check bit**—1. A binary check digit. 2. The bit that is automatically added by the computer to an item of data when it is necessary to make it either even or odd parity. *Synonym:* parity bit.

**check character**—A character used to perform a check.

**check digit**—A digit added to each number in a coding system that allows for detection of errors in the recording of the code numbers. Through the use of the check digit and a predetermined mathematical formula, recording errors, such as digit reversal, can be noted.

**checkerboard**—See worst-case noise pattern.

**checking code**—Machine instructions that read part of a diskette to determine whether it has been copied.

**checkout**—A series of operations and calibration tests used to determine the condition and status of a system or element of the system.

**checkpoint**—1. In a computer routine, a point at which it is possible to store sufficient information to permit restarting the computation from that point. 2. The status of a long-running program is often recorded at frequent intervals called checkpoints. If something goes wrong, the program can be restarted at its last checkpoint instead of from the beginning.

**checkpoint routine**—A computer routine in which information for a checkpoint is stored.

**check problem**—A problem that, when incorrectly solved, indicates an error in the programming or operation of a computer.

**check register**—A special register provided in some computers to temporarily store transferred information for comparison with a second transfer of the same information in order to verify that the information transferred each time agrees precisely.

**check routine**—A program whose purpose is to determine whether a computer or a program is operating correctly.

**checksum**—1. In a computer, a summation of digits or bits summed according to an arbitrary set of rules and primarily used for checking purposes. 2. A value that is the arithmetic sum of all the bytes in a program or program segment. As the program is loaded, the loader computes the sum of all bytes and compares the result with the checksum. If the two values are equal, it is assumed that the program segment was loaded without error. 3. A character added after a block of  $n$  words that contains the truncated binary sum of preceding nibbles. Used to verify the integrity of data in a ROM or on a tape. 4. Error detection data in a diskette sector based on the sum of all data bits in a block; if the sums as written and as calculated do not agree, an error is reported. 5. A simple error-checking technique used in data communications.

**cheese antenna**—An antenna with a cylindrical parabolic reflector enclosed by two plates perpendicular to the cylinder and so spaced that more than one mode can be propagated in the desired direction of polarization. It is fed on the focal line.

**chelate**—A molecule in which a central inorganic ion is covalently bonded to one or more organic molecules, with at least two bonds to each molecule; used as a laser dopant.

**chemical deposition**—The process of depositing a substance on a surface by means of the chemical reduction of a solution.

**chemically deposited printed circuit**—A printed circuit formed on a base by the reaction of chemicals alone. Dielectric, magnetic, and conductive circuits can be applied.

**chemically reduced printed circuit**—1. A printed circuit formed by chemically reducing a metallic compound. 2. A printed circuit formed by the chemical erosion (etching) of portions of the metallic surface of a metal-clad insulative material.

**chemical vapor deposition**—Abbreviated CVD. A gaseous process that deposits insulating films or metal onto a wafer at elevated temperature. Often, reduced pressure is used to promote the chemical reaction.

**chemisorption**—*See* adsorption.

**CHIL**—Abbreviation for current-hogging injection logic.

**Child's law**—Also known as the three-halves power equation. It states that the current in a thermionic diode varies directly with the three-halves power of the anode voltage and inversely with the square of the distance between electrodes.

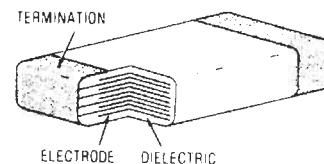
**chip**—1. The uncased and normally leadless form of an electronic component part, either passive or active, discrete or integrated. 2. A single substrate on which all the active and passive circuit elements have been fabricated using one or all of the semiconductor techniques of diffusion, passivation, masking, photoresist, and epitaxial growth. A chip is not ready for use until packaged and provided with external connectors. The term is also applied to discrete capacitors and resistors that are small enough to be bonded to substrates by hybrid techniques. 3. A tiny piece of semiconductor material, scribed or etched from a semiconductor slice, on which one or more

electronic components are formed. The total number of usable chips obtained from a wafer is the yield. 4. An unpackaged semiconductor device; a die incorporating an integrated circuit cut from a silicon wafer. By extension, every LSI package is commonly called a chip. 5. An electronic circuit element prior to having terminal connections added and prior to being encased for physical protection. 6. A single piece of semiconductor material (silicon, sapphire, germanium, etc.) containing one or more circuits, usually packaged as a unit. 7. Also called thread. In mechanical recording, the material removed from the recording medium by the recording stylus as it cuts the groove. 8. In punched cards, a piece of cardboard removed in the punching process.

**chip and wire**—A hybrid technology employing face-up bonded chip devices interconnected to the substrate conventionally, i.e., by flying wires.

**chip architecture**—The design or structure of an IC chip, incorporating arithmetic and logic unit, registers, and control-bus pathway configuration.

**chip capacitor**—1. A capacitor of which the small dimensions or the nature and configuration of its terminations render it suitable for use mainly in hybrid circuits. 2. Discrete device that introduces capacitance into an electronic circuit, made in tiny wedge or rectangular shapes to be soldered onto hybrid circuits. 3. A subminiature capacitor (usually ceramic or solid tantalum) in chip form.



*Chip ceramic (multilayer) capacitor.*

**chip carrier**—1. A low-profile component package, usually square, whose active chip cavity or mounting area is a large fraction of the package size and whose external connections are usually on the four sides of the package. 2. A physical package into which a die is mounted.

**chip component**—An unpackaged circuit element (active or passive) for use in hybrid microelectronics. Besides ICs, the term includes diodes, transistors, resistors, inductors, and capacitors.

**chip-in-tape**—An automated hybrid bonding technique that provides multiple, simultaneous bonding of leads by means of thermal and mechanical energy transmission through a deformable prepunched tape.

**chip-level integration**—The combination of two or more integrated-circuit functions and/or technologies on one IC to achieve miniaturization, reduce systems cost, and make new applications possible. Particularly important for signal processing and power control solutions.

**chip-outs**—Semiconductor die defects where fragments of silicon on the face have been chipped off in processing, leaving an active junction exposed.

**chip resistor**—A subminiature resistor formed on a small insulating substrate.

**chip set**—A set of integrated circuits that supplies all or most of the circuitry needed to build a functional item of electronic equipment. Most modems and computers are built from chip sets.

**chip sets**—The microprocessor chip in addition to RAMs, ROMs, and interface I/O devices. The chip sets

mounted on a board are also referred to as the CPU portion of the microcomputer. Also called microcontroller.

**Chireix antenna**—Also called Chireix-Mesny antenna. Resonant series-fed array of square loops with half-wave sides. The loops feed each other in cascade, corner to corner, and the antenna resembles a double zigzag.

**chirp**—1. An all-encompassing term for the various techniques of pulse expansion and pulse compression applied to pulse radar. A technique to expand narrow pulses to wide pulses for transmission, and to compress wide received pulses to the original narrow pulse width and waveshape. This improves the signal-to-noise ratio without degradation to the range resolution and range discrimination. 2. A colloquial expression for a coded pulse. In coding the pulse, the carrier frequency is increased in a linear manner for the duration of the pulse, and when the pulse is translated to an audio frequency, it sounds like a chirp. 3. A change in the pitch of code signals, generally due to poor regulation of the transmitter power supply. 4. A pulsed frequency-modulation scheme in which a carrier is swept over a wide frequency band during a given pulse interval.

**chirp modulation**—Swept-frequency modulation used in some radar and sonar equipment to increase the on-target energy and improve range resolution by making full use of the average power capability of the transmitter.

**chirp radar**—Radar in which a swept-frequency signal is transmitted, received after being returned from a target, and compressed in time to give a final narrow pulse called the chirp signal. This type of radar has high immunity to jamming and provides inherent rejection of random noise signals.

**choke**—1. An inductance used to impede the flow of pulsating direct current or alternating current by means of its self-inductance. 2. An inductance used in a circuit to present a high impedance to frequencies appreciably limiting the flow of direct current. Also called choke coil. 3. A groove or other discontinuity in a waveguide surface so shaped and dimensioned as to impede the passage of guided waves within a limited frequency range.



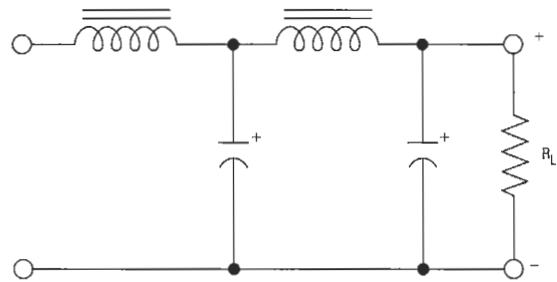
Chokes.

**choke coil**—Also called impedance coil. An inductor (reactor) used to limit or suppress the flow of alternating current without appreciable effect on the flow of direct current.

**choke flange**—A waveguide flange with a grooved surface; the groove is so dimensioned that the flange forms part of a choke joint.

**choke-input filter**—A power-supply filter in which a choke is the first element in series with the input current from the rectifier.

**choke joint**—1. A connector between two sections of transmission line in which the gap between sections to be connected is built out to form a series-branching transmission line carrying a standing wave, in which actual contact falls at or near a current minimum. 2. A joint for connecting two sections of waveguide together. Permits efficient energy transfer without the necessity of an electrical contact at the inside surface of the guide.



Choke-input filter.

**cholesteric phase**—An arrangement of liquid crystal molecules that occurs only in optically active substances and is considered to be a twisted nematic phase with a helical structure. It consists of layers resembling the smectic phase, but each layer has an order characteristic of a nematic phase.

**chopped mode**—A time-sharing method of displaying with a single CRT gun the output signals of two or more channels in sequence at a rate not referenced to the sweep.

**chopper**—1. A device for interrupting a current or a light beam at regular intervals. Choppers are frequently used to facilitate amplification. 2. An electromechanical switch for the production of modified square waves. The waves are of the same frequency as a driving sine wave and bear a definite relationship to it. 3. An electromechanical or electronic device used to interrupt a dc or low-frequency ac signal at regular intervals to permit amplification of the signal by an ac amplifier. It may also be used as a demodulator to convert an ac signal to dc. 4. A rotating shutter for interrupting an otherwise continuous stream of particles. Choppers can release short bursts of neutrons with known energies. Used to measure nuclear cross sections.

**chopper amplifier**—A circuit that amplifies a low-level signal after it has gone through a chopper.

**chopper stabilization**—1. The addition of a chopper amplifier to the regulator input circuitry of a regulated power supply in order to reduce output drift. 2. A method of improving the dc drift of an amplifier by utilization of chopper circuits.

**chopper-stabilized amplifier**—1. An amplifier configuration utilizing a carrier-type dc amplifier to reduce the effect of input offset and drift of a direct-coupled amplifier. 2. An amplifier in which the dc input is chopped, simulating ac in order to overcome amplifier dc drift.

**chopping**—Removal by electronic means of one or both extremities of a wave at a predetermined level.

**chopping frequency**—The frequency at which a chopper interrupts a signal.

**chord**—A harmonious combination of tones sounded together through the use of one or more fingers on either or both hands. On chord organs, a full chord is selected by depressing a single chord button.

**chord organ**—An organ with provision for playing a variety of chords, each produced by means of a single button or key.

**chorus**—A natural electromagnetic phenomenon in the VLF range. Probably originates in the exosphere. Also called dawn chorus because it sounds like birds at dawn. It generally consists of a multitude of rising tones, each tone rising from 1–2 kHz to 3–4 kHz and usually lasting 0.1 to 0.5 second.

**Christiansen antenna**—A radiotelescope composed of two interferometer arrays placed at right angles. It resembles a Mills cross antenna.

**Christmas-tree pattern**—1. See optical pattern. 2. A pattern resembling a Christmas tree, sometimes produced on the screen of a television receiver when the horizontal oscillator falls out of sync.

**chroma**—1. That quality which characterizes a color without reference to its brightness; that quality which embraces hue and saturation. White, black, and gray have no chroma. 2. The quality of light perception that includes color and its purity. The purity of a color varies inversely with the amount of noise, that is, white light, mixed with it. Thus pink, red, and deep-red describe chromas for the visible wavelength in the vicinity of 650 nm. In parlance more relevant to optics, chroma pertains to the response of the eye to the combined effects of hue and saturation.

**chroma-clear raster**—Also called white raster. Looks like a clear raster, but each of the three guns in the CRT is operating under the influence of a color level determined by a white video signal. In this case, all TV set chroma circuits are working as though the TV set were receiving a color transmission of a completely white scene.

**chroma control**—A variable resistor that controls saturation by varying the level of chrominance signal fed to the demodulators of a color television receiver.

**chroma detector**—A circuit that detects the absence of chrominance information in a color encoder input. The chroma detector automatically deletes the color burst from the color encoder output when the absence of chrominance is detected.

**chromatic aberration**—1. An effect that causes refracted white light to produce an image with colored fringes due to the various colors being bent at different angles. 2. An optical lens defect that causes light-color separation because the optical material focuses different light colors at different points. A lens without this defect is said to be achromatic.

**chromaticity**—1. The combination of the hue and saturation attributes of color. 2. A term quantitatively descriptive of a color, and dependent on both hue and saturation, but without reference to brilliance.

## Christiansen antenna — chrominance signal

**chromaticity coordinates**—Proportions of standard primaries (tristimulus values) required for a color match; ratios of each tristimulus value of a color to their sum. In the CIE calorimetric system, designated X, Y, and Z.

**chromaticity diagram**—A plane diagram formed when any one of the three chromaticity coordinates is plotted against another.

**chromaticity flicker**—The flicker that results from fluctuation of the chromaticity only.

**chromatron**—A color kinescope that has a single electron gun and whose color phosphors are laid out in parallel lines on its screen. The electron beam is directed to the correct phosphor by a deflection grid or wire grill near the face of the tube.

**chrominance**—1. Calorimetric difference between any color and a reference color having a specified chromaticity. In standard color-television transmission, the specified chromaticity is that of the zero subcarrier. 2. Pertaining to chroma, that is, to the mix of color and white light. Thus, pale pink may be either more or less bright than its pure constituent, red. An example of this is seen in a TV receiver, wherein the color signal is processed in the chrominance channel, but the brightness information is handled separately in the luminance channel. 3. A color term defining the hue and saturation of a color. Does not refer to brightness. 4. The hue and saturation of a color. The chrominance signal is modulated onto a 4.43 MHz carrier in the PAL television system and a 3.58 MHz carrier in the NTSC television system.

**chrominance amplifier**—The amplifier that separates the chrominance signal from the total video signal.

**chrominance cancellation**—A cancellation of the brightness variations produced by the chrominance signal on the screen of a monochrome picture tube.

**chrominance-carrier reference**—A continuous signal having the same frequency as the chrominance subcarrier, and a fixed phase with the color burst. The phase reference of carrier chrominance signals for modulation or demodulation.

**chrominance channel**—In color television, a combination of circuits designed to pass only those signals having to do with the reproduction of color.

**chrominance component**—Either of the I and Q signals that add to produce the complete chrominance signal in NTSC systems.

**chrominance contrast**—The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

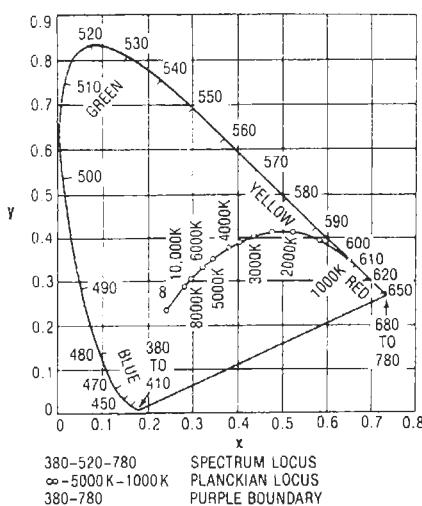
**chrominance demodulator**—A demodulator used in color-television reception for deriving video-frequency chrominance components from the chrominance signal and a sine wave of the chrominance subcarrier frequency.

**chrominance gain control**—In red, green, and blue matrix channels, variable resistors that individually adjust the primary-signal levels. Used in color television.

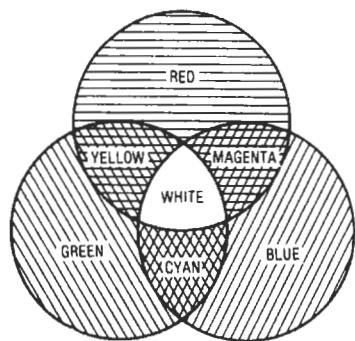
**chrominance modulator**—A modulator used in color-television transmission for generating the chrominance signal from the video-frequency chrominance components and the chrominance subcarrier.

**chrominance primary**—One of two transmission primaries, the amounts of which determine the chrominance of a color. Chrominance primaries have zero luminance and are not physical.

**chrominance signal**—1. The chrominance-subcarrier sidebands added to a monochrome television signal to convey color information. The components of the chrominance signal represent hue and saturation but do not include luminance or brightness. 2. That portion of



Chromaticity diagram.



Chrominance primaries.

the total video signal that contains the color information. Without the chrominance signals, the received TV picture would be in black and white.

**chrominance subcarrier** — Also called color carrier. An rf signal that has a specific frequency of 3.579545 MHz and that is used as a carrier for the I and Q signals.

**chrominance-subcarrier oscillator** — In a color TV receiver, a crystal-controlled oscillator that generates the subcarrier signal for use in the chrominance demodulators.

**chrominance video signals** — Output voltages from the red, green, and blue sections of a color-television camera or receiver matrix.

**chromium dioxide** — A type of recording-tape coating that produces very good quality at low recording speeds. Because of its magnetic properties, it requires a higher value of bias current in the recorder. The high performance inherent in chromium dioxide tape can only be realized in a tape machine having provision for a CrO<sub>2</sub> bias setting. On a standard recorder, the chromium dioxide tape will appear to have high-frequency emphasis and may likely be difficult to erase. Chromium dioxide has a good dynamic range and a low noise level. Used in the cassette format with a suitable machine equipped with the Dolby system, it can make recordings that meet the best high-fidelity standards.

**chronistor** — A subminiature elapsed-time indicator that uses electroplating principles to totalize the operating time of equipment up to several thousand hours.

**chronograph** — An instrument for producing a graphical record of time as shown by a clock or other device.

**chronoscope** — An instrument for measuring very small intervals of time.

**CID** — Abbreviation for charge injection device or charge injection imaging device. 1. A memory in which the charge is stored in an X-Y addressable array of potential cells. For image arrays, the charge for each of the cells is generated by an associated photodiode. 2. A solid-state imaging device utilizing an image sensor composed of a two-dimensional array of coupled MOS charge-storage capacitors and designed to convert near infrared energy to electrical signals, providing broad gray shade or tonal rendition. The sensor collects minority carrier charge, generated by photon energy in the substrate near the charge-storage capacitors, and stores it in the surface inversion region. By injecting the stored charge into the substrate, and by monitoring the current, signal readout is achieved.

**CIE** — Initials of the Commission Internationale de l'Éclairage, or International Commission on Illumination.

**CIE source** — Standard light source representative of the quality of specified natural or artificial illumination.

**CIE standard chromaticity diagram** — A chromaticity diagram in which the X and Y chromaticity coordinates are plotted in rectangular coordinates.

**CIM** — Abbreviation for computer-integrated manufacturing. Applying information technology to production processes and organizational structure to streamline operations. Often focused on integrating systems and processes distributed across a company, such as order entry, scheduling, and production.

**cinching** — Longitudinal slippage between the layers in a tape pack as a result of acceleration or deceleration of the roll.

**cipher** — Cryptographic system in which arbitrary symbols or groups of symbols represent units of plain text of regular length, usually single letters, or in which units of plain text are rearranged, or both, according to certain predetermined rules.

**cipher machine** — Mechanical and/or electrical apparatus for enciphering and deciphering.

**cipher telephony** — A technique by which mechanical and/or electrical equipment is used for scrambling or unscrambling, or enciphering or decoding, radio or voice messages.

**ciphertext or cryptogram** — A secret form of a message.

**ciphony** — See cipher telephony.

**circle cutter** — A tool consisting of a center drill with an adjustable extension-arm cutter, used to cut holes in panels and chassis.

**circle-dot mode** — A method of storage of binary digits in a cathode-ray tube in which one kind of digit is represented by a small circle on the screen, and the other kind is represented by a similar circle with a concentric dot.

**circle of confusion** — The circular image of a point source due to the inherent aberrations in an optical system.

**circotron amplifier** — A one-port, nonlinear cross-field high-power microwave amplifier that uses a magnetron as a negative-resistance element, much as a maser uses an active material.

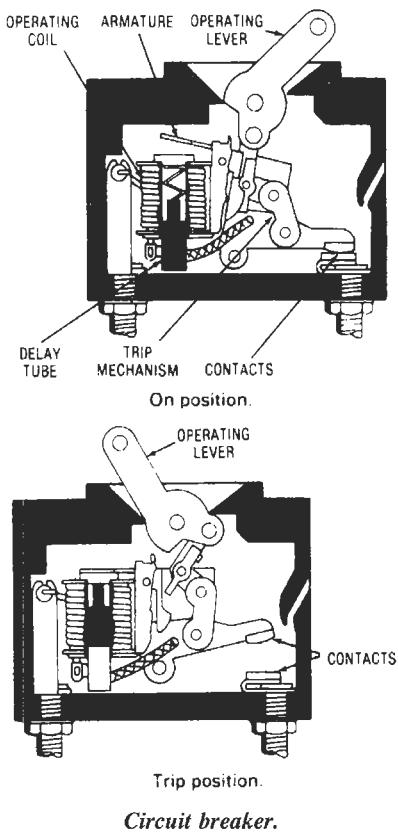
**circuit** — 1. Path through which electrical signals flow. 2. An electronic path between two or more points capable of providing a number of channels. 3. A number of conductors connected together for the purpose of carrying an electrical current. 4. The interconnection of a number of devices in one or more closed paths to perform a desired electrical or electronic function. Examples of simple circuits are high- or low-pass filters, multivibrators, oscillators, and amplifiers. 5. A complete path of electron flow from a negative terminal of voltage source through a conductor and back to the positive terminal. 6. An electrical system using two or more wires in which the current flows from the source to one or more electrical devices and back again to the source of supply. 7. A complete, closed path. Confusion between circuit and network is common. *Circuit* refers to a closed path within a network. 8. An array of elements interconnected to perform functions beyond the range of single-element capability. See channel, 2.

**circuit analysis** — Careful determination of the nature and behavior of a circuit and its various parts. The analysis may be theoretical, practical, or both.

**circuit analyzer** — Also called multimeter. Several instruments or instrument circuits combined in a single enclosure and used in measuring two or more electrical quantities in a circuit.

**circuit bonding jumper** — The connection between portions of a conductor in a circuit to maintain required ampacity of the circuit.

**circuit breaker** — 1. An automatic device that, under abnormal conditions, will open a current-carrying circuit

*Circuit breaker.*

without damaging itself (unlike a fuse, which must be replaced when it blows). 2. A device for interrupting a circuit under normal or abnormal conditions by means of separable contacts. 3. An electromagnetic device that opens a circuit automatically when the current exceeds a predetermined value. It can be reset by operating a lever or by other means.

**circuit-breaker cascade system**—A system wherein the protective devices are arranged in order of ratings such that those in series will coordinate and provide the required protection.

**circuit capacity**—The number of communication channels that can be handled by a given circuit at the same time.

**circuit card**—A printed circuit board containing electronic components.

**circuit commutated turn-off time**—The time interval between the instant when the principal current has decreased to zero after external switching of the principal voltage circuit and the instant when a thyristor is capable of supporting a specified rate of rise of on-state voltage without turning on.

**circuit component**—An element of a circuit, such as a resistor, capacitor, diode, inductor, transformer, integrated circuit, or transistor.

**circuit density**—The number of equivalent transistors per unit area of a IC chip.

**circuit diagram**—A drawing in which symbols and lines represent the components and wiring of an electronic circuit. Also called circuit schematic. *See* schematic diagram.

**circuit dropout**—A momentary interruption of a transmission because of the complete failure of a circuit.

**circuit efficiency (of the output circuit of electron tubes)**—Ratio of the power, at the desired frequency, delivered to a load at the output-circuit terminals of an oscillator or amplifier to the power, at the desired frequency, delivered to the output circuit by the electron stream.

**circuit element**—1. Any basic constituent of a circuit except the interconnections. 2. A discrete unit of resistance, inductance, or capacitance that, when two or more are interconnected, forms an electric circuit.

**circuit hole**—On a printed circuit board, a hole that lies partially or completely within the conductive area.

**circuit noise**—The noise brought to the receiver electrically from a telephone system, but not the noise picked up acoustically by the telephone transmitters.

**circuit noise level**—At any point in a transmission system, the ratio of the circuit noise at that point to some arbitrary amount of circuit noise chosen as a reference. This ratio is usually expressed in decibels above reference noise, abbreviated dB<sub>rn</sub>, signifying the reading of a circuit-noise meter; or in adjusted decibels, abbreviated dB<sub>a</sub>, signifying the circuit-noise meter reading adjusted to represent interfering effect under specified conditions.

**circuit-noise meter**—Also called noise-measuring set. An instrument for measuring the circuit noise level. Through the use of a suitable frequency-weighting network and other characteristics, the instrument gives equal readings for noises of approximately equal interference. The readings are expressed in decibels above the reference noise.

**circuit parameters**—The values of the physical quantities associated with circuit elements; for example, the resistance (parameter) of a resistor (element), or the inductance per unit length (parameter) of a transmission line (element).

**circuit protection**—Automatic protection of a consequence-limiting nature used to minimize the danger of fire or smoke, as well as the disturbance to the rest of the system, that may result from electrical faults or prolonged electrical overloads.

**circuit Q**—The quality factor of a circuit, equal to the ratio of the circuit reactance to the circuit resistance. In a tuned resonant circuit, it determines the selectivity of the circuit; the higher the *Q*, the more selective the circuit.

**circuit reentrancy**—*See* reentrancy, 1.

**circuit reliability**—The percentage of time the circuit meets arbitrary standards set by the user.

**Circutron**—A combination of active and passive components mounted in a single tube-type envelope and functioning as one or more complete operating stages.

**circuit switching**—A communication method in which an electrical connection between calling and called stations is established on demand for exclusive circuit use until the connection is released.

**circuit synthesis**—The development of a circuit by the use of theoretical or practical knowledge of basic electronics principles and component parameters. Compare *circuit analysis*.

**circular antenna**—A horizontally polarized antenna derived essentially from a half-wave antenna but having its elements bent into a circle.

**circularly polarized loop vee**—An airborne communications antenna that provides an omnidirectional radiation pattern for use in obtaining optimum near-horizon communications coverage.

**circularly polarized wave**—Applied usually to transverse waves. An electromagnetic wave for which the electric and/or magnetic field vector at a point describes a circle.

**circular magnetic wave**—A wave with circular magnetic lines of force.

**circular mil**—A unit of area equal to the area of a circle whose diameter is 1 mil (0.001 in or 25.4 µm); equal to square mil × 0.78540. Used chiefly in specifying cross-sectional areas of round conductors.

**circular mil area**—The square of the diameter of a round conductor measured in thousandths of an inch. The circular mil area of a braid is the sum of the circular mil area of each of the wires that make up the braid.

**circular polarization**—1. Polarization such that the vector representing the wave has a constant magnitude and rotates continuously about a point. 2. Simultaneous transmission of vertically and horizontally polarized radio waves. 3. A method of transmitting signals in a rotating corkscrew-like pattern. Both right-hand rotating and left-hand rotating signals can be transmitted simultaneously on the same frequency, thereby doubling the capacity of a satellite to carry communications channels. 4. Polarization of electromagnetic waves whose electric field rotates uniformly along the signal path. Broadcasts used by Intelsat and other international satellites use circular polarization, not horizontally or vertically polarized waves as are common in North American and European transmissions.

**circular scanning**—Scanning in which the direction of maximum radiation generates a plane or a right circular cone with a vertex angle close to 180°.

**circular trace**—A CRO time base produced by applying sine waves of the same frequency and amplitude, but 90° out of phase, to the horizontal- and vertical-deflection plates of a cathode-ray tube. This results in a circular trace, and signals then give inward or outward radial deflections from the circle.

**circular waveguide**—A waveguide having a circular cross-sectional area.

**circulating memory**—1. *See* circulating register. 2. A type of memory in which a data stream circulates in a loop. One example is a string of shift-register stages with the last output connected to the first input. At every clock pulse, a particular bit would be accessed as it passed a certain point in the circuit. Circulating memories also use other delay techniques, including electrical and acoustical delay lines.

**circulating register**—Also called circulating memory. A register (or memory) consisting of a means for delaying the information and a means for regenerating and reinserting it into the delaying means. This is accomplished as the information moves around a loop and returns to its starting place after a fixed delay.

**circulating storage**—A device using a delay line to store information in a train or pattern of pulses. The pulses at the output end are sensed, amplified, reshaped, and reinserted into the input end of the delay line.

**circulator**—1. A microwave coupling device having a number of terminals so arranged that energy entering one terminal is transmitted to the next adjacent terminal in a particular direction. 2. An arrangement of phase shifters and waveguide or coax that distributes incoming signals among selected outputs. For example, a four-port circulator will transfer a signal entering from port 1 to port 2. In turn, a signal entering port 2 will leave only by port 3. A signal entering port 3 will leave by port 4, and a port-4 entering signal leaves by port 1. Can be used to isolate a transmitter and receiver when both are connected to the same antenna.

**circumferential crimp**—The type of crimp in which symmetrical indentations are formed in a barrel by crimping dies that completely surround the barrel.

**circumaural**—A headphone in which the earpiece completely surrounds the wearer's ear and is sealed to the head to provide tight bass coupling.

**CISC**—Abbreviation for complex instruction set computer. A type of computer architecture that has long/complex instructions that are general purpose and powerful, but considered to be slower than RISC computers. Intel x 86 chips are CISC technology.

**Citizens band**—Abbreviated CB. A band of radio frequencies allocated to the Citizens Radio Service.

**Citizens Radio Service**—A radiocommunications service of fixed, land, and mobile stations intended for short-distance personal or business radiocommunications, radio signaling, and control of remote objects or devices by radio; all to the extent that these uses are not specifically prohibited by the FCC rules and regulations.

**cladding**—1. A covering for the core of an optical fiber that provides optical insulation and protection. Generally fused to the fiber, it has a low index of refraction. 2. In fiber optics, a sheathing of a lower

#### Citizens band channels (Class D)

Channel No.	Frequency (MHz)
1	26.965
2	26.975
3	26.985
4	27.005
5	27.015
6	27.025
7	27.035
8	27.055
9	27.065
10	27.075
11	27.085
12	27.105
13	27.115
14	27.125
15	27.135
16	27.155
17	27.165
18	27.175
19	27.185
20	27.205
21	27.215
22	27.225
23*	27.255
24	27.235
25	27.245
26	27.265
27	27.275
28	27.285
29	27.295
30	27.305
31	27.315
32	27.325
33	27.335
34	27.345
35	27.355
36	27.365
37	27.375
38	27.385
39	27.395
40	27.405

\*Shared with Class C radio control

refractive index material, intimately in contact with the core of a higher refractive index material, that serves to provide optical insulation and protection to the reflection interface. 3. A method of applying a layer of metal over another metal whereby the junction of the two metals is continuously welded. 4. A relatively thin layer or sheet of metal foil that is bonded to a laminate core to form the base material for printed circuits.

**clamp** — See clamping circuit.

**clamper** — See clamping circuit.

**clamping** — The process that establishes a fixed level for the picture signal at the beginning of each scanning line.

**clamping circuit** — A circuit that adds a fixed bias to a wave at each occurrence of some predetermined feature of the wave. This is done to hold the voltage or current of the feature at (clamp it to) a specified fixed or variable level. *See also* dc restorer.

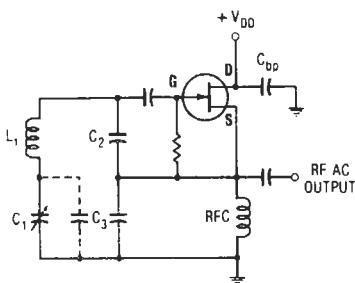
**clamping diode** — A diode used to fix a voltage level at some point in a circuit.

**clamp-on** — See camp-on.

**clamp-on ammeter** — An ac ammeter with a built-in current transformer whose core can be clamped around the conductor in which current is to be measured.

**clapper** — 1. A hinged or pivoted armature. 2. In a bell, the ball or hammer that strikes the bell; in an electric bell, it is attached to the vibrating armature.

**Clapp oscillator** — A Colpitts-type oscillator using a series-resonant tank circuit for improved stability.



Clapp oscillator.

**clarifier** — A control on an SSB transceiver that enables adjustment of frequency so that the frequencies of the recovered audio signal will be essentially the same as the frequencies of the modulating signal fed to a distant transmitter. It is carefully adjusted so the received signal sounds natural. Its effective range is usually  $\pm 600$  to  $\pm 1500$  Hz.

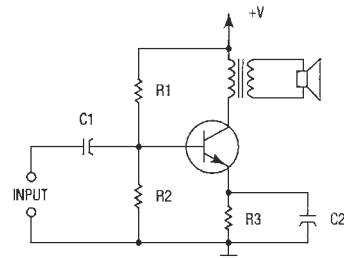
**Clark cell** — An early standard cell that used an anode of mercury, a cathode of zinc amalgam, and an electrolyte containing zinc sulfate and mercurous sulfate. Its voltage is 1.433 at a temperature of 15°C.

**Clarke belt** — The circular orbital belt at 22,238 miles (35,863 kilometers) above the equator, named after the writer Arthur C. Clarke, in which satellites travel at the same speed as the earth's rotation. Also called the geosynchronous or geostationary orbit.

**Clarke orbit** — That circular orbit in space 22,238 miles from the surface of the earth at which geosynchronous satellites are placed. This orbit was first postulated by the science fiction writer Arthur C. Clarke in *Wireless World* magazine in 1945. Satellites placed in these orbits, although traveling around the earth at thousands of miles an hour, appear to be stationary when

viewed from a point on earth because the earth is rotating upon its axis at the same angular rate that the satellite is traveling around the earth. *See also* geostationary.

**class A amplifier** — 1. A class of service of a power-amplifier stage in which both bias and drive signal (to be amplified) are adjusted to allow continuous output current at all times. Current through the load resistor generates the output voltage. Efficiency is low — theoretically reaching 50 percent for a pure sine wave, but in practice generally hovering between 20 and 30 percent. This class of service is generally limited to selected audio applications, amateur single-sideband linear rf service, and some CB. 2. An amplifier in which the grid bias and alternating grid voltage are such that plate current flows at all times. To denote that no grid current flows during any part of the input cycle, the suffix "1" is sometimes added to the letter or letters of the class identification. The suffix "2" denotes that grid current flows during part of the input cycle. 3. An amplifier in which the output transistors or tubes are operating permanently on linear portions of their transfer characteristics. Efficiency is low, but a constant current is drawn from the power supply whatever the signal level. Usually recognized by the use of a single transistor or tube driving the loudspeaker. 4. Operation that implies biasing the tubes or transistors to the middle parts of their transfer characteristics so that the device is driven upward on one half-cycle and downward on the other half-cycle. In a push-pull power amplifier, one of the device pair is driven upward on negative half-cycles while its partner is driven downward, the mode reversing on the positive half-cycles. The stage thus draws a constant current at all drive levels within the dynamic range of the amplifier. A class A power amplifier has an efficiency of almost 50 percent. 5. For a transistor amplifier, an amplifier with a single output device that has collector current for the full  $360^\circ$  of the input cycle.



Class A amplifier.

**class AB amplifier** — 1. An amplifier in which the grid bias and alternating grid voltage are such that plate current flows for more than half but less than the entire electrical cycle. To denote that no grid current flows during any part of the input cycle, the suffix "1" is sometimes added to the letter or letters of the class identification. The suffix "2" denotes that grid current flows during part of the cycle. 2. One type of power amplifier engineered so that at low drive level the stage operates at class A, while at increasing drive level the mode changes to class B.

**class A computing device** — A computing device for use in a commercial, industrial, or business environment, exclusive of any device marketed for use by the general public or intended to be used in the home.

**class A0 emission** — The incidental radiation of an unmodulated carrier wave from a station.

**class A1 emission**—A carrier wave (unmodulated by an audio frequency) keyed normally for telegraphy to transmit intelligence in the International Morse code at a speed not exceeding 40 words per minute (the average word is composed of five letters).

**class A2 emission**—A carrier wave that is amplitude modulated at audio frequencies not exceeding 1250 hertz. The modulated carrier wave is keyed normally for telegraphy to transmit intelligence in the International Morse code at a speed not exceeding 40 words per minute, the average word being composed of five letters.

**class A3 emission**—A carrier wave that is amplitude modulated at audio frequencies corresponding to those necessary for intelligible speech transmitted at the speed of conversation.

**class A GFCI**—A ground fault circuit interrupter that will trip when a fault current to ground is 5 milliamperes or more.

**class A insulating material**—A material or combination of materials, such as cotton, silk, and paper, suitably impregnated, coated, or immersed in a dielectric liquid such as oil. Other materials or combinations of materials may be included if shown to be capable of satisfactory operation at 105°C.

**class A modulator**—A class A amplifier used for supplying the signal power needed to modulate the carrier.

**class A operation**—Operation of a vacuum tube with grid bias such that plate current flows throughout 360° of the input cycle.

**Class A signal area**—A strong TV signal area, defined by the FCC as receiving a signal strength equal to or greater than approximately 2500 microvolts per meter for channels 2 through 6, 3500 microvolts per meter for channels 7 through 13, and 5000 microvolts per meter for channels 14 through 69.

**Class A station**—A station in the Citizens Radio Service licensed to be operated on an assigned frequency in the 460- to 470-MHz band with input power of 60 watts or less.

**class A transistor amplifier**—1. An amplifier in which the input electrode and alternating input signal are biased so that output current flows at all times. 2. An amplifier with a single output device that has collector current for the full 360° of the input cycle.

**class B amplifier**—1. A power-amplifier stage that offers improved efficiency with linear performance. Class B most commonly is configured in the push-pull arrangement popular in both highly linear audio and rf amplifiers. Adjustments in bias and drive effect a 50-percent output-current duty cycle for each active element. When the collector, drain, or plate voltage is at its maximum value, the current is zero. The fact that only one active element is on at any time creates the equivalent of a continuous current source for the load. Output power is the same as for class A, but input power is proportional to average load current. Efficiency can

reach 78 percent, though usually limited to 50 or 60 percent. Amplitude of the output is independent of the supply voltage (provided the amplifier is not saturated). 2. An amplifier in which the grid bias is approximately equal to the cutoff value so that, when no exciting grid voltage is applied, the plate current will be approximately zero and will flow for approximately half of each cycle when an alternating grid voltage is applied. To denote that no grid current flows during any part of the input cycle, the suffix "1" is sometimes added to the letter or letters of the class identification. The suffix "2" denotes that grid current flows during part of the cycle. 3. An amplifier in which two transistors or tubes operate on positive and negative half-cycles of the signal waveform. Each operates from a low initial current, but this rises as the signal level increases. Usually recognized by the use of two transistors or tubes operating in antiphase to drive the loudspeaker. 4. Transistor or tube (power) amplifier whose biasing is adjusted such that the push-pull transistors (or tubes) operate at a low no-drive current (called quiescent current). When drive is applied, the current in one of the pair rises while the partner is pushed into cutoff on one half-cycle, the mode reversing on the other half-cycle.

**class B computing device**—A computing device marketed for use in a residential environment, notwithstanding use to commercial, business, and industrial environment. Examples of such devices include electronic games, personal computers, calculators, and similar electronic devices marketed for use by the general public.

**class B GFCI**—A ground-fault circuit interrupter that will trip when a fault current to ground is 20 milliamperes or more.

**class B insulating material**—A material or combination of materials such as mica, glass fiber, asbestos, etc., suitably bonded. Other materials or combinations, not necessarily inorganic, may be included if shown to be capable of satisfactory operation at 130°C.

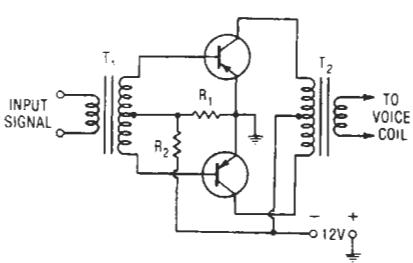
**class B modulator**—A class B amplifier used specifically for supplying the signal power needed to modulate a carrier.

**class B operation**—Operation of a vacuum tube with the triad bias set at or very near cutoff, so that plate current flows for approximately the positive half of each cycle of the input signal.

**Class B station**—A station in the Citizens Radio Service licensed to be operated on an authorized frequency in the 460- to 470-MHz band with input power of 5 watts or less.

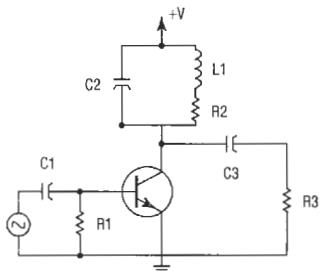
**class B transistor amplifier**—1. An amplifier in which the input electrode is biased so that when no alternating input signal is applied, the output current is approximately zero, and when an alternating input signal is applied, the output current flows for approximately half a cycle. 2. The most common type of audio amplifier, which basically consists of two output devices each of which conducts for 180° of the input cycle.

**class C amplifier**—1. A power-amplifier stage in which bias is adjusted so that drive-signal voltage produces output current for less than half of the total cycle. Class C amplifiers normally operate in a saturated condition and are insensitive to drive variations. They can be modulated by variations of the power-supply voltage because in saturation they perform as voltage sources. Efficiency can theoretically approach 100 percent, but 60 to 80 percent is typical. Because this class is highly nonlinear, it is restricted to rf applications and enjoys wide popularity in broadcast amplifier applications. 2. An amplifier in which the grid bias is appreciably beyond the cutoff point, so that plate current is zero when no alternating grid voltage is applied, and plate current flows for appreciably less



Class B audio amplifier.

than half of each cycle when an alternating grid voltage is applied. To denote that no grid current flows during any part of the input cycle, the suffix "1" is sometimes added to the letter or letters of the class identification. The suffix "2" denotes that grid current flows during part of the cycle.



*Class C amplifier.*

**class C insulating material**—Insulation consisting entirely of mica, porcelain, glass, quartz, or similar inorganic materials. Other materials or combinations of materials may be included if shown to be capable of satisfactory operation at temperatures over 220°C.

**class C operation**—Operation of a vacuum tube with grid bias considerably greater than cutoff. The plate current is zero with no input signal to the grid and flows for appreciably less than one-half of each cycle of the input signal.

**Class C station**—A station in the Citizens Radio Service licensed to be operated on an authorized frequency in the 26.96- to 27.23-MHz band, or on the frequency 27.255 MHz, for the control of remote objects or devices by radio or for the remote actuation of devices that are used solely as a means of attracting attention, or on an authorized frequency in the 72- to 76-MHz band for the control of model aircraft only.

**class C transistor amplifier**—An amplifier in which the collector current flows for less than 180° of each input cycle. Although highly efficient, high distortion results and the load is frequently tuned to minimize this distortion (primarily used in rf power amplifiers).

**class D amplifier**—1. A switching or sampling amplifier with extremely high efficiency (approaching 100 percent). The output devices are used as switches, voltage appearing across them only while they are off and current flowing only when they are saturated. 2. Also called pulse width modulator amplifier. In this amplifier a very high-frequency series of pulses are modulated in their width by the audio signal. The output stages need to conduct for a short interval only to amplify the tips of these pulses; when they do conduct, they are highly efficient—conducting as much as 90 to 95 percent. The high-frequency pulses associated with class D amplifiers (500 kHz or more) present special problems in the transistor switching speed and suitable transistor availability. 3. A power-amplifier stage in which push-pull configuration is driven as a two-position switch alternately connecting the output between  $V_{DD}$  and ground. The class D power amplifier delivers a square wave to a tuned circuit that passes only the fundamental (switching) frequency to the load. Extreme linearity and very high efficiency (approaching 100 percent) are possible. Applications consist mainly of audio and low-frequency broadcast equipment.

## class C insulating material — class J oscilloscope

**class D auxiliary power**—An uninterruptible (no-break) power unit that makes use of stored energy to provide continuous power within specified tolerances for voltage and frequency.

**Class D station**—A station in the Citizens Radio Service licensed to be operated on an authorized frequency in the 26.965- to 27.405-MHz band, with input power of 5 watts or less, and to be used for radio telephony only.

**class D telephone**—A telephone restricted to use in special classes of service, such as fire alarm, guard alarm, and watchman services.

**class E amplifier**—Another switch-mode design amplifier (*see* class D amplifier) that uses only one active element. It combines the switching action of that element with the transient response of the tuned-load network to achieve efficiencies approaching 100 percent in practice. Use has been generally limited to medium-frequency rf designs.

**class F amplifier**—A power-amplifier stage very similar to both class D and class E. Class F amplifiers differ in that the tuned output circuit introduces a third-harmonic component properly phased to improve output-power capability. This configuration achieves very high efficiencies, approaching 90 percent in rf applications.

**class F insulating material**—A material or combination of materials such as mica, glass fiber, asbestos, etc., suitably bonded. Other materials or combinations of materials, not necessarily inorganic, may be included if shown to be capable of satisfactory operation at 155°C.

**class G amplifier**—1. A power-amplifier stage in which two class B amplifiers with different supply voltages are combined. Small-amplitude signals are boosted by the one with the lower supply voltage, resulting in much higher average efficiency for speech and music. 2. An amplifier that uses a minimum of two pairs of output transistors. One pair is powered by a lower voltage supply than the other. When signal levels are relatively low, only the low-powered pair of transistors does the amplifying. When signals exceed the low-voltage supply amplitude, the other transistor pair, which operates from the higher voltage supply, takes over, while the first pair is simultaneously turned off. In this way each pair of transistors is always operating over its most efficient range, and overall amplifier efficiency is greater than with a class B design. Thus, less massive heat sinks are needed for the output transistors, and the complete amplifier or receiver is lighter in weight.

**class H amplifier**—1. An amplifier somewhat similar to class G operation that uses only one set of output transistors, but these transistors are connected to two different power-supply voltages. The lower voltage powers the output devices for low-level signals, while the higher voltage takes over when the input signal amplitudes exceed the limits of the low-voltage supply. As in class G, this approach results in a more efficient use of the output transistors, and the audio signals themselves do not have to be switched from one device to another during the process. 2. A power-amplifier stage in which the supply voltage of the class B amplifier is varied by an efficient class S amplifier so it remains just above the minimum value required to prevent saturation. This configuration also achieves much higher average efficiency for speech and music signals.

**class H insulating material**—A material or combination of materials, such as silicone elastomer, mica, glass fiber, asbestos, etc., suitably bonded. Other materials or combinations of materials may be included if shown to be capable of satisfactory operation at 180°C.

**class J oscilloscope**—*See* J-scope.

**class O insulating material**—An unimpregnated material or combination of materials, such as cotton, silk, or paper. Other materials or combinations of materials may be included if shown to be capable of satisfactory operation at 90°C.

**class S amplifier**—A pulse-width-modulated audio amplifier in which the active elements are switched by a control frequency several times higher than the signal frequency being amplified. Class S offers an ideal efficiency of 90 percent.

**clavier**—Any keyboard, either hand or foot operated.

**clean room**—A confined area in which the humidity, temperature, and particulate matter are precisely controlled within specified units. The class designation of the clean room defines the maximum number of particles of 0.3-micron size or larger that may exist in one cubic foot of space anywhere in the designated area. For example, in a Class 1 clean room, only one particle of any kind may exist in one cubic foot of space. Newer clean rooms are typically Class 1 to 10, and are needed for manufacturing ICs with feature size close to 1 micron.

**clear**—1. Also called reset. To restore a storage or memory device to a prescribed or nonprogrammed state, usually to zero or off (empty). 2. Remove all components of a calculation in a calculator. 3. In a calculator, to erase the contents of a display, memory, or storage register. 4. As used in security work, the term *clear* is synonymous with *reset*, meaning that a latched circuit is restored to normal state. 5. Signal to reset or set all signals to an initial known state (usually zero). 6. The process of setting the contents of a register, flag, or memory location to zero. 7. To erase the contents of a display or a memory or storage register.

**clearance**—The shortest distance through space between two live parts, between live parts and supports or other objects, or between any live part and grounded part.

**clear channel**—In the standard broadcast band, a channel such that the station assigned to it is free of objectionable interference through all of its primary service area and most of its secondary service area.

**clear entry**—Remove only the last number, not the entire calculation, in a calculator.

**clear entry/clear all**—In a calculator, a key used to clear the last entry or to clear the machine completely.

**clearing**—1. Removal of a flaw or weak spot in the dielectric of a metallized capacitor by the electrical vaporization of the metallized electrode at the flaw. 2. The ability of a lightning protector to interrupt follow current before the operation of circuit fuses or breakers. In the case of a simple gap, clearing frequently requires some external assistance.

**clearing ends**—The operation of removing the sheath from the end of a cable, eliminating all moisture, and checking for crosses, shorts, and grounds in preparation for testing.

**clearing-out drop**—A drop signal associated with a cord or trunk circuit and operated by ringing current to attract the operator's attention.

**clear input**—An asynchronous input to a flip-flop used to set the *Q* output to logic zero.

**clear memory key**—Removes what is stored in a memory register of a calculator.

**clear raster**—A raster free of snow such as would be obtained in the absence of a video signal on either the cathodes or the grids of the three guns in the color CRT (mostly a function of bias conditions).

**clear terminal**—See reset terminal.

**clear to send**—See CTS.

**click**—To point a mouse pointer at a word or icon on a monitor, press a mouse button, and then release it

quickly. Clicking is usually performed to select or deselect an item or to activate a program or a program feature.

**click and pop suppressor**—An audio-signal-processing accessory. It removes or greatly reduces the audible transient sounds resulting from scratches and blemishes on the surface of a phonograph record.

**click filter**—A capacitor and resistor connected across the contacts of a switch or relay to prevent a surge from being introduced into an adjacent circuit. See also key-click filter.

**click-noise modulation**—A clipping action performed to increase the bandwidth of a jamming signal. Results in more energy in the sidebands, correspondingly less energy in the carrier, and an increase in the ratio of average power to peak power.

**client**—A software program or computer that requests information from another computer.

**client-server network**—A network that uses a central computer (server) to store data that is accessed from other computers on the network (clients).

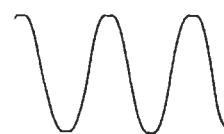
**clipboard**—A temporary storage place in a computer where text or graphics are stored.

**clipper**—A device whose output is zero or a fixed value for instantaneous input amplitudes up to a certain value, but is a function of the input for amplitudes exceeding the critical value.

**clipper amplifier**—An amplifier designed to limit the instantaneous value of its output to a predetermined maximum.

**clipper-limiter**—Also called slicer. A device whose output is a function of the instantaneous input amplitude for a range of values lying between two predetermined limits, but is approximately constant at another level for input values above the range.

**clipping**—1. The loss of initial or final parts of words or syllables due to less than ideal operation of voice-operated devices. 2. Term used to express the clipping of the peaks of a waveform when an amplifier is driven beyond its power capacity. The flattening of the tips of the sine wave due to clipping. 3. Severe distortion caused by overloading the input of an amplifier. A sine-wave signal waveform has a flat top and bottom at the peaks when clipping occurs. 4. The deforming and distortion of speech signals due to limiting the maximum amplitude of the signals. 5. The shearing off of the peaks of a signal. For a picture signal, this may affect either the positive (white) or negative (black) peaks. For a composite video signal, the sync signal may be affected. 6. Removing parts of display elements that lie outside defined bounds. Also called scissoring. 7. The loss of one or more bits at the beginning of a transmission, typically caused by a delay in line turnaround or echo suppression. (May also occur in voice communication, with the loss of the beginning of an initial syllable.)



Clipping, 3.

**clipping level**—The signal level at which clipping (distortion) just begins to occur.

**clock**—1. A pulse generator or signal waveform used to achieve synchronization of the timing of switching

circuits and the memory in a digital computer system. It determines the speed of the CPU. 2. A timing device in a system: usually it provides a continuous series of timing pulses. 3. An electronic circuit that generates timing pulses to synchronize the operation of a computer as well as keep time. 4. A strobe signal that activates a certain sequence of operations. 5. An electronic circuit or device for producing precisely timed, repetitive voltage pulses of fixed frequency and amplitude.

**clock cable**—Cable of specific impedance and electrical characteristics used to distribute the clock (master) frequency where needed in digital computers.

**clocked**—Pertaining to the type of operation in which gating is added to a basic flip-flop to permit the flip-flop to change state only when there is a change in the clocking input or an enabling level of the clocking input is present.

**clocked flip-flop**—A flip-flop circuit designed so that it is triggered only if trigger and clock pulses are present at the same time.

**clocked R-S flip-flop**—A flip-flop in which two conditioning inputs control the state the flip-flop assumes upon arrival of the clock pulse. If the S (set) input is enabled, the flip-flop assumes the logic 1 condition when clocked; if the R (reset) input is enabled, the flip-flop assumes the logic 0 condition when clocked. A clock pulse must be applied to change the state of the flip-flop.

**clock frequency**—In digital computers, the master frequency of periodic pulses that are used to schedule the operation of the computer.

**clock generator**—A test-signal generator that supplies a chain of pulses identical with those supplied by the clock circuit of a digital computer.

**clocking**—Time-synchronizing communication information.

**clock input**—That flip-flop terminal whose condition or change of conditions controls the admission of data through the synchronous inputs and thereby controls the output state of the flip-flop. The clock signal permits data signals to enter the flip-flop and, after entry, directs the flip-flop to change state accordingly.

**clock pulse**—1. The synchronization signal produced by a clock. 2. A pulse used to gate information into a flip-flop operated in the synchronous mode. (In JK flip-flops, the clock pulse causes counting if the data inputs are both held in logic 1.)

**clock rate**—1. The rate at which a word or characters of a word (bits) are transferred from one internal computer element to another. Clock rate is expressed in cycles (in a parallel-operation machine, in words; in a serial-operation machine, in bits) per second. 2. The speed (frequency) at which a processor operates, as determined by the rate at which words or bits are transferred through internal logic sequences. 3. The minimum or maximum pulse rate at which adc counters may be driven. There is a fixed relationship between the minimum conversion rate and the clock rate, depending on the converter accuracy and type. All factors that affect conversion rate of an adc limit the clock rate. 4. The time rate at which pulses are emitted from a clock.

**clock skew**—1. Phase shift in a single clock distribution system in a digital circuit. It results from different delays in clock driving elements and/or different distribution paths. 2. Unintentional time difference between clock edges; can exist between clock phases or between clock signals in different parts of a circuit.

**clock slips**—The relative shift of a system clock with respect to data in synchronous systems. Clock slips can cause modems to lose synchronization.

**clock stagger**—1. Time separation of clock pulses in a multiphase clock system. 2. Voltage separation between the clock thresholds in a flip-flop.

**clockwise-polarized wave**—See right-handed polarized wave.

**clone**—1. A PC designed to duplicate the behavior and performance of another personal computer, usually an IBM PC. 2. A copy that performs the same as the hardware, software, cellular phone, or computer on which it was based.

**close-captioned TV**—A text service for the hard-of-hearing TV audience that decodes a text subcarrier and displays it at the bottom of the TV frame on the accompanying video picture. It does not interfere with the standard audio FM subcarrier.

**close coupling**—1. Coupling between two circuits so that (a) most of the power flowing in one is transferred to the other and (b) impedance changes in one circuit greatly affect the other. 2. Also called tight coupling. Any degree of coupling greater than critical coupling.

**closed architecture**—1. A system whose characteristics are proprietary and therefore cannot be readily connected with other systems (compare with *open architecture*). 2. Equipment designed to work only with peripherals and accessories made by the same company.

**closed array**—An array that cannot be extended at either end.

**closed circuit**—1. A complete electric circuit through which current may flow when a voltage is applied. 2. A program source, audio or video, that is not broadcast for general consumption, but is fed to remote monitored units by wire.

**closed-circuit communication systems**—Certain communication systems that are entirely self-contained and do not exchange intelligence with other facilities and systems.

**closed-circuit jack**—A jack that has its through circuits normally closed. Circuits are opened by inserting a mating plug.

**closed-circuit signaling**—Signaling in which current flows in the idle conditions and a signal is initiated by increasing or decreasing the current.

**closed-circuit system**—An intrusion alarm system in which the sensors of each zone are connected in series so that the same current exists in each sensor. When an activated sensor breaks the circuit or the connecting wire is cut, an alarm is transmitted for that zone.

**closed-circuit television**—Abbreviated CCTV. 1. A television system in which the television signals are not broadcast, but are transmitted over a closed circuit and received only by interconnected receivers. 2. Transmission and reception of video signals via wire carriers.

**closed entry**—A design that places a limit on the size of a mating part.

**closed-entry contact**—A female contact designed to prevent the entry of a device that has a cross-sectional dimension greater than that of a mating pin.

**close-differential relay**—A relay whose dropout value is specified close to its pickup value.

**closed-loop**—1. A circuit in which the output is continuously fed back to the input for constant comparison. 2. In a computer, a group of indefinitely repeated instructions. 3. A system with feedback control in which the output is used to control the input. 4. An automatic control system in which feedback is used to link a controlled process back to the original command signal. The feedback mechanism compares the actual controlled value with the desired value; if there is any difference, an error signal is created that helps correct the variation. In automation, feedback closes the loop. 5. A control arrangement in

which data from the process or device being controlled is fed to the computer to affect the control operation, i.e., the computer can perform all control functions without intervention of an operator. *See also* open loop.

**closed-loop bandwidth**—The frequency at which the closed-loop gain drops 3 dB from its midband or dc value.

**closed-loop drive**—1. A tape transport mechanism in which the tape's speed and tension are controlled by contact with a capstan at each end of the head assembly. 2. A tape transport system that drives both incoming and outgoing tape in order to control the portion of the tape contacting the heads and isolate it from the reels or cassette hubs. There are several closed-loop geometries regularly used with open-reel recorders, but dual-capstan drive is the most popular for both open-reel and cassette tapes.

**closed-loop feedback**—An automatic means of sensing speed variations and correcting to maintain close speed regulation.

**closed-loop gain**—1. The response of a feedback circuit to a voltage inserted in series with the amplifier input. 2. The overall gain of an amplifier with an external negative-feedback loop.

**closed-loop input impedance**—The impedance looking into the input port of an amplifier with feedback.

**closed-loop output impedance**—The impedance looking into the output port of an amplifier with feedback.

**closed-loop system**—Automatic control equipment in which the system output is fed back for comparison with the input for the purpose of reducing any difference between input command and output response.

**closed-loop voltage gain**—The voltage gain of an amplifier with feedback.

**closed magnetic circuit**—A circuit in which the magnetic flux is conducted continually around a closed path through low-reluctance ferromagnetic materials, for example, a steel ring or a toroid core.

**closed repeater**—A repeater whose access is limited to a select group.

**closed routine**—In a computer, a routine that is entered by basic linkage from the main routine other than being inserted as a block of instructions within a main routine.

**closed subroutine**—In a computer, a subroutine not stored in the normal program sequence. Transfer is made from the program to the storage location of the subroutine, and then, following execution of the subroutine, control is returned to the main program.

**close memory**—Part of a directly addressable computer memory that provides fast cycle time and is usually employed for frequently used accesses.

**close-talking microphone**—Also called noise-canceling microphone. A microphone designed to be held close to the mouth of the speaker so that ambient noise will not degrade the speech.

**closing rating**—In a relay, conditions under which the contact must close, with a prescribed duty cycle and contact life.

**cloud absorption**—Absorption of electromagnetic radiation as a result of water drops and water vapor in a cloud.

**cloud attenuation**—Reduction in microwave radiation intensity due largely to scattering, rather than absorption, by clouds.

**cloverleaf antenna**—A nondirectional VHF transmitting antenna that consists of a number of horizontal four-element radiators arranged much like a four-leaf clover, stacked a half-wave apart vertically. These horizontal units are energized to give maximum radiation in the horizontal plane.

**club station**—A separate amateur radio station for use by the members of a bona fide amateur radio society and licensed to an amateur radio operator acting as the station trustee for the society.

**cluster**—1. A group of user terminals co-located and connected to one controller, through which each terminal accesses a communication line. 2. A unit of storage that includes one or more sectors of a floppy or hard disk.

**clustering**—In a computer, the process of grouping things with similar characteristics. A properly programmed computer can take a list of items and group them into clusters.

**clutter**—Confusing, unwanted echoes that interfere with the observation of desired signals on a radar display.

**clutter gating**—The technique that provides switching between moving-target indicators and normal video. This results in normal video being displayed in regions with no clutter, and moving-target indicator video being switched in only for the clutter areas.

**cm**—1. Abbreviation for circular mil. A system for specifying wire size by conductor area. Circular mils are obtained by multiplying the conductor diameter in inches by 1000 and squaring the result. 2. Letter symbol for centimeter.

**CML**—Abbreviation for current mode logic.

**CMOS**—*See* complementary metal-oxide semiconductor.

**CMR**—Abbreviation for common-mode rejection.

**CMRR**—Abbreviation for common-mode rejection ratio.

**CMV**—*See* common-mode voltage.

**CNC**—Abbreviation for computer numerical control. A means of operating production machines (most commonly punch presses and machining equipment) by numerical control instructions generated by CAD/CAM or from a programmable logic controller (PLC).

**C network**—A network composed of three impedance branches in series. The free ends are connected to one pair of terminals, and the junction points to another pair.

**CO**—1. Abbreviation for central office. The switching equipment that provides local-exchange telephone service for a given geographical area; designated by the first three digits of the telephone number. 2. *See* cavity oscillator.

**coarse-chrominance primary**—Also called the Q signal. A zero-luminance transmission primary associated with the minimum bandwidth of chrominance transmission and chosen for its relatively small importance in contributing to the subjective sharpness of the color picture.

**coast**—On a radar, a memory feature that, when activated, causes the range and/or angle systems to continue to move in the same direction and at the same speed as an original target was moving. Used to prevent lock-up to a stronger target if approached by the target being tracked.

**coastal refraction**—Bending of the path of a direct radio wave as it crosses the coast at or near the surface. It is caused by differences in electrostatic conditions between soil and water.

**coast station**—A land-based radio station in the maritime mobile service. It carries on communication with shipboard stations.

**coated cathode**—In a vacuum tube, a cathode that has been coated with compounds so as to increase its electron emission (e.g., an oxide-coated cathode).

**coated filament**—A vacuum-tube filament that has been coated with metal oxides to increase electron emission.

**coated tape**—*See* magnetic-powder-coated tape.

**coating**—1. The magnetic layer, consisting of oxide particles held in a binder, that is applied to the base

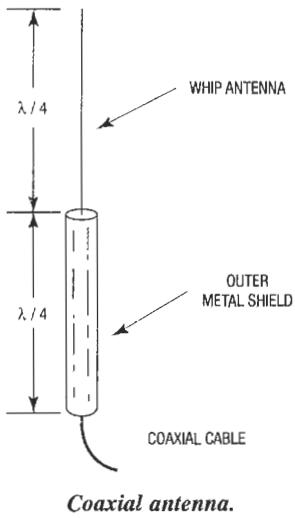
film used for magnetic recordings. 2. The magnetizable material on one surface of a recording tape that stores the (audio) signals when recording.

**coating thickness**—The thickness of the magnetic coating applied to the base film. Modern tape coatings range in thickness from 170 to 650  $\mu\text{in}$  (4.3–16.5  $\mu\text{m}$ ), with a preponderance of coatings being approximately 400  $\mu\text{in}$  (10.1  $\mu\text{m}$ ) thick. In general, thin coatings give good resolution, at the expense of reduced output at long wavelengths; thick coatings give a high output at long wavelengths, at the expense of degraded resolution.

**coax**—Abbreviation for coaxial cable.

**coaxial**—Having a common axis.

**coaxial antenna**—An antenna comprised of a quarter-wavelength extension to the inner conductor of a coaxial line, and a radiating sleeve that in effect is formed by folding back the outer conductor of the coaxial line for approximately one-quarter wavelength.



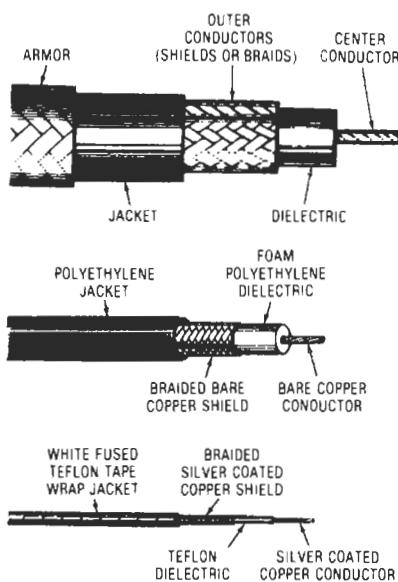
*Coaxial antenna.*

**coaxial cable**—Abbreviated coax. 1. A cylindrical transmission line made up of a central conductor (solid or stranded) inside a metallic tube or shield conductor separated by dielectric material in the form of spacers or a solid continuous extrusion. An insulating jacket is optional. 2. A cable consisting of two cylindrical conductors with a common axis. The two conductors are separated by a dielectric. The outer conductor, normally at ground potential, acts as a return path for current through the center conductor and prevents energy radiation from the cable. The outer conductor, or shield, is also commonly used to prevent external radiation from affecting the current in the inner conductor. The outer shield or conductor consists of woven strands of wire or is a metal sheath. 3. Two-conductor wire whose longitudinal axes are coincident; cable with a noise shield around a signal-carrying conductor. *See also* coaxial line.

**coaxial cavity**—A cylindrical resonating cavity that has a central conductor in contact with its movable pistons or other reflecting devices. The conductor serves to pick up a desired wave in the microwave region.

**coaxial conductor**—An electric conductor comprising outgoing and returning current paths with a common axis, with one of the paths surrounding the other throughout its length.

## coating thickness — cobalt doped



*Coaxial cable.*

**coaxial diode**—A diode that has the same outer diameter and terminations as a coaxial cable, into which the diode is designed to be inserted.

**coaxial-fed linear array**—A beacon antenna having a uniform azimuth pattern.

**coaxial filter**—A passive, linear, essentially nondissipative network that transmits certain frequencies and rejects others.

**coaxial line**—Also called coaxial cable, coaxial transmission line, and concentric line. A transmission line in which one conductor completely surrounds the other, the two being coaxial and separated by a continuous solid dielectric or by dielectric spacers. Such a line has no external field and is not susceptible to external fields from other sources.

**coaxial-line connector**—A device used to provide a connection between two coaxial lines or between a coaxial line and the equipment.

**coaxial-line frequency meter**—A shorted section of coaxial line that acts as a resonant circuit and is calibrated in terms of frequency or wavelength.

**coaxial relay**—A type of relay used for switching high-frequency circuits.

**coaxial speaker**—1. A single speaker comprising a high- and a low-frequency unit plus an electrical crossover network. 2. A tweeter mounted on the axis of and inside the cone of a woofer.

**coaxial stub**—A short length of coaxial cable joined as a branch to another coaxial cable. Frequently a coaxial stub is short-circuited at the outer end, and its length is so chosen that a high or low impedance is presented to the main coaxial cable at a certain frequency range.

**coaxial transistor**—A diffused base-alloy emitter, epitaxial mesa germanium semiconductor device with a bandwidth product up to 3 gigahertz, capable of being operated at medium power.

**coaxial transmission line**—*See* coaxial line.

**cobalt doped**—Utilizing a combination of "standard" gamma ferric oxide and cobalt as the magnetically active portion of the coating of a recording tape in order to improve maximum output level at low and high frequencies.

**COBOL**—Acronym for common business-oriented language. A higher-level computer language developed for programming business problems. Used to express problems of data manipulation and processing in English narrative form.

**co-channel interference**—Interference between two signals of the same type from transmitters operating on the same channel.

**Cockcroft-Walton accelerator**—A device for accelerating charged particles by the action of a high direct-current voltage on a stream of gas ions in a straight insulated tube. The voltage is generated by a voltage-multiplier system consisting essentially of a number of capacitor pairs connected through switching devices (vacuum tubes). The particles (which are nuclei of an ionized gas, such as protons from hydrogen) gain energies of up to several million electronvolts from the single acceleration so produced. Named for the British physicists J. D. Cockcroft and E. T. S. Walton, who developed this machine in the 1930s.

**codan**—Acronym for carrier-operated device, anti-noise. An electronic circuit that keeps a receiver inactive except when a signal is received.

**codan lamp**—A visual indication that a usable transmitted signal has been received by a particular radio receiver.

**code**—1. A communications system in which arbitrary groups of symbols represent units of plain text of varying length. Codes may be used for brevity or security. 2. System of signaling by utilizing dot-dash-space, mark-space, or some other method in which each letter or figure is represented by prearranged combinations. 3. A system of characters and rules for representing information in a language capable of being understood and used by a computer. Code can be in the form of alphanumeric characters or binary data that can be executed directly by a computer. 4. The language that translates bits into characters in the word processor; it is basically the number of bits the code uses to make up a character and the pattern in which those bits are arranged. For example, ASCII, the industry standard for non-IBM machines, uses seven bits to make up a character, whereas EBCDIC, the IBM system, uses eight bits to make up a character. Systems with different codes will interpret each other's communications incorrectly. 5. A system of using symbols to represent other information. 6. A specific way of using symbols and rules to represent information.

**codec**—Abbreviation for coder/decoder. 1. A combination device for either digitally coding an analog signal (such as a voice signal) preliminary to transmission operations or decoding a digital signal preparatory to analog processing. 2. A coding-decoding device that converts voice signals into digital bit streams and back again. 3. A complex mixture of analog and digital functions,

including (as a minimum) a band-limiting filter, S/H circuit, and nonlinear coder/decoder. 4. The related pair of digital coding and decoding functions in a pulse code modulation (PCM) telephone channel. Two codec pairs are required to complete a bidirectional channel. Each pair permits analog voice and tone signals to be multiplexed, switched, and transmitted in digitally encoded form. The subscriber loop is separated into individual transmit and receive paths by a two- to four-wire hybrid that is part of the subscriber loop interface circuit (SLIC). 5. A single integrated circuit that contains both an analog-to-digital converter (ADC) and a digital-to-analog converter (DAC). A codec performs both pulse code modulation and demodulation.

**code character**—One of the elements that makes up a code and that represents a specified symbol or value to be encoded. For example, dot-dot-dot-dash is the Morse code character for the letter V.

**code conversion**—The changing of the bit grouping for a character in one code into the corresponding bit grouping in another code.

**code converter**—1. A device for translating one code to another. Examples: ASCII to EBCDIC, Gray to BCD, Hollerith to EBCDIC, etc. 2. A decision-making type of digital building block that converts information received at its inputs to another digital code that is transmitted at its outputs. (Also called encoder or decoder.) 3. A ROM or equivalent device that changes inputs into equivalent forms in a desired output format, such as ASCII, IBM Selectric, or Baudot.

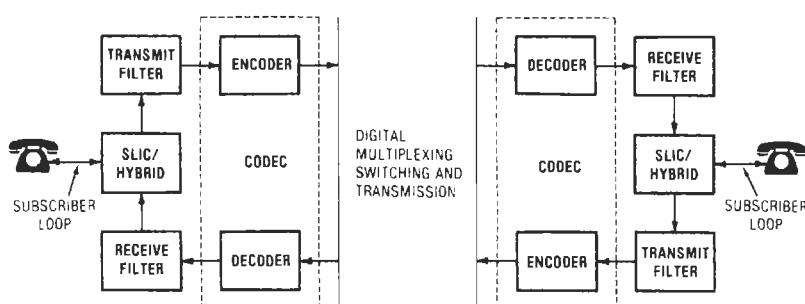
**coded-alarm system**—An alarm system in which the source of each signal is identifiable. This is usually accomplished by means of a series of current pulses that operate audible or visible annunciators or recorders or both to yield a recognizable signal. This technique is usually used to allow the transmission of multiple signals on a common circuit.

**coded decimal digit**—A decimal digit expressed in terms of four or more 1s and 0s.

**code-division multiple access**—Abbreviated CDMA. A spread-spectrum scheme, transmitting on a bandwidth much larger than needed but at a much lower level. PN (pseudorandom noise) code is used for retrieving the information. *See also CDMA.*

**coded passive reflector antenna**—An object intended to reflect Hertzian waves and having variable reflecting properties according to a predetermined code for the purpose of producing an indication on a radar receiver.

**coded program**—A description of a procedure for solving a problem with a digital computer. It may vary in detail from a mere outline of the procedure to an explicit list of instructions coded in the machine's language.



Codec.

**code element**—1. One of the finite set of parts of which the characters in a code may be composed. 2. One of the discrete conditions or events in a code, such as the presence or the absence of a pulse.

**code holes**—The holes in perforated tape that represent information, as opposed to the feed holes or other perforations.

**code-practice oscillator**—An audio oscillator with a key and either headphones or a speaker, used to practice sending and receiving Morse code.

**coder**—1. A device that sets up a series of signals in code form. 2. A beacon circuit that forms the trigger-pulse output of a discriminator into a series of pulses and then feeds them to a modulator circuit. 3. A person who prepares instruction sequences from detailed flowcharts and other algorithmic procedures prepared by others, as contrasted with a programmer, who prepares the procedures and flowcharts.

**coder/decoder**—*See* codec.

**code ringing**—In a telephone system, a method of ringing in which the number and/or duration of rings indicate which station on a party line is being called.

**code set**—1. The entire set of unique codes that represent specific characters. Different code sets are employed in different equipment. 2. A specific set of symbols and rules used to represent information. 3. All possible values of a code. For an  $n$ -bit code, the code set consists of  $2^n$  values. For example, EBCDIC, which is an eight-bit code, has 256 ( $2^8$ ) possible values. The number of characters a code set can represent may exceed the total number of possible values.

**code translation**—In telephone operation, the changing of a directory code or number into a predetermined code that controls the selection of an outgoing trunk or line.

**coding**—1. Converting program flowcharts into the language used by the computer. 2. The assignment of identification codes to transactions, such as a customer code number. 3. A method of representing characters within a computer. 4. Changing a communications signal into a form suitable for transmission or processing. 5. The preparation of a set of instructions or symbols that, when used by a programmable controller, have a special external meaning.

**coding delay**—Arbitrary time delay between pulse signals sent by master and slave transmitters.

**coding disk**—A disk with small projections that operate contacts to generate a predetermined code.

**coding form**—A form on which the instructions for programming a computer are written. Also called a coding sheet.

**coding line**—A single command or instruction that directs a computer to solve a problem, usually written on one line.

**codiphase radar**—A radar system including a phased-array radar antenna and signal-processing and beam-forming techniques.

**codistor**—A multijunction semiconductor device that provides noise-rejection and voltage-regulation functions.

**coefficient**—1. The ratio of change under specified conditions of temperature, length, volume, etc. 2. A number (often a constant) that expresses some property of a physical system in a quantitative way.

**coefficient of coupling**—*See* coupling coefficient.

**coefficient of expansion**—The fractional change in dimension of a material for a unit change in temperature.

**coefficient of reflection**—The square root of the ratio of the power reflected from a surface to the power incident on the same surface.

**coefficient of thermal expansion**—The average expansion per degree over a specified temperature range, expressed as a fraction of the original dimension. The coefficient may be linear or volumetric.

**coercive force**—Symbolized by  $H$ . The magnetizing force that must be applied to a magnetic material in a direction opposite the residual induction in order to reduce the induction to zero.

**coercivity**—1. The property of a magnetic material measured by the coercive force corresponding to the saturation induction for the material. 2. A measure of the amount of applied magnetic field (of opposite polarity) that is necessary to restore a magnetized tape to a state of zero magnetism. High-coercivity tapes exhibit less tendency toward self-erasure and thus have enhanced high-frequency response characteristics, but they require more current through the erase head for full erasure of a recorded signal.

**cofire**—To place circuits onto an unfired ceramic and fire both circuits and ceramic simultaneously.

**cofired ceramic**—A material used in making IC packages; its construction is of layers of alumina laminated and fired together to produce a high-strength monolithic structure.

**cofire**—Processing the thick-film conductors and resistors through the firing cycle at the same time.

**cogging**—1. Nonuniform angular velocity. The armature coil of a motor tends to speed up when it enters the magnetic field produced by the field coils, and to slow down when leaving it. This becomes apparent at low speeds; the fewer the coils, the more noticeable it is. 2. In a motor, the effect caused by improper ratio of stator to rotor slots for a particular speed. It is caused by a magnetic interaction between rotor and stator teeth. In dc motors it is caused by the rich ripple content of the power supply rectifier. The term *cogging torque* is usually applied to reluctance-type synchronous motors. This is the maximum torque of such a synchronous motor before starting to cog or slip, as if a gear were slipping one tooth at a time.

**coherence**—1. The property of a set of waves by which their phases are completely predictable along an arbitrarily specified surface in space; also, the relation between a set of sources by which the phases of their respective radiations are similarly predictable. 2. A term used to denote various forms of temporal or statistical phase correlations of electromagnetic fields at different spatial positions; the more extensive the correlations, the greater the coherence. *See* laser; maser. 3. The property of laser light in which the beam emitted is largely of one color or frequency. In the case of the helium-neon laser, this color is red, at 632.9 nm.

**coherent bundle**—1. A fiber-optics bundle in which each fiber maintains its relative location throughout the bundle. Thus, an image introduced at one end is transmitted to the other without being scrambled. 2. A bundle of optical fibers in which the spatial coordinates of each fiber are the same or bear the same spatial relationship to each other at the two ends of the bundle. Also called aligned bundle.

**coherent carrier**—A carrier, derived from a cw signal, the frequency and phase of which have a fixed relationship to the frequency and phase of the reference signal.

**coherent carrier system**—A transponder system in which the interrogating carrier is raised to a definite multiple frequency and retransmitted for comparison.

**coherent detection**—A method of deriving additional information from the phase of the carrier.

**coherent detector**—A detector that gives an output signal amplitude dependent on the phase rather than the

strength of the echo signal. It is required for a radar display that shows only moving targets.

**coherent display**—In random-sampling oscilloscope technique, a plot of a group of samples in which the time sequence of signal events is maintained.

**coherent echo**—A radar echo that has relatively constant phase and amplitude at a given range.

**coherent electroluminescence device**—See diode laser.

**coherent emitter**—A source of power that provides a high degree of spectral purity, near-perfect beam collimation, and enormous power densities. Lasers are coherent emitters. See incoherent emitter.

**coherent fiber bundle**—A rigid or flexible fiber bundle that is capable of transmitting an image from one end of the bundle to the other.

**coherent interrupted waves**—Interrupted continuous waves occurring in wave trains in which the phase of the waves is maintained through successive wave trains.

**coherent light**—1. A single frequency of light. Light having characteristics similar to a radiated radio wave that has a single frequency. 2. Light of but a single frequency that travels in intense, nearly perfect, parallel rays without appreciable divergence. 3. Light that has the property that, at any point in time or space, particularly over an area in a plane perpendicular to the direction of propagation, or over time at a particular point in space, all the parameters of the wave are predictable and are correlated. 4. Light in which all waves are of exactly the same frequency and exactly in phase. It can therefore act as a carrier and can be modulated for the transmission of information. 5. Light in which the phase relationship between successive waves is such that the beam consists of parallel rays that provide a high concentration of energy.

**coherent light communications**—Communications using amplitude or pulse-frequency modulation of a laser beam.

**coherent light detection and ranging**—See lidar.

**coherent light source**—A light source that is capable of producing radiation with waves vibrating in phase. The laser is an example of a coherent light source.

**coherent oscillator**—An oscillator within some radar sets that furnishes phase references for target returns during intervals between transmitter pulses and that has its output compared with the returns so that the echo becomes coherent video. Coherent video is applied to a cancellation circuit that eliminates nonmoving targets, and only moving targets are supplied to the indicator.

**coherent-pulse operation**—The method of pulse operation in which a fixed phase relationship is maintained from one pulse to the next.

**coherent radar**—A type of radar containing circuits that make possible comparison of the phase of successive received target signals.

**coherent radiation**—1. A form of radiation in which definite phase relationships exist between radiation at different positions in a cross section of the radiant beam. 2. Radiation in which the phase between any two points in the radiation field has a constant difference, or is exactly the same throughout the duration of the radiation. 3. Single-frequency energy such that there is reinforcement when portions of a signal coincide in phase and cancellation when they are in phase opposition.

**coherent reference**—The reference signal, usually of stable frequency, to which other signals are phase-locked to establish coherency throughout a system.

**coherent reflector**—Simple or complex surface (such as a corner reflector) from which reflected wave components are coherent with respect to each other and

thus combine to yield larger effective power than would be observed from a diffuse scattering surface of the same area.

**coherent source**—A theoretically ideal light source (fiber optic) that emits a very narrow, unidirectional beam of light of one wavelength (monochromatic). All light emitted from a coherent source is in phase. A laser approximates a coherent source. Contrast *incoherent source*.

**coherent system of units**—Also called absolute system of units. A system of units in which the magnitude and dimensions of each unit are related to those of the other units by definite simple relationships in which the proportionality factors are usually chosen to be unity.

**coherent transponder**—A transponder, the output signal of which is coherent with the input signal. Fixed relations between frequency and phase of input and output signals are maintained.

**coherent video**—A video signal resulting from the combination of a radar echo signal with the output of a continuous-wave oscillator. After delay, the signal so formed is detected, amplified, and subtracted from the next pulse train to give a signal that represents only moving targets.

**coherer**—An early form of detector used in wireless telegraphy.

**coil**—Also called inductance and inductor. 1. A number of turns of wire wound around an iron core or onto a form made of insulating material, or one that is self-supporting. A coil offers considerable opposition to the passage of alternating current, but very little opposition to direct current. 2. A number of turns of wire used to introduce inductance into an electric circuit, to produce magnetic flux, or to react mechanically to a changing magnetic flux. In high-frequency circuits, a coil may be only a fraction of a turn. The electrical size of a coil is called inductance and is expressed in henrys. The opposition that a coil offers to alternating current is called impedance and is expressed in ohms. The impedance of a coil increases with frequency.

**coil dissipation**—The amount of electrical power consumed by a winding. For most practical purposes, this equals the  $I^2R$  loss.

**coil effect**—The inductive effect exhibited by a spiral-wrapped shield, especially above audio frequencies.

**coil form**—An insulating support of ceramic, plastic, or cardboard onto which coils are wound.

**coil loading**—As commonly understood, the insertion of coils into a line at uniformly spaced intervals. However, the coils are sometimes inserted in parallel.

**coil neutralization**—See inductive neutralization.

**coil rating**—See input-power rating.

**coil resistance**—The total terminal-to-terminal resistance of a coil at a specified temperature.

**coil serving**—A covering, such as thread or tape, that serves to protect a coil winding from mechanical damage.

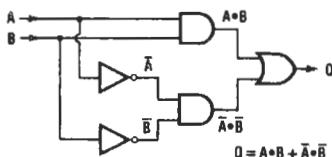
**coil temperature rise**—The increase in winding temperature above the ambient temperature when energized under specified conditions for a given period of time, usually that required to reach a stable temperature.

**coil tube**—A tubular coil form. See also spool.

**coincidence amplifier**—An amplifier that produces no output unless two input pulses are applied simultaneously to the circuit.

**coincidence circuit**—1. A circuit that produces a specified output pulse when and only when a specified number (two or more) or combination of input terminals receives pulses within a specified time interval. 2. A circuit that has an output signal only when all input signals are present. 3. An AND circuit.

## coincidence counting — collector rings



*Coincidence circuit.*

**coincidence counting**—The use of electronic devices to detect when two or more pulses from separate counters occur within a given time interval. This is done to determine whether the pulses were produced by the same particle, for example, in scintillation counting, or whether they correspond to the same event. Also called coincidence setting.

**coincidence gate**—A circuit with the ability to produce an output that is dependent on a specified type or the coincident nature of the input.

**coincidence setting**—The use of electronic devices to detect when two or more pulses occur within a given time interval. This is done to determine whether the pulses were produced by the same particle, for example, in scintillation counting, or whether they correspond to the same event. Also called coincidence counting.

**coincident-current selection**—The selection of a magnetic core, for reading or writing, by the simultaneous application of two or more currents.

**coincident resonance**—A condition in which two systems are joined together (or coupled) and both systems are vibrating near the resonant frequencies at the same time. It often happens that the amplified output from the first system turns out to be the input to the second system, which amplifies that input a second time.

**cold**—Idiomatic term generally used to describe electrical circuits that are disconnected from voltage sources and are at ground potential. Opposite of the term *hot*.

**cold-blade stripper**—Device for removing insulation utilizing a cold knife blade.

**cold boot**—Starting a computer by turning on the power.

**cold cathode**—1. A cathode whose operation does not depend on the temperature being above the ambient temperature. 2. A cathode that emits electrons, not with the influence of heat radiation, but by means of high-voltage gradient at its surface.

**cold-cathode tubes**—Tubes in which no external source is used for heating the cathode. These include tubes such as photoelectric cells, gas glow tubes, and mercury rectifiers.

**cold cleaning**—An organic-solvent cleaning process in which liquid contact accomplishes the solution and removal of residues after soldering.

**cold emission**—See field emission.

**cold light**—Light that is produced without attendant heat, as from the ionization of a gas by high voltage (neon bulbs, fluorescent lamps), or by electroluminescence, bioluminescence, or cathodoluminescence.

**cold-pressure welding**—A method of making an electrical connection in which the members to be joined are compressed to the plastic range of the metals.

**cold rolling**—Rolling a magnetic core alloy into the form of a rod so that the metallic grains are oriented in the long direction of the rod.

**cold solder joint**—A solder connection exhibiting poor wetting and a grayish, porous appearance due to insufficient heat, inadequate cleaning prior to soldering, or to excessive impurities in the solder solution.

**cold weld**—A joint between two metals (without an intermediate material) produced by the application of pressure only.

**colidar**—Acronym for coherent light detection and ranging. An optical radar system that uses the direct output from a ruby laser source without further pulse modulation.

**collate**—To combine two or more similarly ordered sets of items to produce another ordered set. Both the number and the size of the individual items may differ from those of the original sets or their sums.

**collating sequence**—1. In digital computers, the sequence in which the characters acceptable to a computer are ordered. The British term is *marshalling sequence*. 2. An ordering assigned to a set of items such that any two sets in that assigned order can be collated.

**collator**—1. A device to collate sets of punched cards or other documents into a sequence. 2. A device for determining and indicating the coincidence or noncoincidence of two signals.

**collection**—The mechanism whereby the high-potential gradient and intense electric (drift) field present within the depletion layer of a reverse-biased pn junction can cause the depletion layer to collect any carriers of appropriate type that happen to diffuse it from the adjacent semiconductor regions.

**collector**—1. In a transistor, the region into which majority carriers flow from the base under the influence of a reverse bias across the two regions. 2. The external terminal of a transistor that is connected to this region. 3. In certain electron tubes, an electrode to which electrons or ions flow after they have completed their function.

**collector capacitance**—Depletion-layer capacitance associated with the collector junction of a transistor.

**collector-coupled logic**—See current-sourcing logic.

**collector current**—The direct current flowing in the collector of a transistor.

**collector cutoff**—The operating condition of a transistor when the collector current is reduced to the leakage current of the collector-base junction.

**collector cutoff current**—1. The minimum current that will flow in the collector circuit of a transistor with zero current in the emitter circuit. 2. The reverse current of the base-collector junction when the emitter is open circuited, the reverse voltage being specified.

**collector-diffusion isolation**—Abbreviated CDI. A technique for fabrication of bipolar ICs; the collector diffusion is used to isolate transistors on the same silicon chip electrically, thus reducing the number of photolithographic masking steps required.

**collector efficiency**—The ratio, usually expressed in percentage, of useful power output to final-stage power-supply power input of a transistor.

**collector family**—Set of transistor characteristic curves in which the collector current and voltage are variables.

**collector junction**—The semiconductor junction between the base and collector regions of a transistor. In normal transistor operation, it is reverse biased to collect carriers injected by the emitter (base-to-emitter) junction. In general, the collector junction is designed for a high breakdown voltage, and the emitter junction is designed for a high emitting efficiency.

**collector resistance**—Resistance in series with the collector lead in the common-T equivalent circuit of a transistor.

**collector ring**—The collector electrode in an iconoscope.

**collector rings**—Metal rings suitably mounted on an electric machine that serve, through stationary brushes

bearing thereon, to conduct current into or out of the rotating member. *See also* slip ring.

**collector transition capacitance** — The capacitance across the collector-to-base transition region of a transistor.

**collector voltage** — The dc collector supply voltage applied between the base and collector of a transistor.

**collimated light** — 1. Parallel light rays, as opposed to converging or diverging rays. 2. A bundle of light rays in which the rays emanating from any single point in the object are parallel to one another, such as the light from an infinitely distant real source or apparent source, such as a collimator reticle.

**collimated transmittance** — Transmittance of an optical waveguide, such as an optical fiber or integrated optical circuit, in which the light wave at the output has coherency related to the coherency at the input.

**collimation** — 1. The process of adjusting an instrument so that its reference axis is aligned in a desired direction within a predetermined tolerance. 2. The process of making light rays parallel. 3. The property of laser light that keeps the beam from spreading out as it moves away from the laser.

**collimation equipment** — Equipment designed specifically for aligning optical equipment.

**collimation tower** — A tower supporting a visual and a radio target used to check the electrical axis of an antenna.

**collimator** — 1. An optical device that creates a beam made up of parallel rays of light, used in testing and adjusting certain optical instruments. It may be used to simulate a distant target, align the optical axes of instruments, or prepare rays for entry into the end of an optical fiber, fiber bundle, or optical thin film. 2. A lens or lens assembly that focuses light into a beam.

**collinear array** — An antenna array in which half-wave elements are arranged end to end on the same vertical or horizontal line.

**collision** — Overlapping transmissions when two or more nodes attempt to transmit messages simultaneously or almost simultaneously.

**collision-avoidance system** — A group of sensors and related instruments placed on board an aircraft to help the pilot detect points of collision and take the appropriate maneuvers to avoid them.

**collision detection** — The ability of a transmitting node to detect simultaneous transmission attempts on a shared medium.

**colocation** — The placing of several satellites near each other in orbit. Colocation allows a single fixed receiving antenna to receive signals from all the satellites without moving from one satellite to another (tracking).

**color** — 1. The everyday term for hue. One of the two constituents of the quality chroma (the other being white light). The mind-eye sensation produced by different wavelengths within the visible spectrum produces the colors, some of which are simply identifiable by such names as violet, blue, green, yellow, orange, and red. (Black, white, and gray are not properly described as colors.) 2. Embodies the characteristics of light, other than brightness or luminance, by which a human observer may distinguish between two structure-free patches of light of the same size and shape.

**color balance** — The adjustment of electron-gun emissions to compensate for the difference in the light-emitting efficiencies of the three phosphors on the screen of the color picture tube.

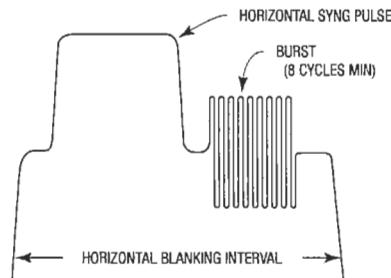
**color bar-dot generator** — An rf signal generator that develops a bar or dot pattern on the screen of a color TV picture tube used for test and alignment purposes.

**color bars** — A test pattern of specifically colored vertical bars used as a reference to test the performance of a color television and transmission paths.

**color-bar signal** — A test signal used in checking chrominance functions of color TV systems. Typically, it contains bars of six colors, yellow, cyan, green, magenta, red, and blue.

**color breakup** — Any fleeting or partial separation of a color picture into its display primary components because of a rapid change in the condition of viewing. For example, fast movement of the head, abrupt interruption of the line of sight, and blinking of the eyes are illustrations of rapid changes in the conditions of viewing.

**color burst** — Also called reference burst. In NTSC color systems, normally refers to a burst of approximately 9 Hz of the 3.579545-MHz unmodulated color subcarrier on the back porch (during the blanking pulse) of the composite video signal. This serves as a color synchronizing signal to establish a frequency and phase reference for the chrominance signal.



Color burst.

**color carrier** — *See* chrominance subcarrier.

**color-carrier reference** — A continuous signal of the same frequency as the color subcarrier and having a fixed phase relationship to the color burst. It is used for modulation at the transmitter and demodulation at the receiver.

**colorcast** — A color television broadcast.

**color code** — 1. A system of colors for specifying the electrical value of a component part or for identifying terminals and leads. Also used to distinguish between cable conductors. 2. A color system for component identification by use of solid colors, tracers, braids, surface printing, etc.

**color coder** — Also called color encoder. In a color TV transmitter, that circuit or section which combines the camera signals and the chrominance subcarrier to form the transmitted color picture signal.

**color coding** — A system of identification of terminals and related devices through the use of colored markings.

**color contamination** — An error in color rendition due to incomplete separation of the paths carrying different color components of the picture. Such errors can arise in the optical, electronic, or mechanical portions of a color television system.

**color-coordinate transformation** — Computation of the tristimulus values of colors in terms of one set of primaries from the tristimulus values of the same colors in another set of primaries. Such computation may be performed electrically in a color television system.

**color decoder** — A section or circuit of a color television receiver used for deriving the signals for the color display device from the color picture signal and the color burst.

**color-difference signal**—The signal produced when the amplitude of a color signal is reduced by an amount equal to the amplitude of the luminance signal. Color-difference signals are usually designated R-Y, B-Y, and G-Y. In a sense, I and Q signals are also color-difference signals because they are formed when specific proportions of R-Y and B-Y color-difference signals have been combined.

**color edging**—1. Spurious color at the boundaries of differently colored areas in a picture. 2. Extraneous colors that appear along the edges of video pictures but have no color relationship to those areas.

**color encoder**—A device that produces an NTSC color signal from separate R, G, and B video inputs. See color coder.

**color facsimile transmission**—The transmission of a facsimile of a color photograph by separating the colors into varying intensities of red, blue, and green and then sending separate transmissions of the three-color reading to a receiving station, which recombines the three signals into the original print.

**color fidelity**—The degree to which a color television system is capable of faithfully reproducing the colors in an original scene.

**color flicker**—The flicker that results from fluctuation of both the chromaticity and the luminance.

**color fringing**—Spurious chromaticity at the boundaries of objects in a color TV picture. It can be caused by the change in relative position of the televised object from field to field, or by misregistration. Color fringing may cause small objects to appear separated into different colors.

**color generator**—A special rf signal generator for adjusting or troubleshooting a color TV receiver.

**colorimeter**—An optical instrument designed to compare the color of a sample with that of a standard sample or a synthesized stimulus. (In a three-color colorimeter, the synthesized stimulus consists of three colors of contrast chromaticity but variable luminance.)

**colorimetric**—Pertaining to the measurement of color characteristics, particularly wavelength and primary-color content.

**colorimetric photometer**—A photometer that uses a set of color filters to measure the intensity of light in various regions of the spectrum.

**colorimetry**—The technique of measuring color and interpreting the results.

**color killer**—A stage designed to prevent signals in a color receiver from passing through the chrominance channel during monochrome telecasts.

**color match**—The condition in which the two halves of a structureless photometric field look exactly the same.

**color media**—Transparent colored materials that can be placed in front of an instrument to color the emitted light. These materials are often referred to as gels (for gelatin), but glass or plastic also may be used.

**color mixture**—Color produced by the combination of lights of different colors. The combination may be accomplished by successive presentation of the components, provided the rate of alternation is sufficiently high; or the combination may be accomplished by simultaneous presentation, either in the same or in adjacent areas, provided the components are small enough and close enough together to eliminate pattern effects.

**color oscillator**—In a color television receiver, the oscillator operating at the burst frequency of 3.579545 MHz. Its frequency and phase are synchronized by the master oscillator at the transmitter.

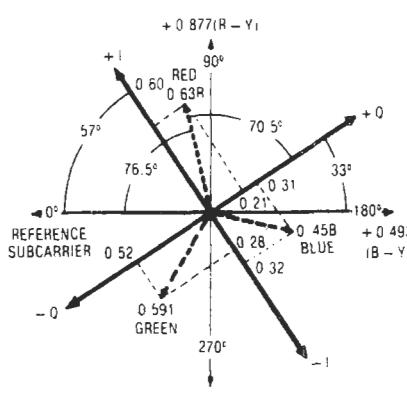
**color phase**—1. The difference in phase between a chrominance primary signal (I or Q) and the chrominance carrier reference. 2. The proper timing relationship with

## color-difference signal — color picture tube

a color signal. Color is considered to be in phase when the hue is reproduced correctly on the screen.

**color-phase alternation**—Periodic changing of the color phase of one or more components of the color television subcarrier between two sets of assigned values.

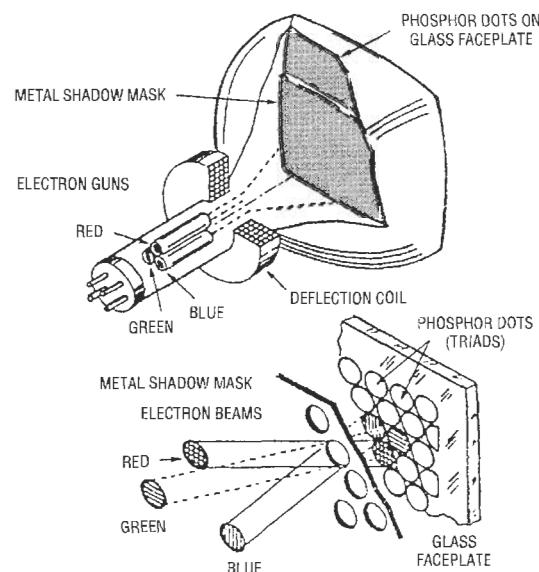
**color-phase diagram**—A vector diagram that denotes the phase difference between the color-burst signal and the chrominance signal for each of the three primary and complementary colors. This diagram also designates vectorially the peak amplitude of the chrominance signal for each of these colors, and the polarities and peak amplitudes of the in-phase and quadrature portions required to form these chrominance signals.



Color-phase diagram.

**color picture signal**—A signal that represents electrically the three color attributes (brightness, hue, and saturation) of a scene. 2. A combination of the luminance and chrominance signals, excluding all blanking and synchronizing signals.

**color picture tube**—An electron tube that provides an image in color by scanning a raster and by varying the



Color picture tube.

intensity at which it excites the phosphors on the screen to produce light of the chosen primary colors.

**color primaries** — In the color receiver, the saturated colors of definite hue and variable luminance produced by the receiver. These color primaries, when mixed in proper proportions, form other colors.

**color purity** — Freedom of a color from white light or any colored light not used to produce the desired color. In reference to the operation of a tricolor picture tube, the term refers to the production of pure red, green, or blue illumination of the phosphor-dot faceplate.

**color-purity magnet** — A magnet placed in the neck region of a color picture tube to alter the electron-beam path and thereby improve color purity.

**color registration** — The accurate superimposing of the red, green, and blue images that are used to form a complete color picture in a color television receiver.

**color rendering index** — Abbreviated CRI. A number that approximately represents the effect of a light source on the appearance of colored surfaces. A measure of the degree to which the perceived colors of objects illuminated by the source conform to those of the same objects illuminated by a reference source for specified conditions.

**color sampling rate** — In a color television system, the number of times per second that each primary color is sampled.

**color saturation** — 1. The degree to which white light is absent in a particular color. A fully saturated color contains no white light. If 50 percent of the light intensity is due to the presence of white light, the color is said to have a saturation of 50 percent. 2. A measure of the amount of white light in a hue. High saturation means that there is no white-light component and that the color is of good quality.

**color sensitivity** — The spectral sensitivity of a light-sensitive device such as a phototube or camera tube.

**color signal** — Any signal at any point in a color television system, used for wholly or partially controlling the chromaticity values of a color television picture. This is a general term encompassing many specific connotations, such as are conveyed by the words "color picture signal," "chrominance signal," "carrier color signal," "monochrome signal" (in color television), etc.

**color subcarrier** — 1. A subcarrier that is added to the main video signal to convey the color information. In NTSC systems, the color subcarrier is centered on a frequency of 3.579545 MHz, referenced to the main video carrier. 2. A monochrome signal to which modulation sidebands have been added to convey color information.

**color sync burst** — A burst of 8 to 11 cycles in the 4.43361875 MHz (PAL) or 3.579545 MHz (NTSC) color subcarrier frequency. This waveform is located on the back porch of each horizontal blanking pulse during color transmissions. It serves to synchronize the color subcarrier's oscillator with that of the transmitter in order to recreate the raw color signals. *See also* color burst.

**color sync signal** — The series of color bursts (pulses of subcarrier reference signal) applied to the back porch of the horizontal-sync pedestal in the composite video signal.

**color television receiver** — A standard monochrome receiver to which special circuits have been added. Phosphors capable of glowing in the three primary colors are used on the special screen. By using these primary colors and mixing them to produce complementary colors, and by varying their intensity, it is possible to reproduce an image in somewhat the original colors.

**color television signal** — The complete signal used to transmit a color picture. Included are horizontal-, vertical-, and color-sync components.

**color temperature** — 1. A way of describing the color of a radiating source in terms of the temperature (in degrees Kelvin) of a blackbody radiating with the same dominant frequency as the source. Certain high-end monitors offer the possibility of setting the color temperature to any desired value. By setting the color temperature, one can often achieve more realistic screen colors. 2. The temperature to which a perfectly black body must be heated to match the color of the source being measured. Color-temperature measurements begin at absolute zero and are expressed in kelvins.

**color temperature of a light source** — The absolute temperature at which a blackbody radiator must be operated to have a chromaticity equal to that of the light source.

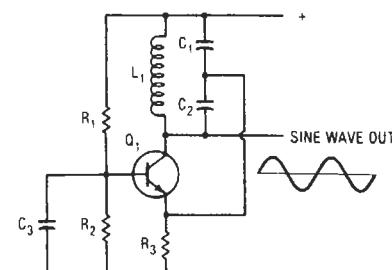
**color transmission** — 1. The transmission of color-television signals that can be reproduced with different values of hue, saturation, and luminance. 2. The transmission of a signal that represents both the brightness values and the color values in a video picture.

**color triad** — One cell of a three-color phosphor-dot screen of a phosphor-dot color picture tube. Each triad contains one dot of each of the three color-producing phosphors.

**color triangle** — A triangle drawn on a chromaticity diagram to represent the entire range of chromaticities obtainable when the three prescribed primaries are added. These are represented by the corners of the triangle.

**color video** — Usually, the technique of combining the three primary colors of red, green, and blue to produce color pictures within the usual spectrum.

**Colpitts oscillator** — A sinusoidal oscillator using a three-terminal active element, such as a tube, transistor, etc., and a feedback loop containing a parallel LC circuit. The capacitance of the LC circuit consists of two capacitors in series, forming a voltage divider that serves to match the input and output impedance of the active device.



Colpitts oscillator.

**column** — Also called place. In positional notation, a position corresponding to a given power of the radix. A digit located in any particular column is a coefficient of a corresponding power of the radix.

**column binary code** — A punched-card code in which successive bits are represented by the presence or absence of punches in adjacent positions in successive columns rather than successive rows. It is used with 36-bit-word computers, in which each group of three columns is used to represent a single word.

**column speaker** — 1. A loudspeaker cabinet of long columnar shape. Usually the loudspeaker is at one end so that the rear of the drive unit is loaded by a column of air. Often columns are made from drain pipes. Also, the name given to a long speaker cabinet containing

several loudspeakers for public address work. 2. An array of loudspeakers arranged in a vertical line, having the property of spreading its radiation through a wide angle in the horizontal plane while keeping it in a beam with respect to the vertical plane.

**COM**—*See* computer-output microfilm printer.

**coma**—1. An aberration of spherical lenses, occurring in the case of oblique incidence, when the bundle of rays forming the image is unsymmetrical. The image of a point is comet shaped, hence the name. 2. A cathode-ray tube image defect that makes the spot on the screen appear comet shaped when away from the center of the screen.

**coma lobe**—A side lobe that occurs in the radiation pattern of a microwave antenna when the reflector alone is moved to sweep the beam. The lobe appears because the feed is not always at the center of the reflector. This scanning method is used to eliminate the need for a rotary joint in the feed waveguide.

**comb amplifier**—Several sharply tuned bandpass amplifiers whose inputs are connected in parallel and whose outputs are separate. The amplifiers separate various frequencies from a multifrequency input signal. The name is derived from the comblike appearance of the response pattern of various output peaks displayed along a frequency-base axis.

**comb filter**—1. A filter for high resolution and picture sharpness that eliminates "dot crawl" and "hanging dots" caused by cross-color and cross-luminance distortion. Comb filters provide exceptional isolation of chrominance and luminance information and increased picture resolution for sharper, clearer, more detail-perfect color picture reproduction. Capable of delivering 700 lines of horizontal resolution, at the S-video input, it greatly exceeds the maximum clarity of the 330 lines of horizontal resolution delivered by broadcast television and easily supports the demands of videodisc, CD-I, and other advanced high-resolution video media. 2. A type of filter network that is, in effect, a multiple-bandpass design that passes only frequencies within a number of narrow bands, or provides outputs corresponding to each of its passbands. Comb filters are so named because their response characteristics have the appearance of a comb. 3. A filter that has a series of very narrow, deep notches where signals are attenuated.

**comb generator**—Usually a step-recovery diode circuit that converts a single frequency rf input into an rf output signal that contains a large number of spectral lines, each of which is harmonically related to the input frequency.

**combination cable**—A cable in which the conductors are grouped in combinations such as pairs and quads.

**combination microphone**—A microphone consisting of two or more similar or dissimilar microphones combined into one.

**combination tones**—Frequencies produced in a nonlinear device, such as in an audio amplifier, having appreciable harmonic distortion.

**combinatorial logic**—Digital circuitry in which the states of the outputs from a device depend only on the states of the inputs. *See also* sequential logic.

**combined-gate IC**—A single IC chip in which several gate circuits are interconnected to form a more complex circuit.

**combiner**—A circuit for mixing video, trigger, and scan data from the synchronizer for the modulation of a link.

**combiner circuit**—A circuit that combines the luminance and chroma channels with the sync signals in color-television cameras.

**combustible**—*See* flammable.

## COM — committed power and ground

**come-back**—A point in the stopband of a filter where a spurious response occurs beyond points at which there is proper attenuation. Come-backs usually occur at frequencies much higher than the passband frequencies because of feed-through in parasitic elements.

**command**—1. In a computer, one or more sets of signals that occur as the result of an instruction. *See also* instruction, 1. 2. An independent signal from which the dependent signals in a feedback control system are controlled according to the prescribed system relationships. 3. A signal that initiates or triggers an action in the device that receives the signal. *See* operation code. 4. An issue to the PC to execute a function, such as print, file, erase, or send a document.

**commandable bug**—A surreptitious listening device that can be turned on and off remotely.

**command code**—*See* operation code.

**COMMAND.COM**—A disk file that contains the command processor and must be present on the start-up disk for DOS to run.

**command control**—A system whereby functions are performed as the result of a transmitted signal.

**command destruct signal**—A radio signal for destroying a missile in flight.

**command file**—A computer file that will execute a program when the filename is entered.

**command guidance system**—A missile guidance system in which both the missile and the target are tracked by radar. The missile is guided by signals transmitted to it while it is in flight. *See also* command link.

**command language**—A computer source language that consists primarily of procedural operators, each of which is capable of invoking a function to be executed.

**command link**—The portion of a command guidance system used to transmit steering commands to the missile. *See also* command guidance system.

**command module**—*See* module.

**command net**—A communication network that connects an echelon of command with some or all of its subordinate echelons for the purpose of command and control.

**command pointer**—A multiple-bit register that indicates the memory location being accessed in the control store.

**command reference**—In a servo or control system, the voltage or current to which the feedback signal is compared. As an independent variable, the command reference exercises complete control over the system output.

**comment**—An expression that explains or identifies a particular step in a routine but which has no effect on the operation of the computer in performing the instructions for the routine.

**comment field**—In a computer, an area in a record assigned for entry of explanatory comments about a program.

**commercial test (measuring) equipment**—Devices used as working instruments selected from suppliers' catalogs as suitable for the user's measuring needs and procured as standard (off-the-shelf) items. This includes measuring devices that are installed, intact, and in consoles. Devices procured from suppliers but modified by user-imposed specifications in such a manner as to affect console performance do not fall into this category.

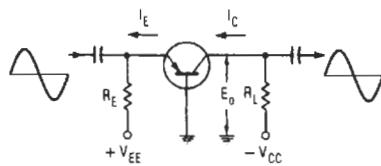
**commercial time-sharing**—A type of computer use with remote terminal, interactive, and time-sharing characteristics. The user of the machine pays an amount determined by the time used.

**committed power and ground**—Patterns that have been permanently established to input/output connectors for power and ground plane busing.

**common**—1. Shared by two or more circuits. Used to designate the terminal of a three-terminal device that is shared by the input and output circuits. (Thus, a transistor may be operated in a common-base configuration, a common-collector configuration, or a common-emitter configuration.) Vacuum tube connections may be characterized in a similar way, but *grounded* is normally used instead of *common*. 2. A point that acts as the reference potential for several circuits—a ground. 3. See *tailor-made*.

**common base**—A circuit configuration in which the base terminal is common to the input circuit and to the output circuit and in which the input terminal is the emitter terminal and the output terminal is the collector terminal.

**common-base amplifier**—Also called a grounded-base amplifier. A transistor amplifier in which the base element is common to both the input and the output circuit. It is comparable to the grounded-grid configuration of a triode electron-tube amplifier.



Common-base amplifier.

**common-base circuit**—A transistor circuit in which the base electrode is common to both input and output circuits.

**common-base feedback oscillator**—A common-base bipolar transistor amplifier with a feedback network between the collector (output) and the emitter (input) to produce oscillations at a desired frequency.

**common-base transistor**—Circuit configurations in which the base terminal is common to the input circuit and to the output circuit and in which the input terminal is the emitter terminal and the output terminal is the collector terminal.

**common battery**—A system of current supply in which all direct-current energy for a unit of a telephone system is supplied by one source in a central office or exchange.

**common-battery office**—A central office that supplies transmitter and signal current for its associated stations, and for signaling by the central office equipment, from a power source located in the central office.

**common business-oriented language**—Specific language by which business data-processing procedures may be precisely described in a standard form. Intended not only as a means for directly presenting any business program to any suitable computer for which a compiler exists, but also as a means of communicating such procedures among individuals. Also called COBOL.

**common bus system**—A set of standard data, address, and control lines available to all computer modules. The use of bus interface circuits makes it possible for a user to tie in and communicate with other users.

**common carrier**—1. A government-regulated (by the FCC) private company that furnishes the general public with telecommunications service facilities, for example, a telephone or telegraph company. Specialized common carriers offer private line services. 2. A commercial company that sells communications services to any

member of the public. A common carrier cannot provide programming for the channels itself.

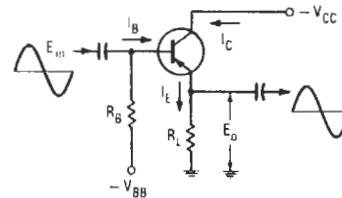
**common-carrier fixed station**—A fixed station that is open to public correspondence.

**common-channel interference**—Radio interference resulting from two stations transmitting on the same channel. Characterized principally by beat-note generation (heterodyne whistle) and the suppression or capture of the weaker signal by the stronger one.

**common-channel signaling**—A method of using a single signaling channel to carry signaling information relating to a number of information channels. Common-channel signaling information is sent in packet form.

**common collector**—A circuit configuration in which the collector terminal is common to the input circuit and to the output circuit and in which the input terminal is the base terminal and the output terminal is the emitter terminal.

**common-collector amplifier**—Also known as an emitter-follower and a grounded-collector amplifier. A transistor amplifier in which the collector element is common to both the input and the output circuit. This configuration is comparable to an electron-tube cathode follower.



Common-collector amplifier.

**common-collector circuit**—A bipolar transistor circuit in which the collector is the common (grounded) electrode.

**common-collector transistor**—Circuit configuration in which the collector terminal is common to the input circuit and to the output circuit and in which the input terminal is the base terminal and the output terminal is the emitter terminal.

**common communications carrier**—A company recognized by an appropriate regulatory agency as having a vested interest in furnishing communications services.

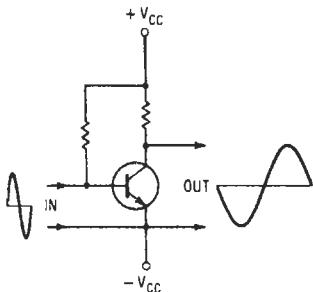
**common emitter**—A circuit configuration in which the emitter terminal is common to the input circuit and to the output circuit and in which the input terminal is the base terminal and the output terminal is the collector terminal.

**common-emitter amplifier**—Also called grounded-emitter amplifier. A transistor amplifier in which the emitter element is common to both the input and the output circuit. This configuration is comparable to a conventional electron-tube amplifier.

**common-emitter circuit**—A bipolar transistor circuit in which the emitter is the common (grounded) electrode.

**common-emitter transistor**—Circuit configuration in which the emitter terminal is common to the input circuit and to the output circuit and in which the input terminal is the base terminal and the output terminal is the collector terminal.

**common language**—A form representing information that a machine can read and that is common to a group of computers and data-processing machines.



Common-emitter amplifier.

**common mode**—1. Signals that are identical with respect to both amplitude and time. Also used to identify the respective parts of two signals that are identical with respect to amplitude and time. 2. A high-speed-modem interface name.

**common-mode characteristics**—The characteristics pertaining to performance of an operational amplifier in which the inverting and noninverting inputs have a common signal.

**common-mode coupling**—Coupling that results in similar signals with respect to ground on different circuit leads.

**common-mode gain**—The ratio of the output voltage of a differential amplifier to the common-mode input voltage. The common-mode gain of an ideal differential amplifier is zero. Typical values in op amps are around -30 dB.

**common-mode impedance input**—The internal impedance between either one of the input terminals of a differential operational amplifier and signal ground.

**common-mode input**—That signal applied in phase (i.e., common mode) equally to both inputs of a differential amplifier.

**common-mode input capacitance**—The equivalent capacitance of both inverting and noninverting inputs of an operational amplifier with respect to ground.

**common-mode input voltage**—The maximum voltage that can be applied simultaneously between the two inputs of a differential amplifier and ground without causing damage.

**common-mode interference**—Interference that appears between the terminals of the measuring circuit and ground.

**common-mode output voltage**—The output voltage of an operational amplifier resulting from the application of a specified voltage common to both inputs.

**common-mode range**—Maximum voltage that can be applied to differential inputs with respect to ground. The maximum difference between inputs is the full-scale input range.

**common-mode rejection**—Abbreviated CMR. 1. Also called in-phase rejection. A measure of how well a differential amplifier ignores a signal that appears simultaneously and in phase at both input terminals (called a common-mode signal). Usually and preferably stated as a voltage ratio, but more often stated in the dB equivalent of said ratio at a specified frequency, e.g., "120 dB at 60 Hz with a source impedance of 1000 ohms." 2. A measure of the ratio of differential-mode gain to the common-mode gain present in all practical amplifiers. When both inputs to the amplifier are raised by the same voltage, the output should, ideally, be unaffected.

**common-mode rejection in decibels**—Twenty times the log of the common-mode rejection ratio.

**common-mode rejection ratio**—Abbreviated CMRR. 1. The ratio of the common-mode input voltage to the output voltage expressed in dB. The extent to which a differential amplifier does not provide an output voltage when the same signal is applied to both inputs. 2. The ratio of differential-mode gain to common-mode gain. 3. The ratio of the change of input offset voltage of an operational amplifier to the change in common-mode voltage producing it.

**common-mode resistance**—The resistance between the input- and output-signal lines and circuit ground. In an isolated amplifier, this is its insulation resistance. (Common-mode resistance has no connection with common-mode rejection.)

**common-mode signal**—1. The instantaneous algebraic average of two signals applied to a balanced circuit (i.e., two ungrounded inputs of a balanced amplifier), with all signals referred to a common reference. 2. In an amplifier with a differential input, a signal (referred to ground) that appears at both inverting and noninverting inputs with the same phase, amplitude, and frequency. Power-line hum is the most frequently encountered common-mode signal.

**common-mode voltage**—Abbreviated CMV. 1. The amount of voltage common to both input lines of a balanced amplifier. Usually specified as the maximum voltage that can be applied without breaking down the insulation between the input circuit and ground. (Common-mode voltage has no connection with common-mode rejection.) 2. The voltage component of a two-wire input (control) signal that is common to both lines. The actual control signal is the difference between the two input voltages; for example, if the two input signals are (with respect to a common ground) 110 volts and 100 volts, then the common-mode voltage is 100 volts, and the control voltage is 10 volts. 3. An undesirable signal picked up in a transmission line by both wires making up the circuit, to an equal degree, with respect to an arbitrary "ground."

**common-mode voltage gain**—The ratio of ac voltage with respect to ground at the output terminal of an amplifier (or between the output terminals of an amplifier with differential outputs) to the common-mode input voltage.

**common-mode voltage range**—The range of voltage that may be applied to both inputs of an operational amplifier without saturating the input stage. This may limit the output capabilities in the voltage-follower connection.

**common pool**—A dedicated area of memory used as storage and shared by various processes.

**common-user channels**—Communication channels that are available to all authorized agencies for transmission of command, administrative, and logistic traffic.

**common-user circuit**—A circuit shared by two or more services, either concurrently or on a time-sharing basis. It may be a unilateral, bilateral, or joint circuit.

**communal chained memory**—A technique employed in dynamic storage allocation in a computer.

**communicating word processor**—See electronic mail.

**communication**—1. The transmission of information from one point, person, or equipment to another. 2. The sensing of a measurement signal or phenomena for display, recording, amplification, transmission, computing, or processing into useful information. 3. Transmission of intelligence between points of origin and reception without alteration of the sequence or structure of the information content.

**communication band**—The band of frequencies due to the modulation (including keying) necessary for a given type of transmission.

**communication channel**—Part of a radio or wire circuit, or a combination of wire and radio that connects two or more terminals.

**communication control character**—A character whose purpose is to control or facilitate data transmission over communication networks.

**communication engineer**—An electrical engineer who specializes in the design, construction, operation, or maintenance of communication circuits, equipment, or systems whether by wire or radio (wireless).

**communication facilities**—Installations, equipment, and personnel used to provide telecommunication.

**communication-line controller**—A hardware unit that performs line-control functions with a modem.

**communication link** — The physical means of connecting one location to another for the purpose of transmitting and receiving information.

**communications common carriers**—Companies that furnish communications services to the public, regulated by the FCC or appropriate state agencies.

**communications port**—A connection on a terminal through which data is input and/or output.

**communications program**—Software that gives a computer the ability to communicate with other computers over telephone lines.

**communications protocol**—A set of rules that govern the communications between computers over telephone lines. Both computers must have the same settings and follow the same standards for communication to be successful.

**communications receiver**—A receiver designed for reception of voice or code signals from stations operating in the communications service.

**communications satellite**—An orbiting space vehicle that actively or passively relays signals between communications stations.

**communications security**—The protection resulting from all measures designed to deny unauthorized persons information of value that might be derived from the possession and study of telecommunications or to mislead unauthorized persons in their interpretations of the results of such possession and study.

**communication switch**—A device used to execute repetitive sequential switching.

**communication zone indicator**—A device that indicates whether or not long-distance high-frequency broadcasts are successfully reaching their destination.

**community antenna television**—Abbreviated CATV. A television system that receives and retransmits television broadcasts. Microwave transmitters and coaxial cables are used to bring the television signals to subscribers in a community.

**community bulletin board**—A dial-up computer used to exchange messages.

**community dial office**—A small dial-telephone office that serves an exchange area and that operates with no employees located in the building.

**community television system**—A receiving system by means of which television signals may be distributed over coaxial cables to homes in an entire community.

**community TV cable**—Coaxial cables used to transmit television signals from a master antenna to a group of receivers in a community.

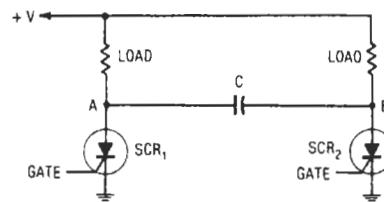
**commutating capacitor**—Also called speedup capacitor. 1. In a flip-flop circuit, a capacitor connected in parallel with the cross-coupling resistor to accelerate

the transition from one stable state to another. 2. The capacitor connected in parallel between SCR stages to momentarily reverse the current through the SCR so as to cut it off (commutate).

**commutating filter**—1. A bandpass filter whose center frequency depends only on the frequency with which it is driven. 2. A clocked, switched-capacitance digital filter that uses periodic signal sampling techniques to synthesize discrete approximations of all the classic analog filters.

**commutation**—1. A mechanical process of converting the alternating current in the armature of direct-current generators into the direct-current generator output. 2. Sampling of various quantities in a repetitive manner for transmission over a single channel. 3. The switching of currents back and forth between various paths as required for operation of some system or device. In particular, a switching of current to or from the appropriate armature coils of a motor or generator. The turning off of an active element at the correct time as in an inverter or power controller. 4. The transfer of load current from one thyristor to another; sometimes used as a means of turning off a thyristor by rapidly reducing its current to zero.

**commutation capacitors**—1. Cross-connected capacitors in a thyratron inverter. They provide a path such that the start of conduction in one thyratron causes an extinguishing pulse to be applied to the alternate thyratron. Also used in inverter circuits employing semiconductor devices. 2. A specially designed capacitor used in the turn-off (commutation) circuit of an SCR, where it is subjected to exceedingly fast rise time pulses. Thus the capacitor must be capable of discharging large peak currents in very short periods of time.



### *Commutation capacitor.*

**commutation switch**—A device used to carry out repetitive sequential switching.

**commutator**—1. The part of the armature to which the coils of a motor are connected. It consists of wedge-shaped copper segments arranged around a steel hub and insulated from it and from one another. The motor brushes ride on the outer edges of the commutator bars and thereby connect the armature coils to the power source. 2. Device used in a direct-current generator to reverse the direction of an electric current and maintain a current flowing in one direction. 3. A switch or equivalent device that permits the reversal or exchange of external connections of a transducer to provide a desired sequencing of signals.

**compact cassette** — A small ( $4 \times 2\frac{1}{2} \times \frac{1}{2}$  inch or  $10.2 \times 6.3 \times 1.3$  cm) tape cartridge developed by Philips, containing tape about  $\frac{1}{8}$ -inch (3.2 mm) wide, running at  $1\frac{7}{8}$  ips (12.1 cm/s). Recordings are bidirectional, with both stereo tracks adjacent for compatibility with monophonic cassette recorders, whose heads scan both stereo tracks at once.

**compact disc (CD)**—1. A read-only plastic disc that uses optical storage techniques to store large amounts of music (audio) or digitally encoded data. 2. A stereo digital audio system based upon a 12 cm single-sided polycarbonate disc with an internal reflective layer of aluminum or gold. Information is read by sensing the presence or absence of reflected light from a tightly focused laser beam pointing at the pits and bumps in the reflective surface within the disc. The digital audio signal is sampled to 16 bits per channel at a rate of 44.1 kHz. 3. Small plastic disc on which digital information is recorded. The data thus recorded can be played back using a laser. The packing density on the disc is very high, enabling hundreds of megabytes of data to be stored.

**compactron**—An electron tube based on a building-block concept that involves the standardizing of basic tube sections, diodes, triodes, and pentodes; clipping them together as required; and sealing them in a single envelope.

**compander**—1. A combination consisting of a compressor at one point in a communication path to reduce the volume range of signals, followed by an expander at another point to improve the ratio of the signal to the interference entering the path between the compressor and expander. 2. A device consisting of a compressor at the transmitting end and an expander at the receiving end that operate as nonlinear amplifiers to obtain a more advantageous amplitude-quantizing relationship for the reduction of noise. The process of companding is particularly important with audio signals. The principles have also been effectively used in the processing of picture information. 3. A complementary noise-reduction system in which both pre- and postprocessing are used to provide no alteration of signal while reducing noise. It improves the signal-to-noise ratio in systems in which an analog signal is passed through a noisy transmission medium. 4. An electronic circuit that amplifies low-input signal amplitudes more than high amplitudes so that all signal amplitudes are compressed into a narrow range. This compressed signal can be expanded back into the original signal by amplifying large amplitudes more than smaller amplitudes. 5. A device used on some telephone channels to improve transmission performance. The equipment compresses the outgoing speech volume range and expands the incoming volume range on a long-distance telephone circuit.

**companding**—A process in which compression is followed by expansion. Companding is often used for noise reduction, in which case the compression is applied at the transmitter before the noise exposure and the expansion at the receiver.

**compandor**—1. Abbreviation for compressor-expander. An audio-frequency circuit that reduces (compresses) loud sounds and increases (expands) quiet sounds so that the output level stays almost constant. A compressor is used in the transmitter. In the receiver, an expander would follow the demodulator and precede the audio power amp. 2. *See* compander.

**companion keyboard**—A remote keyboard connected by a multiwire cable to an ordinary keyboard and able to operate it.

**comparator**—1. A circuit that compares two signals and supplies an indication of agreement or disagreement. 2. In a computer, a circuit that determines whether the absolute difference between a data sample and the previous sample passed is greater than or equal to a redundancy criterion (which may be a tolerance or a limit). 3. A device that compares two inputs for equality. One type compares voltages and gives one of two outputs: less than or greater than. Another type compares binary numbers and has three outputs: less than, equal to, or

greater than. A third type compares phase or frequency and gives a variable voltage depending on the relationship between the inputs. 4. A unit often found in audio showrooms, which, by switch selection, will connect up a combination of speakers, amplifier, tuner, pickup, tape player, etc., for comparing different types. 5. A circuit that compares two signals and provides a difference signal. 6. An active device that provides a logical 0 when its input is below a preset reference value and a logical 1 when its input is above that value. 7. A device that compares two different signals and provides an output when they differ in frequency, phase, voltage, or power level. 8. A circuit that evaluates an output parameter to determine if it falls within some predetermined limits. 9. A device for checking the accuracy of one set of data by comparing it with a second set of data and then noting any variation between the two.

**compare**—1. A computer operation in which two quantities are matched for the purpose of discovering their relative magnitudes or algebraic values. 2. A computer instruction that effectively subtracts one word from another and indicates which of the two is larger.

**comparison**—The examination of how two similar items of data are related. The comparison is usually followed by a decision.

**comparison bridge**—A type of voltage-comparison circuit resembling a four-arm electrical bridge. The elements are so arranged that if a balance exists in the circuit, a zero error signal is derived.

**comparison testing**—Real-time comparison between the actual output responses of the device under test and those of a known good reference device when the same input stimulus patterns are applied to both devices in parallel.

**compatibility**—1. That property of a color television system that permits unaltered monochrome receivers to receive substantially normal monochrome from the transmitted signal. 2. The property that makes possible use of a stereo system with a monophonic program source, or reproduction of a stereo program monophonically on a monophonic system. 3. The ability of one unit to be used with another without detrimental effect on the signal through mismatch. For example, a compatible pickup will play both mono and stereo records. 4. The ability to run the same software programs and connect the same peripherals and add-on equipment (e.g., boards, printers, modems) as another PC. When a machine is said to be compatible, it is more often than not compatible with the IBM PC. Compatible PCs are also referred to as clones.

**compatible**—A term applied to a computer system that implies that it is capable of handling both data and programs devised for some other type of computer system.

**compatible color**—A TV broadcast system that produces a color signal that can be received by either a black-and-white or a color set. The luminance values (the basis of black-and-white reception) and the chrominance values (the basis of color reception) are broadcast as different portions of the total signal so that the luminance values are not dependent on the chrominance values for reproduction.

**compatible integrated circuit**—A hybrid IC in which the active circuit element is within the silicon planar integrated structure. A passive network, which may be separately optimized, is deposited onto its insulating surface to complete the IC device.

**compatible monolithic integrated circuit**—A device in which passive components are deposited by thin-film techniques on top of a basic silicon-substrate circuit containing the active components and some passive parts. *See also* all-diffused monolithic integrated circuit.

**compensated amplifier**—1. A broadband amplifier whose frequency range is extended by the proper choice of circuit constants. 2. A wideband amplifier made so by the addition of low- and high-frequency compensation.

**compensated-impurity resistor**—A diffused-layer resistor into which are introduced additional n- and p-type impurities.

**compensated-loop direction finder**—A direction finder employing a loop antenna and a second antenna system to compensate for polarization error.

**compensated semiconductor**—A semiconductor in which one type of impurity or imperfection (donor) partially cancels the electrical effects of the other (acceptor).

**compensated volume control**—See loudness control.

**compensating filter**—A filter used to alter the spectral emission of an emulsion to a specified response to different wavelengths.

**compensation**—1. The controlling elements that compensate for, or offset, the undesirable characteristics of the process to be controlled in the system. 2. The shaping of an op-amp frequency response in order to achieve stable operation in a particular circuit. Some op amps are internally compensated, whereas others require some external compensation components in some circuits. 3. The phenomenon whereby extremely small quantities of donor and acceptor impurities present in a semiconductor crystal tend to cancel out each other, so that the material tends to behave according to the dominant impurity only. If both types of impurity are present to an equal extent, the material tends to behave as if it were an intrinsic material.

**compensation signal**—A signal recorded on a tape, along with the computer data and on the same track as the data; this signal is used during the playback of data to electrically correct for the effects of tape-speed errors.

**compensation theorem**—An impedance in a network may be replaced by a generator of zero internal impedance, the generated voltage of which at any instant is equal to the instantaneous potential difference produced across the replaced impedance by the current flowing through it.

**compensator**—1. In a direction finder, the portion that automatically applies to the direction indication all or part of the correction for the deviation. 2. An electronic circuit for altering the frequency response of an amplifier system to achieve a specified result. This refers to record equalization or loudness correction.

**compile**—1. To bring digital-computer programming subroutines together into a main routine or program. 2. To produce a binary coded program in a computer from a program written in source (symbolic) language by selecting appropriate subroutines from a subroutine library as directed by the instructions or other symbols of the source program. The linkage is supplied for combining the subroutines into a workable program, and the subroutines and linkage are translated into binary code.

**compiler**—1. An automatic coding system in a computer that generates and assembles a program from instructions written by a programmer. 2. A unit that converts computer programs written in higher-level languages, such as BASIC and C++, into the machine language (object code) of the computer. It is necessary to write an entire program into a compiler's memory before the compiler executes or performs a translation on it. 3. Computer routine that translates symbolic instructions to machine instructions and replaces certain items of input with series of instructions, called subroutines.

4. A high-level, Englishlike programming language that converts instructions into executable machine code. Two examples of such programming languages are COBOL and FORTRAN. 5. A high-level language processor that converts or translates a sequence of source language statements into a corresponding sequence of machine language instructions that may be later loaded into memory and executed by the processor to perform the desired functions. No matter how many times a section of code is used in the assembled program, it will be translated only once and put in its proper place. 6. A program that converts a high-level language into machine language for a specific microprocessor/computer. 7. A program that translates high-level language programs into a series of machine-code instructions for a computer to execute; it may also check the programs' semantic consistency.

**compiler language**—A computer language system consisting of various subroutines that have been evaluated and compiled into one routine that can be handled by the computer. FORTRAN, COBOL, and ALGOL are compiler languages. Compiler language is the third level of computer language. See machine language, 3, for other levels. See also high-level language.

**compiler program**—Software, usually supplied by the manufacturer, to convert an application program from compiler language to machine language.

**compiling routine**—A routine by means of which a computer can itself construct the program used to solve a problem.

**complement**—1. In an electronic computer, a number whose representation is derived from the finite positional notation of another by one of the following rules.

True complement: Subtract each digit from 1 less than the base, then add 1 to the least significant digit and execute all required carries.

Base-minus-1s complement: Subtract each digit from 1 less than the base. (For example, 9s complement in base 10, 1s complement in base 2, etc.)

2. To form the complement of a number. (In many machines, a negative number is represented as a complement of the corresponding positive number.) The binary opposite of a variable or function. The complement of 1 is 0 and the complement of 0 is 1; thus, for example, the complement of 011010 is 100101.

**complementary**—1. A term describing integrated circuits that employ components of both polarity types connected in such a way that operation of either is complemented. A complementary bipolar circuit would employ both npn and pnp transistors, and a complementary MOS circuit (CMOS) would employ both n-channel and p-channel devices. In general, complementary devices operate with opposite polarity voltages and currents, which is advantageous in many circuit applications. 2. Two driving-point functions whose sum is a positive constant.

**complementary binary or inverted binary**—The negative true binary system. It is similar to the binary code except that all binary bits are inverted. Thus, zero scale is all 1s while full scale is all 0s.

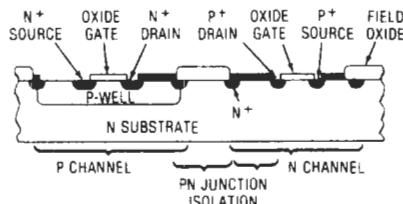
**complementary circuit**—A circuit that provides push-pull operation (sink and source capability) with a single input.

**complementary clocks**—Two clock signals with opposite phase.

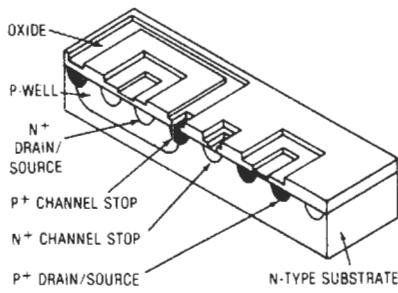
**complementary colors**—Two colors are complementary if, when added together in proper proportion such as by projection, they produce white light.

**complementary constant current logic (C<sup>3</sup>L)**—A high-density approach to bipolar LSI that has switching speeds of 3 nanoseconds.

**complementary metal-oxide semiconductor**—Device formed by the combination of a PMOS (p-type and n-type channel semiconductors), exhibiting very low power consumption and high noise immunity. Strictly speaking, CMOS refers to an IC manufacturing technology; the term is almost always used to describe an IC logic family. The CMOS logic family is characterized by very low power dissipation, low circuit density per chip, and moderate speed of operation when compared with other IC logic families. *See also* complementary MOS; ECL; I<sup>2</sup>L; Schottky TTL; TTL.



Conventional CMOS.



CMOS process.

### Complementary metal-oxide semiconductor (CMOS).

**complementary MOS**—Abbreviated CMOS. 1. Pertaining to n- and p-channel enhancement-mode devices fabricated compatibly on a silicon chip and connected into push-pull complementary digital circuits. These circuits offer low quiescent power dissipation and potentially high speeds, but they are more complex than circuits in which only one channel type (generally p-channel) is used. 2. A digital inverter consisting of a p-channel and an n-channel enhancement-mode field-effect transistor. The transistors are connected in series across the power supply with gates linked together as the input.

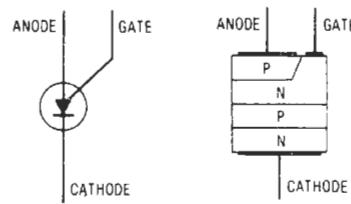
**complementary operator**—The logic operator whose result is the NOT of a given logic operator.

**complementary push-pull**—A power amplifier in which the output transistors are of complementary polarities (i.e., pnp and npn). In some amplifiers of this kind the driven transistors also constitute a complementary pair.

**complementary rectifier**—Half-wave rectifying circuit elements that are not self-saturating rectifiers in the output of a magnetic amplifier.

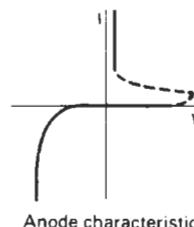
**complementary silicon-controlled rectifier**—A pnpn semiconductor device that is the polarity complement of the silicon-controlled rectifier.

**complementary-symmetry circuit**—An arrangement of pnp and npn transistors that provides push-pull operation from one input signal.



Symbol.

Junctions.



Anode characteristic

### Complementary silicon-controlled rectifier.

**complementary tracking**—A system of interconnection of two or more devices in which one (the master) operates to control the others (the slaves).

**complementary transistor amplifier**—An amplifier that utilizes the complementary symmetry of npn and pnp transistors.

**complementary transistor logic**—A digital logic circuit configuration making use of a complementary transistor emitter coupled AND-OR gate. Basically, a two-level diode gate using simultaneous npn and pnp action.

**complementary transistors**—Two transistors that have opposite conductivity (pnp and npn) and usually have matching electrical characteristics; npn and pnp pairs with similar electrical characteristics.

**complementary unijunction transistor**—Abbreviated CUJT. 1. An integrated semiconductor structure with characteristics similar to those of a unijunction transistor, but complementary to other unijunction transistors in the way that pnp transistors are complementary to npn transistors. 2. A silicon planar device similar to a unijunction transistor except that the operating currents and voltages are of the opposite polarity. The electrical characteristics are stable, consistent, and predictable over a wide temperature range. The CUJT will operate from a 5-volt supply and is therefore compatible with integrated circuits. Typically, the case is electrically connected to the substrate and must be isolated from the circuit.

**complementary wave**—A wave brought into existence at the ends of a coaxial cable or two-conductor transmission line, or any discontinuity along the line.

**complementary wavelength**—The wavelength of light of a single frequency. When combined with a sample color in suitable proportions, the wavelength matches the reference-standard light.

**complementing**—Changing each binary 1 into a 0 and each 0 into a 1.

**complement number**—A number that, when added to another number, gives a sum equal to the base of the numbering system. For example, in the decimal system, the complement of 2 is 8. Complement numbers are used in some computer systems to facilitate arithmetic operations.

**complement number system**—A system of number handling in which operations are performed on

the complement of the actual number. The system is used in some computers to facilitate arithmetic operations.

**complementor**—A circuit or device that produces a Boolean complement. A NOT circuit.

**complete carry**—A system of executing the carry process in a computer. All carries, and any other carries to which they give rise, are allowed to propagate to completion in this system.

**complex components**—Indivisible and nonreversible components having more than one function.

**complex function**—An integrated device in which three or more circuits are integral to a single silicon chip. In addition, the circuits are interconnected on the chip itself to form some electronic function at a higher level of organization than a single circuit. The interconnection pattern for the function is predetermined by the fixed mask; no wiring discretion is available for yield purposes. The input and outputs of all the circuits are not normally exposed to the package terminals. An example of a complex function would be a full adder or a multibit serial shift register.

**complex instruction set computer**—See CISC.

**complex parallel permeability**—The complex relative permeability measured under stated conditions on a core with the aid of a coil. The parameter characterizing the induction is the impedance of the coil when placed on the core, expressed as a parallel connection of reactance and resistance. The parameter characterizing the field strength is the reactance the coil would have if placed on a core of the same dimensions but with unity relative permeability, the distribution of the magnetic field being identical in both cases. The coil should have negligible copper losses.

**complex permeability**—Under stated conditions, the complex quotient of the moduli of the parallel vectors representing induction and field strength in a material. One of the moduli varies sinusoidally with time, and the component chosen from the other modulus varies sinusoidally at the same frequency.

**complex series permeability**—The complex relative permeability measured under stated conditions on a core with the aid of a coil. The parameter characterizing the induction in the core is the impedance of the coil when placed on the core, expressed as a series connection of reactance and resistance. The parameter characterizing the field strength is the reactance this coil would have if placed on a core of the same dimensions but with unity relative permeability. The coil should have negligible copper losses.

**complex steady-state vibration**—A periodic vibration of more than one sinusoid. It includes repeating square waves, sawtooth waves, etc., because these waveforms can be expressed in terms of a Fourier series of sinusoidal terms.

**complex target**—A radar target made up of a number of reflecting surfaces that, taken together, are smaller in all dimensions than the resolution capability of the radar.

**complex tone**—A sound wave produced by the combination of simple sinusoidal components of different frequencies. A sound sensation characterized by more than one pitch.

**complex wave**—A periodic wave made up of a combination of several frequencies or several sine waves superimposed on one another.

**complex-wave generator**—A device that generates a nonsinusoidal signal having a desired repetitive characteristic and waveform.

**compliance**—1. The reciprocal of stiffness; that is, the ability to yield or flex. 2. The ease with which a phonograph stylus can be deflected by the groove wall.

Expressed in microcentimeters per dyne ( $10^{-8}$  m/dyne) as the distance through which the stylus will be deflected by a force of 1 dyne. Typical values are from 10 to 50 microcentimeters per dyne. In general, the higher the compliance, the better the low-frequency tracking at a given tracking force. Compliance can be measured in several ways—static and dynamic. 3. The mechanical and acoustical equivalent of capacitance. 4. The flexibility of a speaker cone's suspension. High compliance is important in a woofer for accurate reproduction of low-frequency signals of large amplitude.

**compliance extension**—A form of master/slave interconnection of two or more current-regulated supplies to increase their output voltage range through series connection.

**compliance range**—The range of voltage needed to sustain a given constant current throughout a range of load resistances.

**compliance voltage**—The output voltage of a dc power supply operating in constant-current mode.

**compliance voltage range**—The output voltage range of a dc power supply operating in a constant-current mode.

**component**—1. An essential functional part of a subsystem or equipment. It may be any self-contained element with a specific function, or it may consist of a combination of parts, assemblies, accessories, and attachments. 2. In vector analysis, one of the parts of a wave, voltage, or current considered separately. 3. A packaged functional unit consisting of one or more circuits made up of devices, which in turn may be part of an operating system or subsystem. A part of, or division of, the whole assembly or equipment. Normally interchangeable with *unit*. 4. In high fidelity, a specialized item of equipment designed to do a particular part of the work in a sound system. 5. Any of the basic parts used in building electronic equipment, such as a resistor or capacitor.

**component density**—The number of components contained in a given volume or within a given package or chip. The quantity of components on a printed board per unit area.

**component layout**—The physical arrangement of the components in a chassis or printed circuit.

**component level bus**—The set of input and output pins, with defined functions and timing, through which a microprocessor sends and receives signals.

**component operating hours**—A unit of measurement for the period of successful operation of one or more components (of a specified type) that have endured a given set of environmental conditions.

**component part**—A term sometimes used to denote a passive device.

**component placement equipment**—Automatic systems for sorting and placing components onto hybrid circuit substrates or printed circuit boards, consisting of indexing conveyor, sorter, placement heads, missing component detector, programmable electropneumatic control, and options to handle special requirements.

**component population**—The variety and number of components (transistors, resistors, transformers, etc.) necessary to perform the desired electrical function.

**component side**—That side of a printed board on which most of the components will be mounted.

**component stress**—Those factors of usage or test, such as voltage, power, temperature, frequency, etc., that tend to affect the failure rate of component parts.

**composite cable**—A cable in which conductors of different gages or types are combined under one sheath.

**composite circuit**—A circuit that can be used simultaneously for telephony and direct-current telegraphy or signaling, the two being separated by frequency discrimination.

**composite color signal**—The color picture signal plus all blanking and synchronizing signals. Includes luminance and chrominance signals, vertical- and horizontal-sync pulses, vertical- and horizontal-blanking pulses, and the color-burst signal.

**composite color sync**—The signal comprising all the sync signals necessary for proper operation of a color receiver. Includes the deflection sync signals to which the color sync signal is added in the proper time relationship.

**composite conductor**—Two or more strands of different metals, such as aluminum and steel or copper and steel, assembled and operated in parallel.

**composite controlling voltage**—The voltage of the anode of an equivalent diode, combining the effects of all individual electrode voltages in establishing the space-charge limited current.

**composed circuit**—A circuit that can be used simultaneously for telephony and for direct-current telegraphy or signaling, separation between the two being accomplished by frequency discrimination.

**composite dialing**—In telephone operations, a method of dialing between distant offices over one leg of a composite set.

**composite filter**—A filter with two or more sections.

**composite guidance system**—A guidance system using a combination of more than one individual guidance system.

**composite picture signal**—The television signal produced by combining a blanked picture signal with the sync signal.

**composite signal**—The stereo FM broadcast modulation signal consisting of a 19-kHz pilot tone, L + R information and L - R information modulated on a suppressed 38-kHz carrier and (if any) a 67-kHz FM carrier with a  $\pm 6$ -kHz deviation SCA channel.

**composite sync signal**—The position of the composite video signal that synchronizes the scanning process.

**composite TV signal**—A combination of video picture, color, audio, and synchronization information.

**composite video**—A standard type of video in which red, green, and blue signals are mixed together.

**composite video signal**—1. The complete video signal, containing both picture and sync information. For monochrome, it consists of the picture signal and the blanking and synchronizing signals. For color, color-synchronizing signals and color-picture information are added. 2. The combined signals in a television transmission, including the picture signal, vertical and horizontal blanking, and synchronizing signals. 3. The complete video signal, consisting of the chrominance and luminance information as well as all sync and blanking pulses.

**composite wave filter**—A combination filter consisting of two or more low-pass, high-pass, bandpass, or band-elimination filters.

**composite wire clad**—A wire having a core of one metal to which is fused an outer shell of one or more different metals.

**composition**—The conversion of computer files containing text and typesetting commands into a format for input to an imaging system, such as a phototypesetter.

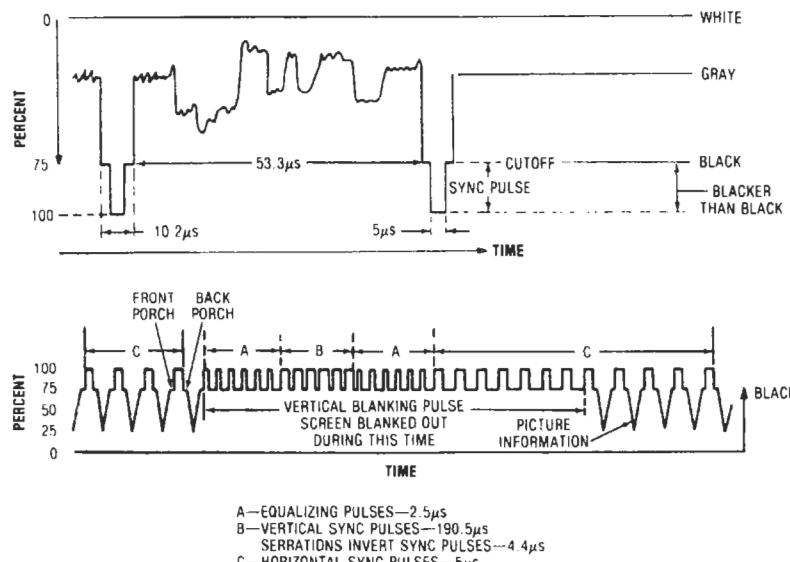
**composition resistor**—See carbon resistor.

**compound-connected transistor**—Two transistors that are combined to increase the current amplification factor at high emitter currents. This combination is generally employed in power-amplifier circuits.

**compound-filled transformer**—A transformer that is contained within a case and in which the structural insulating material is supplemented by submergence in a solid or semisolid insulating material introduced into the case in a fluid state.

**compound horn**—An electromagnetic horn of rectangular cross section. The four sides of the horn diverge in such a way that they coincide with or approach four planes, with the provision that the two opposite planes do not intersect the remaining planes.

**compounding**—A form of noise reduction using compression at the transmitting end and expansion at the receiver. A compressor is an amplifier that increases its gain for lower-power signals. The effect is to boost these components into a form having a smaller dynamic



Composite picture signal.

range. A compressed signal has a higher average level and therefore less apparent loudness than an uncompressed signal, even though the peaks are no higher in level. An expander reverses the effect of the compressor to restore the original signal.

**compound modulation**—*See* multiple modulation.

**compound-wound motor**—A dc motor having two separate field windings. One, usually the predominant field, is connected in parallel with the armature circuit, and the other is connected in series.

**compress**—To reduce some parameter of a signal, such as bandwidth, amplitude variation, duration, etc., while preserving its information content.

**compressed-air loudspeaker**—A loudspeaker that has an electrically actuated valve to modulate a stream of compressed air.

**compressed file**—A file whose contents have been compressed by a special utility program so that it occupies less space on a disk or other storage device than in its uncompressed (normal) state.

**compressed speech**—A representation of speech in which some redundant features of the digitized speech have been removed.

**compression**—1. A process in which the effective amplification of a signal is varied as a function of the signal magnitude, the effective gain being greater for small than for large signals. In television, the reduction in gain at one level of a picture signal with respect to the gain at another level of the same signal. 2. Electronic reduction of the dynamic range so that quiet sounds are raised and loud sounds lowered. The most common application is an "automatic" recording in which it is important that all sounds recorded are made intelligible when played back. Also used when necessary to avoid overrecording and distortion, or to lift the signal level clear of background noise or hum. 3. A technique used to increase the number of bits per second sent over a data link by replacing often-repeated characters, strings, and command sequences with electronic code. When this compressed data reaches the remote end of the transmission link, data decompression is used to restore the data to its normal form for display. 4. The conversion of information to a format that requires fewer bits and can be reversed to its original state once transferred to a new location.

**compressional wave**—In an elastic medium, a wave that causes a change in volume of an element of the medium without rotation of the element.

**compression driver unit**—A speaker driver unit that does not radiate directly from the vibrating surface. Instead, it requires acoustic loading from a horn that connects through a small throat to an air space adjacent to the diaphragm.

**compression ratio**—The ratio between the magnitude of the gain (or amplification) at a reference signal level and its magnitude at a higher stated signal level.

**compression seal**—A seal made between an electronic package and its leads. The seal is formed as the heated metal, when cooled, shrinks around the glass insulator, thereby forming a tight joint.

**compressor**—1. A device that performs analog compression. 2. A transducer that, for a given amplitude range of input voltages, produces a smaller range of output voltages. In one important type of compressor, the envelope of speech signals is used to reduce their volume range.

**compressor expander**—*See* compander.

**compromise network**—In a telephone system, a network used in conjunction with a hybrid coil to balance a subscriber's loop. The network is adjusted for an average loop length, an average subscriber's set, or both,

and gives compromise (not precision) isolation between the two directional paths of the hybrid coil.

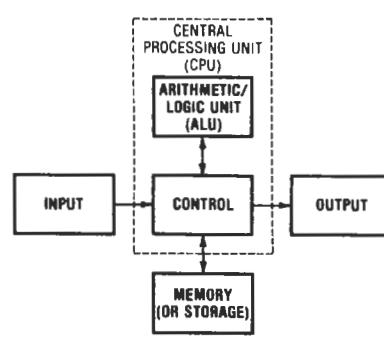
**Compton diffusion**—An elastic shock between a photon and an electron. The photon is diffused with a lesser energy and the electron acquires a kinetic energy equal to the energy decrease of the photons.

**Compton effect**—The elastic scattering of photons by electrons. Because the total energy and momentum are conserved in the collisions, the wavelength of the scattered radiation undergoes a change that depends on the scattering angle.

**computational stability**—The degree to which a computational process remains valid when subjected to such effects as errors or malfunctions.

**compute bound**—A program that is speed-limited by the computations being performed.

**computer**—1. Any device capable of accepting information, applying prescribed processes to the information, and supplying the results of these processes; sometimes, more specifically, a device for performing sequences of arithmetic and logical operations; sometimes, still more specifically, a stored-program digital computer capable of performing sequences of internally stored instructions, as opposed to calculators on which the sequence is impressed manually (desk calculator) or from tape or cards (card-programmed calculator). 2. A tool for managing data. It can work with numbers and alphanumeric data such as names, words, addresses, and stock numbers. It can be programmed to repeat the same function over and over. It can logically evaluate information given to it, and act on its own findings. It can store huge volumes of data for future use, reference, and updating, and even "converse" with its operator. 3. A machine in which stored instructions operate on other instructions to modify or alter them. Data words and instruction words of the same size, stored in the same medium, differ only in their function. The same word can be both a data word and an instruction word at different times during the execution of a program. 4. An electrical/electronic device that can accept information, process it mathematically (in accordance with previous instructions), and then provide the results of this processing. 5. An electronic device that uses programmed instructions to monitor and control various types of data in order to solve mathematical problems or control industrial applications. Its instructions are executed in various sequences, as required. 6. A calculating device that processes data represented by a combination of discrete data (in digital computers) or continuous data (in analog computers). 7. A device that manipulates data and makes comparisons according to a series of instructions stored in its memory. By changing the instructions the computer can be made to do a completely different



Computer.

task. Instructions and data are stored in the same memory and both can be manipulated by the computer with equal ease. 8. A device that is capable of solving problems or manipulating data by accepting data, performing prescribed operations (mathematical or logical) on the data, and then delivering or applying the results of these operations.

**computer access device input**—A device that automatically routes to the computer all teletypewriter observation reports that are received in a standard format.

**computer-aided design**—*See CAD.*

**computer-aided engineering**—Abbreviated CAE. An umbrella term that covers all uses of computers in engineering applications. Thus, computer-aided design and computer-aided manufacturing are branches of computer-aided engineering. The subject area is not usually considered to include software engineering.

**computer-aided manufacturing**—Abbreviated CAM. The use of computer technology to manage, control, and operate manufacturing either through direct or indirect computer interface with the physical and human resources of the company.

**computer-aided software engineering**—*See CASE.*

**computer-aided tomography**—*See CAT.*

**computer architecture**—That set of a computer's attributes (such as registers, addressing modes, and instruction set) that are visible to the programmer.

**computer assisted tomography**—*See CAT.*

**computer code**—Also called machine language. The code by which data is represented within a computer system. An example is binary-coded decimal.

**computer control**—The parts of a digital computer that have to do with the carrying out of instructions in the proper sequence, the interpretation of each instruction, and the application of signals to the arithmetic unit and other parts in accordance with this interpretation.

**computer control counter**—1. A counter that stores the next required address. 2. Any counter that provides information to the control unit.

**computer diagnosis**—The use of data processing systems for evaluation of raw data.

**computer entry punch**—A combination card reader and keypunch used to enter data directly onto the memory drum of a computer.

**computer-generated hologram**—A synthetic hologram produced using a computer plotter. The binary structure is formed on a large scale and is then photographically reduced. The holograms are finally etched into a medium.

**computer graphics**—1. Computer output in the form of pictorial representation (graphs, charts, drawings, etc.) that is displayed visually, usually by a cathode-ray tube. 2. A person-oriented system that uses a computer to create, transform, and display pictorial and symbolic data.

**computer-integrated manufacturing**—*See CIM.*

**computer interface**—1. Peripheral equipment for attaching a computer to scientific or medical instruments. 2. A device designed for data communication between a central computer and another unit such as a PC processor.

**computer interfacing**—The synchronization of digital data transmission between a computer and one or more external I/O devices.

**computerized axial tomograph**—*See CAT.*

**computerized robot**—A servo model run by a computer. The computer controller does not have to be taught by leading the arm-gripper through a routine; new instructions can be transmitted electronically. The programming for such "smart" robots may include the ability to optimize, or improve, its work-routine instructions.

## computer access device input — computing device

**computer language**—1. A system of commands used to develop software for computers (e.g., DOS). 2. The method or technique used to instruct a computer to perform various operations. *See high-level language; machine language.*

**computer-limited**—Having to do with the condition in which the time required for computation is greater than the time required to read inputs and write outputs.

**computer literacy**—1. Computer and information system comprehension. 2. The ability to use computer technology in a particular discipline.

**computer network**—Two or more connected computers that have the ability to exchange information.

**computer numerical control**—Abbreviated CNC. The use of a dedicated computer within a numerical-control unit to perform some or all of the basic numerical-control functions.

**computer-output microfilm printer**—Abbreviated COM printer. A microfilm printer that will take output directly from the computer, thus substituting for line printer or tape output.

**computer polarization holography**—A technique used to store waveform information on thin polarization information-recordable materials (i.e., photochromic crystals) by controlling the polarization angle of a small illuminating spotlight in each sampling cell on a crystal.

**computer port**—The physical location at which the communication line interfaces to the computer.

**computer program**—A series of instructions or statements prepared in a form acceptable to the computer, the purpose of which is to achieve a certain result. *See software.*

**computer programmer**—A person who designs, writes, debugs, and documents computer programs.

**computer programming language**—A set of precisely defined structures and syntax (representation, conventions, and rules of use and interpretation) devised to simplify communication with a computer, such as BASIC, FORTRAN, C++, and Java. The greater the power of a higher-level language, the greater is the complexity of information that can be precisely conveyed in an efficient manner.

**computer science**—1. The field of knowledge that involves the design and use of computer equipment, including software development. 2. The science of solving problems with computers.

**computer system**—The computer and its attached peripherals, such as disk drives, monitor, keyboard, and printer.

**computer tape**—A high-quality magnetic digital recording tape that must be rated at 1600 fci (flux changes per inch) or 530 flux changes per centimeter, or greater.

**computer terminal**—Peripheral computer equipment for entering and retrieving data. Sometimes incorporates cathode-ray tube for display.

**computer user tape system**—*See CUTS.*

**computer utility**—A network of central computers linked through data communications facilities to remote terminal systems.

**computer word**—A sequence of bits or characters that is treated as a unit and that can be stored in one computer location. Same as machine word.

**computing**—Performing basic and more involved mathematical processes of comparing, adding, subtracting, multiplying, dividing, integrating, etc.

**computing device**—Any electronic device or system that generates and uses timing signals or pulses of more than 10,000 pulses (cycles) per second and uses digital techniques; inclusive of telephone equipment that uses digital techniques or any device or system that generates

and uses rf energy for data processing functions, such as electronic computations, operations, transformations, recording, filing, sorting, storage, retrieval, or transfer. (Radio transmitters and receivers; industrial, scientific, and medical equipment; and any other radio-frequency devices specifically subject to an examination requirement are excluded from this definition.)

**computing machine** — An automatic device that carries out well-defined mathematical operations.

**COMSTAR I, II, and III** — Three American satellites that can carry video and are operated by AT & T. They are located at 128°, 95°, and 87° west longitude.

**concatenate** — To unite in a series; to connect together; to chain. Used to describe the action of relating data used by a computer program in some organized manner.

**concave** — Curved inward.

**concentrated-arc lamp** — A type of low-voltage arc lamp having nonvaporizing electrodes sealed in an atmosphere of inert gas and producing a small, brilliant, incandescent cathode spot.

**concentration gradient** — A difference in carrier concentration (holes or free electrons) from point to point in a semiconductor.

**concentrator** — 1. A device that feeds the signals from several data terminals into a single transmission line for input to a computer, or vice versa. 2. An analog or digital buffer switch used to reduce the required number of trunks. 3. A device for combining many low-speed data lines into one high-speed data line. 4. A device that uses hardware and software to perform computer communication functions. (A term first applied to telephone-switching systems that permitted greater economy in use of facilities by combining many phone circuits into one.) 5. An electronic device that interfaces in a store-and-forward mode with multiple low-speed communication lines at a message level and then retransmits those messages to a processing site via one or more high-speed communication lines.

**concentric cable** — *See* coaxial line.

**concentric groove** — *See* locked groove.

**concentric-lay cable** — 1. A concentric-lay conductor. 2. A multiple-conductor cable composed of a central core surrounded by one or more layers of helically laid insulated conductors.

**concentric-lay conductor** — A conductor composed of a central core surrounded by one or more layers of helically laid wires. In the most common type of concentric-lay conductor, all wires are of the same size, and the central core is a signal wire.

**concentric line** — *See* coaxial line.

**concentric strand** — A strand that consists of a central wire or core surrounded by one or more layers of spirally laid wires. Each layer after the first has six more strands than the preceding layer and is applied in a direction opposite to that of the layer under it.

**concentric stranding** — A method of stranding wire in which the final wire is built up in layers such that the inner diameter of a succeeding layer always equals the outer diameter of the underlying layer.

**concentric-wound coil** — A coil with two or more insulated windings that are wound one over the other.

**concurrent processing** — The ability of a computer to work on more than one program at the same time.

**condensation soldering** — The immersion of a part to be reflow soldered into a reservoir of hot saturated vapor. As the vapor condenses on the part, the latent heat of vaporization is released to heat the part.

**condensed mercury temperature** — The temperature of a mercury-vapor tube, measured on the outside

of the tube envelope, in the region where the mercury is condensing in a glass tube or at a designated point on a metal tube.

**condenser** — Obsolete term for capacitor in electronics. A device in an ignition circuit that is connected across the contact points to reduce arcing by providing a storage for electricity as points open. Note: The term condenser is still used in the automotive field.

**condenser antenna** — *See* capacitor antenna.

**condenser microphone** — *See* electrostatic microphone.

**condenser speaker** — *See* electrostatic speaker.

**condenser tissue** — Kraft paper of 0.002 inch (51 µm) or less nominal thickness used in the manufacture of capacitors with paper or paper/film dielectrics.

**conditional** — 1. In a computer, subject to the result of a comparison made during computation. 2. Subject to human intervention.

**conditional breakpoint instruction** — A conditional jump instruction that causes a computer to stop if a specified switch is set. The routine then may be allowed to proceed as coded, or a jump may be forced.

**conditional jump** — Also called conditional transfer of control. 1. An instruction causing a program transfer to an instruction location other than the next sequential instruction only if a specific condition tested by the instruction is satisfied. If the condition is not satisfied, the next sequential instruction in the program line is executed. 2. A computer program transfer that occurs only when the instruction that specifies it is executed and other specified conditions are satisfied.

**conditional statement** — Also called IF statement. A statement that causes the computer to check something and use that as a basis for choosing among alternative courses of action. Same as a branch.

**conditional transfer** — A program instruction that causes central control either to process the next instruction in sequence or to jump to some other indicated instruction, depending on the results of some previous operation.

**conditional transfer of control** — *See* conditional jump.

**condition code** — In a computer, a limited group of program conditions, such as carry, borrow, overflow, etc., that are pertinent to the execution of instructions. The codes are contained in a condition codes register.

**conditioned line** — A telephone circuit that has had its frequency response and/or delay characteristics optimized.

**conditioning** — 1. Equipment modifications or adjustments required to provide matching of transmission levels and impedances or to provide equalization between facilities. 2. The addition of equipment to a leased voice-grade channel to provide minimum line characteristics necessary for data transmission. 3. Time-limited exposure of a test specimen to a specified environment(s) prior to testing. 4. Applying electronic filtering elements to a communication line to improve its ability to support higher transmission data rates. *See also* equalization.

**condition queue** — A queue, declared in the monitor, that lines up blocked processes.

**Condor** — A cw navigational system, similar to Benito, that automatically measures bearing and distance from a single ground station and displays them in a cathode-ray indicator. The distance is determined by phase comparison, and the bearing by automatic direction finding.

**conductance** — Symbolized by  $G$  or  $g$ . 1. In an element, device, branch, network, or system, the physical property that is the factor by which the square of an instantaneous voltage must be multiplied to give the corresponding energy lost by dissipation as heat or other permanent radiation, or by loss of electromagnetic

energy from the circuit. 2. The real part of admittance. 3. Reciprocal of resistance; measured in siemens. It is the ratio of current through a material to the potential difference at its ends. 4. The component of sinusoidal current in phase with the terminal voltage of a circuit, divided by that voltage.

**conducted heat** — Thermal energy transferred by thermal conduction.

**conducted interference** — Any unwanted electrical signal conducted on the power lines supplying the equipment under test, or on lines supplying other equipment to which the one under test is connected.

**conducted signals** — Electromagnetic or acoustic signals propagated along wire lines or other conductors.

**conducted spurious transmitter output** — A spurious output of a radio transmitter that is conducted over a tangible transmission path such as a power line, control circuit, radio-frequency line, waveguide, etc.

**conductimeter** — *See* conductivity meter.

**conduction** — The transmission of heat or electricity through or by means of a conductor.

**conduction band** — 1. A partially filled energy band in which electrons can move freely, allowing the material to carry an electric current (with electrons as the charge carriers). 2. The band of energy levels occupied by a valence electron when it is liberated from an atom. Electrical conduction in a semiconductor crystal takes place through the transport of electrons in the conduction band.

**conduction current** — The power flow parallel to the direction of propagation, expressed in siemens per meter.

**conduction-current modulation** — 1. Periodic variations in the conduction current passing a point in a microwave tube. 2. The process of producing such variations.

**conduction electrons** — The electrons that are free to move under the influence of an electric field in the conduction band of a solid.

**conduction error** — The error in a temperature transducer due to heat conduction between the sensing element and the mounting to the transducer.

**conduction field** — Energy that surrounds a conductor when an electric current is passed through the conductor, and that, because of the difference in phase between the electrical field and magnetic field set up in the conductor, cannot be detached from the conductor.

**conductive adhesive** — An adhesive material that has metal powder added to increase electrical conductivity.

**conductive epoxy** — An epoxy material (polymer resin) that has been made conductive by the addition of a metal powder, usually gold or silver.

**conductive gasket** — A special highly resilient gasket used to reduce rf leakage in shielding that has one or more access openings.

**conductive level detector** — A device with single or multiple probes. A change in level completes an electrical circuit between the container and/or probe.

**conductive material** — A material in which a relatively large conduction current flows when a potential is applied between any two points on or in a body constructed from the material. Metals and strong electrolytes are examples of conductors.

**conductive pattern** — 1. The arrangement or design of the conductive lines on a printed circuit board. 2. The configuration or design of the conductive material on the base material. Includes conductors, lands, and through connections when these connections are an integral part of the manufacturing process.

**conductive pattern-to-board cutline** — The location of the printed pattern relative to the overall outline dimensions of the printed circuit board.

**conductive plastic potentiometer** — A potentiometer in which the resistive element consists of a blend of resin (epoxy, polyester, etc.) and processed carbon powder applied to a plastic or ceramic substrate.

**conductivity** — 1. The conductance between opposite faces of a unit cube of material. The volume conductivity of a material is the reciprocal of the volume resistivity. 2. The ability of a material to conduct electric current. It is expressed in terms of the current per unit of applied voltage. It is the reciprocal of resistivity. 3. The ability to conduct or transmit heat or electricity. 4. The ability of a material to allow electrons to flow, measured by the current per unit of voltage applied. It is also the reciprocal of resistivity. 5. Synonym for conductance. 6. The parameter of a material that indicates the extent to which it permits a net electrical current; normally measured in terms of the conductance in reciprocal ohms (siemens) between opposite faces of a cube of the material measuring 1 centimeter on each side. The conductivity of a material is the reciprocal of its resistivity. 6. Property of a material to allow electrical current to flow with very little loss. For natural surfaces, conductivity in general is increased with increased moisture content.

**conductivity meter** — Also called conductimeter. An instrument that measures and/or records electrical conductivity.

**conductivity modulation** — 1. The change in conductivity of a semiconductor as the charge-carrier density is varied. 2. The process whereby the effective electrical conductivity of a semiconductor region is modified by the injection of excess carriers. Thus, excess majority carriers injected into a lightly doped region can cause the effective conductivity to be increased simply by providing further carriers for current conduction. Conversely, excess minority carriers injected into a heavily doped region can cause the effective conductivity to be reduced by increasing the incidence of recombination and, hence, reducing the number of carriers available for conduction.

**conductivity-modulation transistor** — A transistor in which the active properties are derived from minority-carrier modulation of the bulk of resistivity of the semiconductor.

**conductor** — 1. A bare or insulated wire or combination of wires not insulated from one another, suitable for carrying an electric current. 2. A body of conductive material so constructed that it will serve as a carrier of electric current. 3. A material (usually a metal) that conducts electricity through the transfer of orbital electrons. 4. A material, such as copper or aluminum, that offers low resistance or opposition to the flow of electric current. 5. A medium for transmitting electrical current. A conductor usually consists of copper, aluminum, steel, silver, or other material. 6. A solid, liquid, or gas that offers little opposition to the continuous flow of electric current. 7. Any material whose valence energy band is only partially filled with electrons, so that empty levels are immediately available for a net electron movement. Such materials conduct electricity readily, even at extremely low temperatures. 8. A substance or body that allows a current of electricity to pass continuously and easily through it. A member of a class of materials that conduct electricity easily, i.e., have a low resistivity ( $10^{-4}$  ohm/cm). 9. A single conductive path in a conductive pattern.

**conductor side** — The side of a single-sided printed board containing the conductive pattern.

**conductor spacing** — The distance between adjacent edges (not centerline to centerline) of isolated conductive patterns in a conductor layer of a printed circuit.

**conductor-to-hole spacing**—The distance between a conductor edge and the edge of a component hole.

**conduit**—1. A tubular raceway designed for holding wires or cables designed and used expressly for this purpose. It may be a solid or flexible tube in which insulated electrical wires are run. 2. Metal sleeve through which electrical wires pass.

**conduit wiring**—Wiring carried in conduits and conduit fittings.

**cone**—The diaphragm that sets the air in motion to create a sound wave in a direct-radiator loudspeaker. Usually it is conical in shape.

**cone breakup**—The inability of a speaker cone to work as a piston at high frequencies, the effect being that the cone is not under the complete control of the voice coil, certain parts of it moving in opposition to other parts like a rippled rope. Responsible for uneven frequency response.

**cone of nulls**—A conical surface formed by directions of negligible radiation.

**cone of silence**—An inverted cone-shaped space directly over the aerial towers of some radio beacons. Within the cone, signals cannot be heard or will be greatly reduced in volume.

**conference call**—A telephone call that interconnects three or more telephones and permits all parties to converse at random.

**confetti**—Flecks or streaks of color caused by tube noise in the chrominance amplifier. Because of its colors, confetti is much more noticeable than snow in a black-and-white picture. The chrominance amplifier is therefore cut off during a monochrome program.

**confidence**—1. The likelihood, expressed as a percentage, that a measurement or statement is true. 2. The degree of assurance that the stated failure rate has not been exceeded.

**confidence factor**—The percentage figure expressing confidence level.

**confidence interval**—A range of values believed to include, with a preassigned degree of confidence, the true characteristic of the lot.

**confidence level**—1. The probability (expressed as a percentage) that a given assertion is true or that it lies within certain limits calculated from the data. 2. A degree of certainty.

**confidence limits**—Extremes of a confidence interval within which there is a designated chance that the true value is included.

**configuration**—1. The relative arrangement of parts (or components) in a circuit. 2. A listing of the names and/or serial numbers of the assemblies that make up an equipment. 3. The hardware and/or software making up a system. 4. Combination of computer and peripheral devices at a single installation. 5. A general-purpose computer term that can refer to the way a computer is set up. It is also used to describe the total combination of hardware components that make up a computer system and the software settings that allow various hardware components of a computer system to communicate with one another.

**configuration file**—A file that contains information on the way a system is set up.

**configure**—The act of changing software or hardware actions by changing the settings in a computer.

**confocal resonator**—A wavemeter for millimeter wavelengths. It consists of two spherical mirrors that face each other; a change in the spacing between the mirrors affects the propagation of electromagnetic energy between them, making possible direct measurement of free-space wavelengths.

**conformal coating**—1. A thin nonconductive coating, either plastic or inorganic, applied to a circuit for environmental and/or mechanical protection. 2. A protective coating applied to completed printed circuit boards that conforms to the shape of the components and provides complete electrical as well as environmental insulation.

**conformance error**—The deviation of a calibration curve from a specified curve line.

**confusion jamming**—An electronic countermeasure by means of which a radar may detect a target, but the radar operator is denied accurate data regarding range, azimuth, and velocity of the target. This result is accomplished through amplification and retransmission of an incident radar signal with distortion to create a false echo. Also called deception jamming.

**confusion reflector**—A device that reflects electromagnetic radiation to create echoes for purposes of causing confusion of radar, guided missiles, and proximity fuses.

**congestion**—A condition in which the number of calls arriving at the various inputs of a communications network are too many for the network to handle at once and are subject to delay or loss. (The concept applies in an analogous way to any system in which arriving traffic can exceed the number of servers.)

**conical horn**—A horn whose cross-sectional area increases as the square of the axial length.

**conical scanning**—A form of scanning in which the beam of a radar unit describes a cone, the axis of which coincides with that of the reflector.

**conjugate**—Either of a pair of complex numbers that are mutually related in that their real parts are identical and the imaginary part of one is the negative of the imaginary part of the other, that is, if  $a = x + iy$ , then  $a = x - iy$  is its conjugate.

**conjugate branches**—Any two branches of a network in which a driving force impressed on one branch does not produce a response in the other.

**conjugate bridge**—A bridge in which the detector circuit and the supply circuits are interchanged, compared with a normal bridge.

**conjugate impedance**—An impedance whose value is the conjugate of a given impedance. For an impedance associated with an electric network, the conjugate is an impedance with the same resistance component as the original and a negative reactive component.

**conjugate matching**—A condition of source- and loading-impedance matching in which the source impedance and the load impedance have equal resistive parts and equal reactance values with opposite signs. This results in maximum power transfer.

**connected**—A network is connected if, between every pair of nodes of the network, there exists at least one path composed of branches of the network.

**connecting block**—A cable-termination block in which access to circuit connections is available.

**connection**—1. The attachment of two or more component parts so that conduction can take place between them. 2. The point of such attachment.

**connection diagram**—1. A diagram showing the electrical connections between the parts that make up an apparatus. 2. A pattern illustrating the connections needed to place an electronic system in operation when such a system includes one or more assemblies, power supplies, and devices being controlled.

**connector**—1. A coupling device that provides an electrical and/or mechanical junction between two cables, or between a cable and a chassis or enclosure. 2. A device that provides rapid connection and disconnection of electrical cable and wire terminations. 3. A

plug or receptacle that can be easily joined to or separated from its mate. Multiple-contact connectors join two or more conductors with others in one mechanical assembly. 4. A device consisting of a mating plug and receptacle. Various types of connectors include DIP, card-edge, two-piece, hermaphroditic, and wire-wrapping configurations. 5. Devices designed to provide separable through connections in cable-to-cable, cable-to-chassis, or rack and panel applications. 6. A device that holds two parts of a circuit together so that they make electrical contact.

**connector assembly** — The combination of a mated plug and receptacle.

**connector discontinuity** — An ohmic change in contact resistance.

**connector flange** — A projection that extends from or around the periphery of a connector and incorporates provisions for mounting the connector to a panel.

**connector receptacle** — 1. An electrical fitting with contacts constructed to be electrically connected to a cable, coaxial line, cord, or wire to join with another electrical connector mounted on a bulkhead, wall, chassis, or panel.

**connect time** — 1. The total time required for establishing a connection between two points. 2. In a computer-based data communications assembly, the switching time required to set up a connection between two terminal points.

**conoscope** — An instrument for determining the optical axis of a quartz crystal.

**consequent poles** — Additional magnetic poles present at other than the ends of a magnetic material.

**consol** — See sonne.

**console** — 1. A cabinet for a radio or television receiver that stands on the floor rather than on a table. 2. Main operating unit in which indicators and general controls of a radar or electronic group are installed. 3. A part of a computer that may be used for manual control of the machine. The computer operator's control panel or terminal. 4. An array of controls and indicators for the monitoring and control of a particular sequence of actions, as in the checkout of a rocket, a countdown, or a launch.

**console operator** — A person who monitors and controls an electronic computer by means of a central control unit or console.

**consonance** — Electrical or acoustical resonance between bodies or circuits not connected directly together.

**constant** — 1. An unvarying or fixed value or data item. 2. Any number not expected to change.

**constant-amplitude recording** — In disc recording, a relationship between the modulations in the groove and the electrical signals making them so that the width of the groove (the excursions of the cutting stylus) is proportional to the amplitude, or power, of the signal. In playback, a similar relation between the record and the motion of the stylus so that the cartridge produces equal voltage regardless of frequency. Crystal and ceramic pickups have a constant amplitude characteristic on playback.

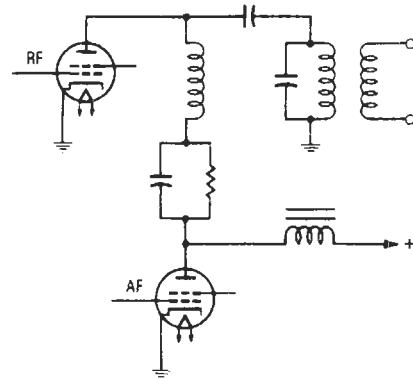
**constant current** — 1. A current that does not undergo a change greater than the required precision of the measurement when the impedance of the generator is halved. 2. Having to do with a type of power-supply operation in which the output current remains at a preset value (within specified limits) while the load resistance varies, resulting in an output-voltage variation within the voltage range of the power supply.

**constant-current characteristic** — The relationship between the voltages of two electrodes, the current to one of them as well as all other voltages being maintained constant.

### constant-current/constant-voltage supply

A power supply that behaves as a constant-voltage source for relatively large values of load resistance and as a constant-current source for relatively small values of load resistance. The crossover point between these two modes of operation occurs when the value of the critical load resistance equals the value of the supply voltage setting divided by the supply current setting.

**constant-current modulation** — Also called Heising modulation. A system of amplitude modulation in which the output circuits of the signal amplifier and carrier-wave generator or amplifier are directly and conductively coupled by a common inductor. The inductor has an ideally infinite impedance to the signal frequencies and therefore maintains the common plate-supply current of the two devices constant. The signal-frequency voltage thus appearing across the common inductor also modulates the plate supply to the carrier generator or amplifier, with corresponding modulation of the carrier output.



Constant-current modulation.

**constant-current power supply** — A regulated power supply that acts to keep its output current constant in spite of changes in load, line, or temperature. Thus, for a change in load resistance, the output current remains constant to a first approximation, while the output voltage changes by whatever amount necessary to accomplish this.

**constant-current transformer** — 1. A transformer that automatically maintains a constant current in its secondary circuit under varying conditions of load impedance when supplied from a constant-potential source. 2. A transformer that supplies a constant current to a varying load. Regulation is accomplished by either varying the separation between primary and secondary windings or by the use of a resonant network.

**constant-delay discriminator** — See pulse demoder.

**constant K-filter** — An image-parameter filter comprising a tandem connection of a number of identical prototype L-section filters. Each adjacent pair of L-sections together forms either a T- or  $\pi$ -network. The product of the series and shunt impedances is a constant that is independent of frequency.

**constant K-network** — A ladder network in which the product of its series and shunt impedances is independent of frequency within the range of interest.

**constant-luminance transmission** — A type of transmission in which the transmission primaries are a luminance primary and two chrominance primaries.

**constant-power-dissipation line**—A line superimposed on the output static characteristic curves and representing the points of collector voltage and current, the product of which represents the maximum collector power rating of a particular transistor.

**constant-ratio code**—A code in which the combinations that represent all characters contain a fixed ratio of ones to zeros.

**constant-resistance network**—A network that will reflect a constant resistance to the output circuit of the driving amplifier when terminated in a resistive load. Loudspeakers do not reflect a constant impedance; therefore, an amplifier does not see a constant resistance. This disadvantage may be somewhat compensated for by the use of negative feedback by the amplifier.

**constant-ringing drop**—Abbreviated CRD. A relay that when activated even momentarily will remain in an alarm condition until reset. A key is often required to reset the relay and turn off the alarm.

**constant-velocity recording**—In disc recording, a relationship between the wiggles in the groove and the electrical signals making them, whereby the frequency of the signal determines the degree of excursion of the cutter. In playback, a similar relation between the recorded wiggles and the motion of the stylus so that the cartridge produces voltages that vary in strength, or amplitude, as the frequency in the groove varies. Magnetic cartridges have a constant velocity characteristic and must be equalized by special networks during playback.

**constant voltage**—1. Voltage that does not undergo a change greater than the required precision of the measurement when the impedance of the generator is doubled. 2. Having to do with a type of power-supply operation in which the output voltage remains at a preset value (within specified limits) while the output current is varied within the range of the power supply.

**constant-voltage charge**—A charge method for a rechargeable battery (storage battery) in which voltage at the battery terminals is held at a constant value throughout the charge cycle.

**constant-voltage charger**—A battery charger that maintains a constant output voltage so that the charging current tapers off as the battery becomes charged. When fully charged, the battery and the charger supply only minor variations in the load current.

**constant-voltage/constant-current cross over**—Behavior of a power supply in which there is automatic conversion from voltage stabilization to current stabilization (and vice versa) when the output current reaches a preset value.

**constant-voltage/constant-current (cv/cc) output characteristic**—A regulated power supply that acts as a constant-voltage source for comparatively large load resistances and as a constant-current source for comparatively small load resistances.

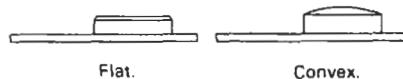
**constant-voltage power supply**—1. A regulated power supply that acts to keep its output voltage constant in spite of changes in load, line, or temperature. Thus, for a change in load resistance, the output current changes by whatever amount necessary to accomplish this. 2. A power supply capable of maintaining a fixed voltage across a variable load resistance and over a defined input voltage and frequency change. The output is automatically controlled to maintain constant the product of output current times load resistance.

**constant-voltage transformer**—A transformer delivering a fixed predetermined voltage over a limited range of input-voltage variations (e.g., 95–125 volts).

**constructive synthesis**—Synthetic voice generation system that builds words from a prescribed set of

linguistic or phonetic sound segments, such as phonemes. Each language has its own set of such sound segments.

**contact**—1. One of the current-carrying parts of a relay, switch, or connector that is engaged or disengaged to open or close the associated electrical circuits. 2. To join two conductors or conducting objects in order to provide a complete path for current flow. 3. The juncture point to provide the complete path. 4. The conducting part of a connector that acts with another such part to complete or break a circuit; contacts provide a separable through connection in a cable-to-cable, cable-to-box, or box-to-box situation. 5. The disc or bar of precious metal on a key, jack, or relay spring that touches another similar contact, thus making a temporary, low-resistance electrical connection through which current can flow.



*Contact, I.*

**contact-actuation time**—The time required for any specified contact on a relay to function. When not otherwise specified, it is the initial actuation time. For some purposes, it is preferable to use either the final or effective actuation time.

**contact arc**—The electrical (current) discharge that occurs between mating contacts when the circuit is being disestablished.

**contact area**—The common area between two conductors or a conductor and a connector through which the flow of electricity takes place.

**contact arrangement**—1. The combination of contact forms that make up the entire relay-switching structure. 2. The number, spacing, and positioning of contacts in a connector.

**contact bounce**—1. The uncontrolled making and breaking of contact when relay contacts are closed. 2. Internally caused intermittent and undesired opening of closed contacts of a relay, caused by one or more of the following: (a) Impingement of mating contacts. (b) Impact of the armature against the coil core on pickup or against the backstop on dropout. (c) Momentary hesitation, or reversal, of the armature motion during the pickup or dropout stroke.

**contact bounce time**—The time interval from initial actuation of a relay contact to the end of bounce brought about during pickup or dropout or from external causes.

**contact chatter**—1. The undesired vibration of mating contacts during which there may or may not be actual physical contact opening. If there is no actual opening but only a change in resistance, it is referred to as dynamic resistance and appears as "grass" on the screen of an oscilloscope having adequate sensitivity and resolution. 2. A sustained rapid physical opening and closing of contact points caused by mechanical vibrations.

**contact combination**—1. The total assembly of contacts on a relay. 2. Sometimes used for contact form.

**contact current**—The peak current through the contacts of a contact-triggered system at the instant the contacts open.

**contact device**—A device that when actuated opens or closes a set of electrical contacts; a switch or relay.

**contact emf**—A small voltage established whenever two conductors of different materials are brought into contact.

**contact follow**—The displacement of a stated point on the contact-actuating member following the initial closure of a contact.

**contact force**—1. The amount of force exerted by one of a pair of closed contacts on the other. 2. The force exerted by the moving mercury on a stationary contact or electrode in a mercury switch.

**contact gap**—Also called contact separation. The distance between a pair of mating relay contacts when they are open.

**contact length**—The length of travel of one contact while touching another contact during the assembly or disassembly of a connector.

**contactless vibrating bell**—A vibrating bell whose continuous operation depends on application of an alternating current without circuit-interrupting contacts, such as those used in vibrating bells operated by direct current.

**contact load**—The electrical power demands encountered by a contact set in any particular application.

**contact microphone**—1. A microphone designed to pick up mechanical vibrations directly from the sound source and convert them into corresponding electrical currents or voltages. 2. A microphone designed for attachment directly to a surface of a protected area or object; usually used to detect surface vibrations.

**contact miss**—Failure of a contact mating pair to establish the intended circuit electrically. This may be a contact resistance in excess of a specified maximum value.

**contact modulator**—Also called electromechanical chopper. A switch used to produce modified square waves having the same frequency as, and a definite phase relationship to, a driving sine wave.

**contact noise**—The random fluctuation of voltage across a junction through which current is flowing from one solid to another.

**contactor**—1. A device for the purpose of repeatedly establishing or interrupting an electric power circuit. 2. A heavy-duty relay used to control electrical circuits.

**contactor alarm**—A signal calling attention to lowered pressure in a cable gas-pressure system.

**contact potential**—Also called Volta effect. 1. The difference of potential that exists when two dissimilar, uncharged metals are placed in contact. One becomes positively charged and the other negatively charged, the amount of potential depending on the nature of the two metals. 2. The potential difference between the contacting surfaces of two metals that have different work functions.

**contact-potential difference**—The difference between the work functions of two materials, divided by the electronic charge generated by them.

**contact pressure**—The amount of pressure holding a set of contacts together.

**contact printing**—A method of screen printing in which the screen is almost in contact with the substrate. Used for printing with metal mask.

**contact rating**—The electrical power-handling capability of relay or switch contacts under specified environmental conditions and for a prescribed number of operations.

**contact rectifier**—A rectifier consisting of two different solids in contact. Rectification is due to the greater conductivity across the contact in one direction than in the other.

**contact resistance**—1. Total electrical resistance of a contact system, such as the resistance of a relay or a switch measured at the terminals. Usually this resistance is only a fraction of an ohm. 2. The ohmic resistance between the contacts of a switch connector or relay. It may be extremely small value—typically in the milliohm range. Contact resistance is normally measured from

terminal to terminal. 3. The resistance between the wiper terminal and the resistive element of a potentiometer. 4. Electrical resistance of pin and socket contacts when assembled in a connector under typical service use. Electrical resistance of each pair of mated pin and socket contacts in the connector assembly is determined by measuring from the pin to the extreme terminal end of the socket (excluding both crimps) when carrying a specified test current. (Overall contact resistance includes wire-to-wire measurement.) 5. In electronic elements, such as capacitors or resistors, the apparent resistance between the terminating electrode and the body of the device.

**contact resistance variation**—Abbreviated crv. The maximum instantaneous change in contact resistance that results from moving the wiper of a potentiometer from one position to another. It is expressed as a percentage of the potentiometer's total resistance.

**contact retainer**—A device used to retain a contact in an inset or body; it may be either on the contact or in the insert.

**contact retention**—The minimum axial load a contact in a connector can withstand in either direction while remaining firmly fixed in its normal position in the insert.

**contacts**—In a relay, the current-carrying parts that engage or disengage to open or close electrical circuits.

**contact separation**—The maximum distance between the stationary and movable contacts when the circuit is broken.

**contact spring**—1. A current-carrying spring to which the contacts are fastened. 2. A non-current-carrying spring that positions and tensions a contact-carrying member.

**contact symbology diagram**—Commonly referred to as a ladder diagram, it expresses the user-programmed logic of the controller in relay-equivalent symbology.

**contact wetting**—The coating of a contact surface with an adherent film of mercury.

**contact wipe**—The distance of travel (electrical engagement) of one contact during its engagement with or separation from another or during mating or unmating of the connector halves.

**contaminated**—Made radioactive by addition of a radioactive material.

**content-addressable memory**—Memory in which information is retrieved by specifying the data rather than the address at which the data is stored.

**content-addressed storage**—See associative storage.

**content indicator**—A display device that indicates the content in a computer, and the program or mode in use.

**contention**—1. A condition that occurs on a multidrop communication channel when two or more locations attempt to transmit simultaneously. 2. Unregulated bidding for a line by multiple users. 3. Competition for use of the same communication facilities; a line-control method in which terminals request or bid to transmit.

**contents**—The information stored in any part of the computer memory.

**contiguous allocation**—An allocation method that assigns adjacent sectors to a file.

**Continental code**—See International Morse code.

**continuity**—1. A continuous path for the flow of current in an electric circuit. 2. In radio broadcasting, the prepared copy from which the spoken material is presented.

**continuity check**—A test performed on a length of finished wire or cable to determine if electrical current flows continuously throughout the length. Conductors

may also be checked against each other to ascertain that there are no shorts.

**continuity test** — An electrical test for determining whether a connection is broken.

**continuity writer** — In radio broadcasting, the person who writes the copy from which the spoken material is presented.

**continuous carrier** — A carrier over which transmission of information is accomplished by means which do not interrupt the carrier.

**continuous commercial service** — *See CCS.*

**continuous-current rating** — The designated rms alternating or direct current that a device can carry continuously under specified conditions.

**continuous data** — Any set of data whose information content can be ascertained continuously in time.

**continuous duty** — The ability of a device or a control to operate continuously with no off or rest periods.

**continuous duty rating** — The rating applied to equipment if operated for an indefinite length of time.

**continuous load** — A load in which the maximum current is expected to continue for three hours or more.

**continuously loaded cable** — A submarine cable in which the conductors are continuously loaded.

**continuous output power** — The maximum power (in watts) that an amplifier will deliver from each channel (with all channels operating) without exceeding its rated harmonic distortion. Measured with a 1-kHz signal. Power ratings should include harmonic distortion and the load impedance (4, 8, or 16 ohms). For example, continuous output power 40 W/40 W (at less than 1 percent harmonic distortion, into 8-ohm load).

**continuous power** — The power an amplifier is capable of delivering for at least 30 seconds with a sine-wave signal.

**continuous power output** — *See* rated power output.

**continuous rating** — The rating that defines the load that can be carried for an indefinite length of time.

**continuous recorder** — A recorder that makes its record on a continuous sheet or web rather than on individual sheets.

**continuous scan thermograph** — Equipment for presenting a continuous scan image of the thermal pattern (thermogram) of a patient or an object on a cathode-ray tube.

**continuous spectrum** — The spectrum that exhibits no structure and appears to represent a continuous variation of wavelength from one to the other.

**continuous variable** — A variable that may assume any value within a defined range.

**continuous-wave radar** — A system in which a transmitter sends out a continuous flow of radio energy to the target, which reradiates (scatters) the energy intercepted and returns a small fraction to a receiving antenna.

**continuous waves** — Abbreviated cw. Electromagnetic sine waves generated as a continuous train of identical oscillations. They can be interrupted according to a code, or modulated in amplitude, frequency, or phase in order to convey information.

**continuous-wave tracking system** — A tracking system that operates by keeping a continuous radio beam on a target and determining its behavior from changes in the antenna necessary to keep the beam on the target.

**contour control system** — In automatic control of machine tools, a system in which the cutting path of a tool is controlled along two or more axes.

**contourograph** — A device in which a cathode-ray oscilloscope is used to produce images that have a three-dimensional appearance.

**contrahelical** — In the wire and cable industry, the term is used to mean the direction of a layer with respect to the previous layer. Thus, it would mean a layer spiraling in an opposite direction from the preceding layer within a wire or cable.

**CONTRAN** — A computer-programming language in which instructions are written at a compiler level, thereby eliminating the need for translation by a compiling routine.

**contrast** — 1. The actual difference in density between the highlights and the shadows. Contrast is not concerned with the magnitude of density, but only with the difference in densities. 2. Amplitude ratio between picture white and picture black. 3. Ratio between the maximum and minimum brightness values in a picture. 4. In optical character recognition, the differences between the color or shading of the printed material on a document and the background on which it is printed. 5. A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison. 6. The difference in tone between the lightest and darkest areas of a photographic print or television image. 7. The ratio between the brightest and darkest parts of a picture.

**contrast control** — 1. A method of adjusting the contrast in a television picture by changing the amplitude of the video signal. 2. With respect to television, a potentiometer that allows variation of the intensity of the different elements of an image and that can be used to accentuate the highlights and shadows in an image. In a color television system, saturation and hue may also be controlled.

**contrast range** — The ratio between the whitest and blackest portions of a television image.

**contrast ratio** — 1. Ratio of the maximum to the minimum luminance values in a television picture or a portion thereof. 2. The ratio of total display element of luminance to the background luminance.

**control** — Also called a control circuit. 1. In a digital computer, those parts that carry out the instructions in proper sequence, interpret each instruction, and apply the proper signals to the arithmetic unit and other parts in accordance with the interpretation. 2. Sometimes called a manual control. In any mechanism, one or more components responsible for interpreting and carrying out manually initiated directions. 3. In some business applications, a mathematical check. 4. In electronics, a potentiometer or variable resistor. 5. In an alarm system, any mechanism that sequences the interrogation of protected site units, resets latched alarms, and performs similar functions.

**control ampere turns** — The magnitude and polarity of the control magnetomotive force required for operation of a magnetic amplifier at a specified output.

**control amplifier** — *See* preamplifier.

**control block** — A storage area through which information of a particular type required for control of the operating system is communicated among the parts of the system.

**control cable** — A multiconductor cable made for operation in control or signal circuits, usually flexible, relatively small in size, and with relatively small current ratings.

**control card** — In computer programming, a card containing input data or parameters for a specific application of a general routine.

**control center** — *See* preamplifier.

**control character** — 1. A character whose occurrence in a particular context initiates, modifies, or halts operation. 2. An element of a character set that may produce some action in a device other than a printed or displayed character. A character may become a control character in some systems by being preceded by a special

character or set of characters. 3. Within a code set, a character intended to initiate, modify, or stop a control function.

**control characteristic**—1. A plot of the load current of a magnetic amplifier as a function of the control ampere turns for various loads and at the rated supply voltage and frequency. 2. The relationship between the critical grid voltage and the anode voltage of a tube.

**control circuit**—See control.

**control circuits**—In a digital computer, the circuits that carry out the instruction in proper sequence, interpret each instruction, and apply the proper commands to the arithmetic element and other circuits in accordance with the interpretation.

**control-circuit transformer**—A voltage transformer utilized to supply a voltage suitable for the operation of control devices.

**control-circuit voltage**—The voltage provided for the operation of shunt-coil magnetic devices.

**control compartment**—A space within the base, frame, or column of a machine used for mounting the control panel.

**control counter**—In a computer, a device that records the storage location of the instruction word to be operated on following the instruction word in current use.

**control current**—Current that occurs in the control circuit when control voltage is applied.

**control data**—In a computer, one or more items of data used to control the identification, selection, execution, or modification of another routine, record file, operation, data value, etc.

**CONTROL DATA or Control Data**—A trademark and service mark of Control Data Corporation in respect to data processing equipment and related services.

**control electrode**—An electrode on which a voltage is impressed to vary the current flowing between other electrodes.

**control field**—In a sequence of similar items of computer information, a constant location where control information is placed.

**control-flow machine**—A parallel-processing architecture with a single central sequence of instruction, carried out by many processors.

**control grid**—The electrode of a vacuum tube, other than a diode, upon which a signal voltage is impressed to regulate the plate current.

**control-grid bias**—The average direct-current voltage between the control grid and cathode of a vacuum tube.

**control-grid plate transconductance**—The ratio of the amplification factor of a vacuum tube to its plate resistance, combining the effect of both into one term.

**controlled avalanche**—A predictable, nondestructive avalanche characteristic designed into a semiconductor device as protection against reverse transients that exceed its ratings.

**controlled-avalanche device**—A semiconductor device that has very specific maximum and minimum avalanche-voltage characteristics and is also able to operate and absorb momentary power surges in this avalanche region indefinitely without damage.

**controlled-avalanche silicon rectifier**—A silicon diode manufactured with characteristics such that, when operating, it is not damaged by transient voltage peaks.

**controlled-carrier modulation**—Also called variable-carrier or floating-carrier modulation. A modulation system in which the carrier is amplitude modulated by the signal frequencies, and also in accordance with the

## control characteristic — control section

envelope signal, so that the modulation factor remains constant regardless of the amplitude of the signal.

**controlled-impedance cable**—Package of two or more insulated conductors in which impedance measurements between respective conductors are kept essentially constant throughout the entire length.

**controlled rectifier**—1. A rectifier employing grid-controlled devices such as thyratrons or ignitrons to regulate its own output current. 2. Also called an SCR (silicon-controlled rectifier). A four-layer pnpn semiconductor that functions like a grid-controlled thyratron.

**controller**—1. An instrument that holds a process or condition at a desired level or status as determined by comparison of the actual value with the desired value. 2. A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected. 3. A hardware interface that accepts instructions from a computer and reformats them to program an instrument or peripheral.

**controller function**—Regulation, acceleration, deceleration, starting, stopping, reversing, or protection of devices connected to an electric controller.

**control-line timing**—Clock signals between a modem and a communication-line controller unit.

**control link**—Apparatus for effecting remote control between a control point and a remotely controlled station.

**control locus**—A curve that shows the critical value of grid bias for a thyratron.

**control operator**—An amateur radio operator designated by the licensee of an amateur radio station to also be responsible for the emissions from that station.

**control panel**—A panel having a systematic arrangement of terminals used with removable wires to direct the operation of a computer or punched-card equipment.

**control point**—1. A point that may serve as a reference for all incremental commands. 2. The operating position of an amateur radio station where the control operator's function is performed.

**control-power disconnecting device**—A disconnection device, such as a knife switch, circuit breaker, or pullout fuse block, used for the purpose of connecting and disconnecting the source of control power to and from the control bus or equipment.

**control program**—A computer program that places another program and its environment in core memory in proper sequence and retains them there until it has finished operating.

**control ratio**—1. The ratio of the change in anode voltage to the corresponding change in critical grid voltage of a gas tube, with all other operating conditions maintained constant. 2. Also called programming coefficient. The required range in control resistance of a regulated power supply to produce a 1-volt change in output voltage. Expressed in ohms per volt.

**control read-only memory**—Abbreviated CROM. A major component in the control block of some microprocessors. It is a ROM that has been microprogrammed to decode control logic.

**control rectifier**—A silicon rectifier capable of switching or regulating the flow of a relatively large amount of power through the use of a very small electrical signal. These solid-state devices can take the place of mechanical and vacuum tube switches, relays, rheostats, variable transformers, and other devices used for switching or regulating electric power.

**control register**—Also called instruction register. In a digital computer, the register that stores the current instruction governing the operation of the computer for a cycle.

**control section**—See control unit.

**control sequence**—In a computer, the normal order of execution of instructions.

**control station**—Station licensed to conduct remote control of another amateur radio station.

**control store**—A memory circuit designed to hold the sequence of commands that determines operation of the sequential-state machine. Sometimes referred to as the microprogram store.

**control tape**—In a computer, a paper or plastic tape used to control the carriage operation of some printing output devices. Also called carriage tape.

**control unit**—1. That section of an automatic digital computer that directs the sequence of operations, interprets coded instructions, and sends the proper signals to the other computer circuits to carry out the instructions. Also called control section. 2. A preamplifier unit in an audio setup. Signals from audio sources, e.g., tuner or pickup microphone, are fed into it. Equalization (where necessary) is applied, then the signal is fed to the main amplifier. Volume and tone controls are usually incorporated, together with any necessary program-selection switch.

**control variable**—The plant inputs and outputs that a control system manipulates and measures to properly control them.

**control voltage**—Voltage applied to control input terminals of a relay.

**control-voltage winding**—The motor winding that is excited by a varying voltage at a time phase difference from the voltage applied to the fixed-voltage windings of a servomotor.

**control winding**—In a saturable reactor, the winding used for applying a controlling magnetomotive premagnetization force to the saturable-core material.

**control wire and cable**—Any wire that carries current to control a tube, device, relay, or to cause any event without actually carrying the energy controlled in the event.

**convection**—1. The motion in a fluid as a result of differences in density and the action of gravity. 2. The transfer of heat from a high-temperature region in a gas or a liquid as a result of movement of masses of the fluid. 3. A conveying, or transference, of heat or electricity by moving particles of matter.

**convection cooling**—A method of heat transfer that depends on the natural upward movement of the air warmed by the heat dissipated from the device being cooled.

**convection current**—The amount of time required for a charge in an electron stream to be transported through a given surface.

**convection-current modulation**—1. The time variation in the magnitude of the convection current passing through a surface. 2. The process of producing such a variation.

**convenience receptacle**—An assembly consisting of two or more stationary contacts mounted in a small insulating enclosure that has slots to permit blades on attachment plugs to enter and make contact with the circuit.

**convention**—A definite formatting method used in electronic diagrams to present the clearest picture of the circuit function. Some common conventions are as follows: (a) circuit signal flow from left to right, with inputs on the left and outputs on the right; (b) locating various circuit functional stages in the same sequence as the signal flow; (c) placing the highest voltage sources at the top of the sheet and the lowest at the bottom; and (d) showing auxiliary circuits that are included but are not a main part of the signal flow, such as oscillators and power supplies, on the lower half of the drawing.

**convergence**—1. The condition in which the electron beams of a multibeam cathode-ray tube intersect at a specified point. 2. Orientation of the three electron beams in a color TV picture tube so they pass through the same hole in a shadow mask at the same time. 3. In optics, the bending of light rays toward each other, as by a convex or positive lens.

**convergence coil**—One of the two coils associated with an electromagnet, used to obtain dynamic beam convergence in a color television receiver.

**convergence control**—A variable resistor in the high-voltage section of a color television receiver. It controls the voltage applied to the three-gun picture tube.

**convergence electrode**—An electrode whose electric field causes two or more electron beams to converge.

**convergence magnet**—A magnet assembly whose magnetic field causes two or more electron beams to converge.

**convergence phase control**—A variable resistor or inductance for adjusting the phase of the dynamic convergence voltage in a color TV receiver employing a three-gun picture tube.

**convergence surface**—The surface generated by the point at which two or more electron beams intersect during the scanning process in a multibeam cathode-ray tube.

**conversation**—An interactive exchange of information between two systems or systems users.

**conversational mode**—A mode of computer operation in which a user is in direct contact with a computer, and interaction is possible between human and machine without the user being conscious of any language or communications barrier.

**conversational operation**—A type of operation similar to the interactive mode, except that the computer user must wait until a question is posed by the computer before interacting.

**conversational system**—See interactive system.

**conversion**—1. The process of changing from one data-processing method or system to another. 2. The process of changing from one form of representation to another. 3. See encode, 2.

**conversion efficiency**—1. The ratio of ac output power to the dc input power to the electrodes of an electron tube. 2. The ratio of the output voltage of a converter at one frequency to the input voltage at some other frequency. 3. In a rectifier, the ratio of dc output power to ac input power. 4. The ratio of maximum available luminous or radiant flux output to total input power. 5. Of a solar cell, the ratio of the electrical power obtained from the cell to the radiant power falling on the cell.

**conversion gain**—1. The ratio of the intermediate-frequency output voltage to the input-signal voltage of the first detector of a superheterodyne receiver. 2. The ratio of the available intermediate-frequency power output of a converter or mixer to the available radio-frequency power input.

**conversion loss**—The ratio of available input power to available output power under specified test conditions.

**conversion rate**—The speed at which an analog-to-digital converter or digital-to-analog converter can make repetitive data conversions, or the number of conversions performed per second. It is affected by propagation delay in counting circuits, ladder switches, and comparators; ladder RC and amplifier settling times; and amplifier and comparator slew rates and integrating time of dual-slope converters. Conversion rate is specified as a number of conversions per second, or conversion time

is specified as a number of microseconds to complete one conversion (including the effects of settling time). Sometimes conversion rate is specified for less than full resolution, thus showing a misleading (high) rate.

**conversion speed**—The measure of how long it takes an analog-to-digital converter to arrive at the proper output code. It is the time delay between the edge of the pulse that starts conversion and the edge of the signal that indicates completion of the conversion.

**conversion time**—1. The length of time required by a computer to read out all the digits in a given coded word. 2. The time required for a complete conversion or measurement by an analog-to-digital converter, starting from a reset condition. In successive-approximation converters, it ranges typically from 0.8 microsecond to 400 microseconds. 3. Time required for an a/d converter to digitize an input signal. Throughput, the reciprocal of conversion time plus acquisition time, is expressed in channels per second.

**conversion transconductance**—The magnitude of the desired output-frequency component of current divided by the magnitude of the input-frequency component of voltage when the impedance of the output external termination is negligible for all frequencies that may affect the result.

**conversion transducer**—A transducer in which the signal undergoes frequency conversion. The gain or loss is specified in terms of the useful signal.

**conversion voltage gain (of a conversion transducer)**—With the transducer inserted between the input-frequency generator and the output termination, the ratio of the magnitude of the output-frequency voltage across the output termination to the magnitude of the input-frequency voltage across the input termination of the transducer.

**convert**—1. To change information from one form to another without changing the meaning, e.g., from one number base to another. 2. In computer terminology, to translate data from one form of expression to a different form.

**converted data**—The output from a unit that changes the language of information from one form to another so as to make it available or acceptable to another machine, e.g., a unit that takes information punched on cards to information recorded on magnetic tape, possibly including editing facilities.

**converter**—1. In a superheterodyne receiver, the section that converts the desired incoming rf signal into a lower carrier frequency known as the intermediate frequency. 2. A rotating machine consisting of an electric motor driving an electric generator, used for changing alternating current to direct current. 3. A facsimile device that changes the type of modulation delivered by the scanner. 4. Generally called a remodulator. A facsimile device that changes amplitude modulation to audio-frequency-shift modulation. 5. Generally called a discriminator. A device that changes audio-frequency-shift modulation to amplitude modulation. 6. A conversion transducer in which the output frequency is the sum or difference of the input frequency and an integral multiple of the local-oscillator frequency. 7. A device that accepts an input that is a function of maximum voltage and time and converts it to an output that is a function of maximum voltage only. 8. See shaft position encoder. 9. A device capable of converting impulses from one mode to another, such as analog to digital, or parallel to serial, or one code to another. 10. Device in a digital system that transforms information coded in one number system to its equivalent in another number system. Typically, conversion is either decimal-to-binary or binary-to-decimal.

**converter tube**—A multielement electron tube that combines the mixer and local-oscillator functions of a heterodyne conversion transducer.

**converter unit**—The unit of a radar system in which the mixer of a superheterodyne receiver and usually two stages of intermediate-frequency amplification are located. Performs a preamplifying operation.

**converting**—Changing data from one form to another to facilitate its transmission, storage, or the manipulation of information.

**convex**—Curved outward.

**Cook system**—An early stereo-disc recording technique in which the two channels were recorded simultaneously with two cutters on different portions (bands) of a record as concentric spirals. The playback equipment consisted of two pickups mounted side by side so that each played at the correct spot on its own band.

**Coolidge tube**—An X-ray tube in which the electrons are produced by a hot cathode.

**coordinate digitizer**—A device that transcribes graphic information in terms of a coordinate system for subsequent processing.

**coordinated indexing**—1. In a computer, a system in which individual documents are indexed by descriptors of equal rank so that a library can be searched for a combination of one or more descriptors. 2. A computer indexing technique in which the coupling of individual words is used to show the interrelation of terms.

**coordinated transpositions**—Transpositions that are installed in either electric supply or communication circuits, or in both, for the purpose of reducing induction coupling, and which are located effectively with respect to the discontinuities in both the electric supply and communication circuit.

**coordinate system**—A way by which a pair of numbers is associated with each point in a plane (or a triplet of numbers is associated with each point in three-dimensional space) without ambiguity.

**coordination**—A term describing the ability of the lower rating of two breakers in series to trip before the higher-rating one trips.

**coordinatograph**—A precision drafting instrument used in the preparation of artwork for mask making.

**copperclad**—A thin coating of copper fused to an aluminum core. Used in some building wires (No. 12 and larger).

**copper-covered steel wire**—A wire having a steel core to which is fused an outer shell of copper.

**copper loss**—See  $I^2R$  loss.

**copper-oxide photocell**—An early type of non-vacuum photovoltaic cell consisting of a layer of copper oxide on a metallic substrate, with a thin transparent layer of a conductor over the oxide. Light falling on the cell produces a small voltage between the substrate and the conducting layer. This type of cell is extensively used in exposure meters for cameras because it requires no external source of electric power.

**copper-oxide rectifier**—A metallic rectifier in which the rectifying barrier is the junction between metallic copper and cuprous oxide. A disc of copper is coated with cuprous oxide on one side, and a soft lead washer is used to make contact with the oxide layer.

**copper-sulfide rectifier**—A semiconductor rectifier in which the rectifying barrier is a junction between magnesium and copper sulfide.

**copperweld**—A thin coating of copper fused to a steel core. Used in line wire and cable messengers, and stranded with copper for strength or extending flex life.

**coprocessor**—1. A device that performs specialized processing in conjunction with the main

microprocessor of a system. 2. In a computer, a device that performs specialized processing in conjunction with the main microprocessor. It works in tandem with another central processing unit to increase the computing power of a system. An extra microprocessor to handle certain tasks faster than the main processor. Same as math coprocessor, numeric coprocessor.

**copy**—1. To hear a transmission. *See* subject copy. 2. To duplicate a file or program so that one can retain the original and work on the duplicate. Usually refers to duplicating one disk to another. *See also* backup.

**copyguard**—Also called stop-copy. Trademarked names for processing applied to a prerecorded video tape to prevent unauthorized copying of the recording. Typically the 60-Hz vertical-sync pulses are weakened, with the expectation that when they are further weakened in copying the tape, the image will roll vertically in playback.

**copying telegraph**—An absolute term for a facsimile system for the transmission of black-and-white copy only.

**copy the mail**—CB radio term for just listening to the radio without talking much.

**Corbino effect**—A special case of the Hall effect that occurs when a disc carrying a radial current is placed perpendicularly into a magnetic field.

**cord**—1. One or a group of flexible insulated conductors covered by a flexible insulation and equipped with terminals. 2. A small, very flexible insulated cable constructed to withstand mechanical abuse. Generally, a cord is considered to be a size No. 10 and smaller.

**cord circuit**—A circuit, terminated in a plug at one or both ends, used at a telephone switchboard position in establishing connections.

**cordless phone**—A communication system that consists of two pieces: a transponder and a portable wireless handset. The transponder answers the telephone call, or processes an outgoing call, and is connected directly to the telephone line. Typically the transponder transmits to the handset on a frequency that is nominally 1.6 MHz (the high end of the broadcast band) by feeding rf into the ac power line. The handset receives the signal through a ferrite bar or loop antenna built into the handset. The handset transmits to the transponder on the radio control band at 49 MHz. The modulation is NBFM (narrow-band FM), which provides essentially noise-free reception both ways over an (approximately) 300-foot operating range.

**cordless switchboard**—A telephone switchboard in which manually operated keys are used to make connections.

**cord sets**—Portable cords fitted with any type of wiring device at one or both ends.

**cordwood**—1. A sandwich-type construction wherein components lie in a vertical cordwood pattern between horizontal layers. 2. The technique of producing modules by bundling parts as closely as possible and interconnecting them into circuits by welding or soldering leads together.

**cordwood module**—1. A high-density circuit module in which discrete components are mounted between and perpendicular to two small, parallel printed circuit boards to which their terminals are attached. 2. A module formed by bundling or stacking parts between a pair of end plates and interconnecting them into circuits by welding or soldering leads together.

**core**—1. A magnetic material placed within a coil to intensify the magnetic field. 2. Magnetic material inside a relay or coil winding. 3. In fiber optics, the light-conducting portion of the fiber, defined by the high refractive index region. The core is normally in the center

of the fiber, bounded by the cladding. 4. The central, light-transmitting portion of a fiber-optic cable. It must have a higher index of refraction than the cladding. 5. A small magnetic torus of ferrite used to store a bit of information. Core memories can be strung on wires so that organizations of 32K by 18 are possible in a size of  $\frac{1}{2}$  inch high by 6 by 6 inches (1.27 by 15.24 by 15.24 cm). Advantages of core memory are that it is nonvolatile and the oldest main storage technology. (This technology is no longer used.)

**core instruction set**—A complete set of the operators of the instructions of a computer and the types of meanings associated with their operands.

**coreless-type induction heater**—A device in which an object is heated by induction without being linked by a magnetic core material.

**core loss**—Also called iron loss. Loss of energy in a magnetic core as the result of eddy currents, which circulate through the core and dissipate energy in the form of heat.

**core memory**—1. A magnetic type of memory made up of miniature ferrite toroids, each of which can be magnetized in one direction to represent a 0 and in the other direction to represent a 1. It is a permanent memory, since if the power is removed the stored information remains. Core memory is characterized by low-cost storage and relatively slow memory operating speed. Core memories are nonvolatile, but have destructive readouts. 2. An array of doughnut-shaped ferrite cores whose diameter ranges from 9 to 18 mils (thousandths of an inch) or 37.5 to 75  $\mu$ m. Core memories are arranged in a stack configuration in which fine wires are strung through the center of the cores, usually by manual methods. The wires supply current, which causes data to be written into and read out from the core. The storage property is a magnetic one in which the orientation of the core molecules is changed to read or write data. Core stacks can contain as few as 1024 bits or as many as  $10^6$  bits (one megabit). 3. A memory that is characterized by low-cost storage and relatively slow memory operating speed. Core memories are nonvolatile, but have destructive readouts. *See also* internal storage, 1. (This technology is no longer used.)

**core plane**—A horizontal network of magnetic cores that contains a core common to each storage position.

**core rope storage**—Direct-access storage in which a large number of doughnut-shaped ferrite cores are arranged on a common axis, and sense, inhibit, and set wires are threaded through individual cores in a predetermined manner to provide fixed storage of digital data. Each core stores one or more complete words instead of a single bit.

**core storage**—1. In a computer, a form of high-speed storage that uses magnetic cores. 2. In a calculator, a storage register in which the contents will remain even after the machine has been switched off.

**core store**—A matrix of small magnetic rings or cores upon which electrical pulses may be stored. The presence of a pulse in a train is recorded by magnetizing a core, the absence of a pulse by leaving a core unmagnetized.

**core transformer**—A transformer in which the windings are placed on the outside of the core.

**core tuning**—Adjusting the inductance and thereby the frequency of resonance of a coil by moving a powdered iron or ferrite core in or out of the coil.

**core-type induction heater**—A device in which an object is heated by induction. Unlike the coreless type, a magnetic core links the induction winding to the object.

**core wrap**—Insulation placed over a core before the addition of windings.

**corner**—1. An abrupt change in direction of the axis of a waveguide. 2. A neighborhood or point at which a curve makes a sharp or discontinuous change of slope.

**corner cut**—A corner removed, for orientation purposes, from a card to be used with a computer.

**corner effect**—The rounding off of the attenuation versus frequency characteristic of a filter at the extremes (or corners) of the passband.

**corner frequency**—1. The frequency at which the open-loop gain-versus-frequency curve changes slope. For a servo motor, the product of the corner frequency in radians per second and the time constant of the motor is unity. 2. The frequency at which the two asymptotes of the gain-magnitude curves of an operational amplifier intersect. 3. The upper frequency at which 3-dB attenuation occurs in a high-gain amplifier. A cornering circuit usually is introduced to attenuate the high-frequency signals before the natural phase shift of the amplifier becomes greater than 90°. When properly designed, the cornering circuit prevents high-frequency oscillations in feedback amplifiers. The corner frequency is sometimes erroneously referred to as the cutoff frequency.

**corner reflector**—A reflecting object consisting of two (dihedral) or three (triangular) mutually intersecting conducting surfaces. Triangular reflectors are often used as radar targets.

**corner-reflector antenna**—An antenna consisting of a primary radiating element and a dihedral corner reflector formed by the elements of the reflector.



Corner-reflector antenna.

**corona**—1. A luminous discharge of electricity, due to ionization of the air, appearing on the surface of a conductor when the potential gradient exceeds a certain value but is not sufficient to cause sparking. 2. Any electrically detectable, field-intensified ionization that occurs in an insulating system but does not result immediately in catastrophic breakdown. (Corona always precedes dielectric breakdown.) 3. The ionization of gases about a conductor that results in a bluish-purple glow due to the voltage differential between a high-voltage conductor and the surrounding atmosphere. 4. A device used in an electrostatic copier to impart an electrical charge (in the dark) to the photoconductive material (zinc-oxide-coated paper) to make it sensitive to the action of light. 5. The small, erratic current pulses resulting from discharges in voids in a dielectric during voltage stress.

**corona discharge**—A phenomenon that occurs when an electric field is sufficiently strong to ionize the gas between electrodes and cause conduction. The effect is usually associated with a sharply curved surface, which concentrates the electric field at the emitter electrode. The process operates between an inception voltage and a spark breakdown voltage. These potentials and the

current-voltage characteristics within the operating range are affected by the polarity of the corona electrodes as well as the composition and density of the gas in which the discharge occurs.

**corona effect**—The glow discharge that occurs in the neighborhood of electric conductors where the insulation is subject to high electric stress. With an alternating current, the effect produced when two wires, or other conductors having a great difference of voltage, are placed near each other.

**corona endurance**—Resistance to corona cutting.

**corona extinction voltage**—Abbreviated cev. The voltage at which discharges preceded by corona cease as the voltage is reduced. The corona extinction voltage is always lower than the corona start voltage.

**corona failure**—Failure due to corona degradation at areas of high voltage stress.

**corona loss**—A loss or discharge that occurs when two electrodes having a great difference of pressure are placed near each other. The corona loss takes place at the critical voltage and increases very rapidly with increasing pressure.

**corona resistance**—Also called ionization resistance, brush-discharge resistance, slot-discharge resistance, or voltage endurance. 1. That length of time that an insulation material withstands the action of a specified level of field-intensified ionization that does not result in the immediate, complete breakdown of the insulation. 2. The ability of a material to withstand sustained high applied voltage.

**corona shield**—A shield placed around a high-potential point to redistribute electrostatic lines of force and prevent corona.

**corona start voltage**—Abbreviated csv. The voltage at which corona discharge begins in a given system.

**corona voltage level**—The voltage at which corona discharge does not exceed a specified level following the application of a specified higher voltage.

**corona voltmeter**—A voltmeter in which the peak voltage value is indicated by the beginning of corona at a known and calibrated electrode spacing.

**correction**—An increment that, when added algebraically to an indicated value of a measured quantity, results in a better approximation to the true value of the quantity.

**corrective equalization**—See frequency-response equalization.

**corrective maintenance**—The maintenance performed on a nonscheduled basis to restore equipment to satisfactory condition.

**corrective network**—Also called shaping network. An electric network designed to be inserted into a circuit to improve its transmission or impedance properties, or both.

**corread**—A glass-enclosed miniature reed switch. It is similar to the ferreed except that it is operated only when there is current through its surrounding winding, and releases when current stops.

**corread relay**—A device consisting of a hermetically sealed reed capsule surrounded by a coil. It is used as a switching device in telephone equipment.

**correlated characteristic**—A characteristic known to be reciprocally related to some other characteristic.

**correlation**—1. The relationship, expressed as a number between -1 and 1, between two sets of data, etc. 2. A relationship between two variables; the strength of the linear relationship is indicated by the coefficient of correlation. 3. A measure of the similarity of two signals.

**correlation detection**—A method of detection in which a signal is compared, point to point, with an

internally generated reference. The output of such a detector is a measure of the degree of similarity of the input and reference signal. The reference signal is constructed in such a way that it is at all times a prediction, or best guess, of what the input signal should be at that time.

**correlation direction finder**—A satellite station separated from radar to receive a jamming signal. By correlating the signals received from several such stations, the range and azimuth of many jammers may be obtained.

**correlation distance**—A term used in tropospheric propagation. The minimum spatial separation between antennas that will give rise to independent fading of the received signals.

**correlation orientation tracking and range system**—A system generally using a parabolic antenna for the analysis of a narrow band of radar energy for tracking and ranging purposes.

**correlation tracking and ranging**—A nonambiguous short-base-line, single-station, cw phase comparison system measuring two direction cosines and a slant range, from which space position can be computed.

**correlation tracking and triangulation**—A trajectory-measuring system composed of several antenna base lines separated by large distances and used to measure direction cosines to an object. From these measurements, the space position is computed by triangulation.

**correlation tracking system**—A system utilizing correlation techniques in which signals derived from the same source are correlated to derive the phase difference between the signals. This phase difference contains the system data.

**corrosion**—1. A chemical action that causes gradual destruction of the surface of a metal by oxidation or chemical contamination. Also caused by reduction of the electrical efficiency between the metal and a contiguous substance or the disintegrating effect of strong electrical currents or ground-return currents in electrical systems. The latter is known as electrolytic corrosion. 2. In semiconductors, a defect in or on the aluminum metallization, usually a white crystalline growth. 3. A material's chemical alteration by electrochemical interaction with its environment. Corrosion reflects a metal's proclivity to return to the more stable compound state from which it was refined. Corrosive reaction represents an essential division of chemical kinetics.

**corrosive fluxes**—Also called acid fluxes. Fluxes consisting of inorganic acids and salts; they are generally required where the condition of the surface is well below the ideal for rapid wetting by molten solder.

**cosecant-squared antenna**—An antenna that emits a cosecant-squared beam. In the shaped-beam antenna used, the radiation intensity over part of its pattern in some specified plane (usually the vertical) is proportionate to the square of the cosecant of the angle measured from a specified direction in that plane (usually the horizontal).

**cosecant-squared beam**—A radar-beam pattern designed to give uniform signal intensity in echoes from distant and nearby objects. It is generated by a spun-barrel reflector. The beam intensity varies as the square of the cosecant of the elevation angle.

**cosine law**—The law which states that the brightness in any direction from a perfectly diffusing surface varies in proportion to the cosine of the angle between that direction and the normal to the surface.

**cosmic noise**—Radio static whose origin is due to sources outside the earth's atmosphere. The source may be similar to sunspots, or spots on other stars.

**cosmic rays**—Any rays of high penetrating power produced by transmutations of atoms in outer space. These

particles continually enter the earth's upper atmosphere from interstellar space.

**COS/MOS**—See complementary metal-oxide semiconductor.

**coulomb**—1. The quantity of electricity that passes any point in an electric circuit in 1 second when the current is maintained constant at 1 ampere. The coulomb is the unit of electric charge in the mksa system. 2. The measure of electric charge, defined as a charge equivalent to that carried by  $6.281 \times 10^{18}$  electrons.

**Coulomb's law**—Also called law of electric charges or law of electrostatic attraction. The force of attraction or repulsion between two charges of electricity concentrated at two points in an isotropic medium is proportionate to the product of their magnitudes and is inversely proportionate to the square of the distance between them. The force between unlike charges is an attraction, and the force between like charges is a repulsion.

**coulometer**—An electrolytic cell that measures a quantity of electricity by the amount of chemical action produced.

**Coulter counter**—An electronic cell-counting instrument operating on the ion-conductivity principle. Designed by J. R. Coulter. See also cell counter.

**count**—In radiation counters, a single response of the counting system.

**countdown**—A decreasing tally that indicates the number of operations remaining in a series.

**counter**—1. A circuit that counts input pulses. One specific type produces one output pulse each time it receives some predetermined number of input pulses. The same term may also be applied to several such circuits connected in cascade to provide digital counting. Also called divider. 2. In mechanical analog computers, a means for measuring the angular displacement of a shaft. 3. Sometimes called accumulator. A device capable of changing from one to the next of a sequence of distinguishable states upon receipt of each discrete input signal. 4. An arrangement of flip-flops producing a binary word that increases in value by 1 each time an input pulse is received. It may also be called a divider, since successive counter stages divide the input frequency by 2. A counter has a maximum count, depending on its size, called a modulus or mod. For example, a mod-8 counter can count up to 7, and on the eighth input it resets itself back to a count of 0. When it resets, it also provides an output pulse, which could be counted by another counter. 5. A device capable of changing stages in a specified sequence upon receiving appropriate input signals; a circuit that provides an output pulse or other indication after receiving a specified number of input pulses. 6. A memory-type digital building block that counts pulses received at its input and transmits the cumulative total at its output. 7. In relay-panel hardware, an electromechanical device that can be wired and preset to control other devices according to the total cycles of one on and off function. 8. An instrument that detects and records the occurrence of events either for as long as the counter remains energized or over some predetermined period.

**counterbalance**—A weight, usually adjustable, fitted at the pivot end of a pickup arm. It counters the weight of the pickup head and cartridge unit and allows adjustment of the stylus pressure to the desired value.

**counter circuit**—A circuit that receives uniform pulses representing units to be counted and produces a voltage in proportion to their frequency.

**counterclockwise polarized wave**—See left-handed polarized wave.

**counter-countermeasures**—Use of anti-jamming techniques and circuits designed to decrease the

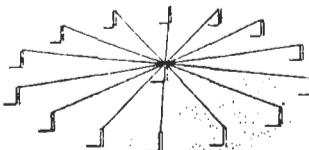
effectiveness of electronic countermeasure activities on electronic equipment.

**counterelectromotive cell** — A cell of practically no ampere-hour capacity used to oppose the line voltage.

**counterelectromotive force** — Abbreviated counter EMF. A voltage developed in an inductive circuit by an alternating or pulsating current. The polarity of this voltage is at every instant opposite that of the applied voltage.

**countermeasures** — That part of military science dealing with the employment of devices and/or techniques intended to impair the operational effectiveness of enemy activity.

**counterpoise** — A system of wires or other conductors, elevated above and insulated from ground, forming a lower system of conductors of an antenna. Used to capacitively couple a radio transmitter to the ground when the ground resistance is high.



Counterpoise.

**counters (Geiger and scintillation)** — Instruments used to detect ionizing radiation having very short wavelength (about one-thousandth the wavelength of visible light). Natural sources of this radiation are radium, uranium isotopes, cosmic rays, and ores in which these elements are present; man-contrived sources are the atomic bomb, nuclear reactors used for generating electric power, high-voltage radar CRTs, and X-ray machines.

**counter tube** — Also called radiation counter tube. An electron tube that converts an incident particle or burst of incident radiation into a discrete electric pulse. This is generally done by utilizing the current flow through a gas that is ionized by the radiation.

**counting efficiency** — In a scintillation counter, the ratio, under specified conditions, of the average number of photons or particles of ionizing radiation that produce counts to the average number of photons or particles incident on the sensitive area.

**counting-rate meter** — A device for indicating the time rate of occurrence of input pulses averaged over a time interval.

**counting-type frequency meter** — An instrument for measuring frequency. Its operation depends on the use of pulse-counting techniques to indicate the number and/or rate of recurring electrical signals applied to its input circuits.

**counts** — Clicking noises made by a radiation-detecting instrument in the presence of radiation. *See* scintillation counter.

**counts per turn** — The total number of code positions per  $360^\circ$  of encoder shaft rotation.

**couple** — Two or more dissimilar metals or alloys in electrical contact with each other that act as the electrodes of an electrolytic cell when they are immersed in an electrolyte.

**coupled circuit** — Any network containing only resistors, inductors (self and mutual), and capacitors and having more than one independent mesh.

**coupled modes** — In a waveguide, such as an optical fiber, coaxial cable, or metal pipe, coexisting

propagation modes whose fields are interrelated and whose energies are mutually interchanged.

**coupler** — 1. A passive device that divides an antenna signal to feed two or more receivers, or combines two or more antenna signals to feed a single down lead. A coupler provides some interset isolation and maintains an impedance match between the antenna and receiver. 2. A component that interconnects a number of optical waveguides (fibers) and provides an inherently bidirectional system by mixing and splitting all signals within the component.

**coupling** — The association or mutual relationship of two or more circuits or systems in such a way that power may be transferred from one to another.

**coupling angle** — In connection with synchronous motors, the mechanical-degree relationship between the rotor and the rotating field.

**coupling aperture** — Also called coupling hole or coupling slot. An aperture, in the wall of a waveguide or cavity resonator, designed to transfer energy to or from an external circuit.

**coupling capacitor** — 1. Any capacitor used to couple two circuits together. Coupling is accomplished by means of the capacitive reactance common to both circuits. 2. A capacitor that allows alternating currents to pass but blocks direct currents. 3. A capacitor intended for the coupling of two or more ac circuits with different dc levels.

**coupling coefficient** — Also called coefficient of coupling. The degree of coupling that exists between two circuits. It is equal to the ratio between the mutual impedance and the square root of the product of the total self-impedances of the coupled circuits, all impedances being of the same kind.

**coupling hole** — *See* coupling aperture.

**coupling loop** — A conducting loop projecting into a waveguide or cavity resonator and designed to transfer energy to or from an external circuit.

**coupling loss** — 1. *See* fiber optics. Those signal losses due to small differences in numerical aperture, core diameter, core concentricity, and tolerances in splicing connectors when two fibers are aligned. Also known as splicing loss and transfer loss. 2. The total optical power loss within a junction, expressed in decibels, attributed to the termination of the optical conductor. 3. Attenuation of the optical signal due to coupling inefficiencies between the flux source and the optical fiber, or between fibers, or between the fiber and the detector in a receiver. Expressed in decibels.

**coupling probe** — A probe projecting into a waveguide or cavity resonator and designed to transfer energy to or from an external circuit.

**coupling slot** — *See* coupling aperture.

**coupling transformer** — A transformer that couples two circuits together by means of its mutual inductance.

**courtesy tone** — An audible signal transmitted by a repeater that lets users know the repeater had reset at the end of one person's transmission and is available for use by the next person.

**covalent bond** — A type of linkage between atoms. Each atom contributes one electron to a shared pair that constitutes an ordinary chemical bond.

**coverage** — A percentage of the completeness with which a braid or shield covers the surface of an underlying insulated conductor or conductors.

**covered relay** — A relay contained in an unsealed housing.

**Covington and Broten antenna** — A compound interferometer in which a long line source is adjacent to a two-element interferometer of comparable aperture, in the same straight line.

**CPC**—Abbreviation for calling party control. A telephone signaling system that notifies the terminating office and any line-connected auxiliary equipment when the calling party has disconnected. This system permits more efficient use of telephone trunk lines by removing the called party from the line as soon as the calling party disconnects. The CPC signal is a pulse to ground potential, usually 100 ms long, equivalent to shorting the two wires of the phone line together.

**cpm**—Abbreviation for cycles per minute.

**C power supply**—A device connected in the circuit between the cathode and grid of a vacuum tube to apply grid bias.

**cps**—1. Abbreviation for cycles per second, an obsolete term. Replaced by the term *hertz*, abbreviated Hz. 2. The number of times per second an electronic event is repeated. 3. Abbreviation for characters per second when speaking of data transmission. A data-rate unit, not to be confused with cycles per second.

**cps/bps**—The number of characters or bytes per second (bits per track per second) written to or read from a magnetic tape.

**CPU**—Abbreviation for central processing unit. A primary unit of the computer system that controls interpretation and execution of instructions.

**CPU portion**—See chip sets.

**crash**—1. A computer condition that causes it to stop working for some reason and need to be restarted by the operator. 2. Abrupt computer failure.

**crash-locator beacon**—Airborne equipment consisting of various transmitters, collapsible antennas, etc., designed to be ejected from a downed aircraft and to transmit beacon signals to help searching forces to locate the crashed aircraft.

**crater lamp**—1. A glow-discharge type of vacuum tube whose brightness is proportional to the current passing through the tube. The glow discharge takes place in a cup or crater rather than on a plate as in a neon lamp. 2. A gaseous lamp usually containing neon. Provides a point source of light that can be modulated with a signal.

**crazing**—Checking of an insulation material when it is stressed and in contact with certain solvents or their vapors.

**CRC**—Abbreviation for cyclic redundancy check. 1. A method of error detection consisting of a character generated at the transmitting terminal that is matched with a character at the receiving terminal. Matched characters signify correct character reception; unmatched characters indicate an error. 2. An error-checking control technique utilizing a binary prime divisor that produces a unique remainder.

**credence**—A measure of confidence in a radar target detection; generally it is proportional to the target-return amplitude.

**credit balance indicator**—In a calculator, warning light to indicate a negative answer.

**creepage**—The conduction of electricity across the surface of a dielectric.

**creepage distance**—The shortest distance between conductors of opposite polarities, or between a live part and ground, measured over the surface of the supporting material.

**creepage path**—The path across the surface of a dielectric between two conductors. Lengthening the creepage path reduces the possibility of arc damage or tracking.

**creepage surface**—An insulating surface that provides physical separation between two electrical conductors of different potential.

**creep-controlled bonding**—A method of diffusion bonding in which enough pressure is exerted to cause

significant creep deformation at the joint interfaces. The method is characterized by use of intermediate and low unit loads for a period of hours.

**creep distance**—The shortest distance on the surface of an insulator between two electrically conductive surfaces separated by the insulator.

**creep recovery**—The change in no-load output occurring with time after removal of a load that had been applied for a specific period of time.

**crest factor**—1. The ratio of the peak voltage to the rms voltage of a waveform (with the dc component removed). 2. An instrument's dynamic range and ability to respond faithfully to waveform peaks as the rms value approaches full scale. Can also refer to the quality of rms-conversion techniques in general.

**crest value**—Also called peak value. The maximum absolute value of a function.

**crest voltmeter**—A peak-reading voltmeter.

**crest working off-stage voltage**—The highest instantaneous value of the off-state voltage that occurs across a thyristor, excluding all repetitive and nonrepetitive transient voltages.

**crest working reverse voltage**—The highest instantaneous value of the reverse voltage that occurs across a semiconductor diode or reverse-blocking thyristor, excluding all repetitive and nonrepetitive transient voltages.

**CRI**—See color rendering index.

**crimp**—1. To compress or deform a connector barrel around a cable so as to make an electrical connection. 2. Final configuration of a terminal barrel formed by the compression of terminal barrel and wire.

**crimp contact**—A contact whose back portion is a hollow cylinder to allow it to accept a wire. After a bared wire is inserted, a swaging tool is applied to crimp the contact metal firmly against the wire. An excellent mechanical and electrical contact results. A crimp contact often is referred to as a solderless contact.

**crimping**—A method of attaching a terminal, splice, or contact to a conductor through the application of pressure.

**crimping tool**—A device used to apply solderless terminals to a conductor.

**crimp terminal**—A point at which the bared portion of the hookup wire is crimped to either the contact or a tab or pin that mates with the contact terminal.

**crimp termination**—Connection in which a metal sleeve is secured to a conductor by mechanically crimping the sleeve with pliers, presses, or automated crimping machines. Splices, terminals, and multicontact connectors are typical terminating devices attached by crimping. Suitable for all wire types.

**crimp-type termination**—Open-barrel or closed-barrel termination in which a stripped wire is inserted into or through a tube that is crimped to the wire with an appropriate tool.

**crippled leapfrog test**—In a computer, a variation of the leapfrog test in which the test is repeated from a single set of storage locations rather than from a changing set of storage locations. See also leapfrog test.

**critical area**—See picture element, 2.

**critical angle**—1. The maximum angle at which a radio wave may be emitted from an antenna and will be returned to the earth by refraction in the ionosphere. 2. The maximum angle of incidence for which light will be transmitted from one medium to another. Light approaching the interface at angles greater than the critical angle will be reflected back into the first medium. 3. The maximum angle at which light can be propagated within a fiber. The sine of the critical angle equals the ratio of the numerical aperture to the index of refraction of the

fiber core. 4. Basically, the least angle of incidence at which total reflection takes place. The angle of incidence in a denser medium, at an interface between the denser and less dense medium, at which the light is refracted along the interface. When the critical angle is exceeded, the light is totally reflected back into the denser medium. The critical angle varies with the indexes of refraction of the two media with the relationship

$$\sin l_c = n'/n$$

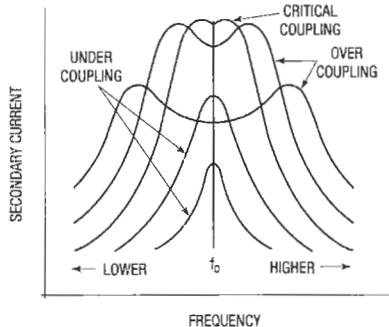
where

$l_c$  is the critical angle,

$n'$  is the refractive index of the less dense medium, and  
 $n$  is the refractive index of the denser medium.

**critical characteristic**—A characteristic not having the normal tolerance to variables.

**critical coupling**—Also called optimum coupling. Between two circuits independently resonant to the same frequency, the degree of coupling that transfers the maximum amount of energy at the resonant frequency.



*Critical coupling.*

**critical current**—That current, at a specified temperature and in the absence of external magnetic fields, above which a material is normal and below which it is superconducting.

**critical damping**—The value of damping that provides the most rapid transient response without overshoot. Operation between underdamping and overdamping.

**critical dimension**—The dimension of a waveguide cross section that determines the cutoff frequency.

**critical failure**—A failure that causes a system to operate outside designated limits.

**critical field**—Also called cutoff field. Of a magnetron, the smallest theoretical value of a steady magnetic-flux density, at a steady anode voltage, that would prevent an electron emitted from the cathode at zero velocity from reaching the anode.

**critical flicker frequency**—The frequency at which a flickering light source is perceived as changing from pulsating to continuous.

**critical frequency**—Also called penetrating frequency. The limiting frequency below which a magnetohydrodynamic wave component is reflected by an ionospheric layer and above which the component penetrates the layer at vertical incidence. *See also* waveguide cutoff frequency.

**critical grid current**—The instantaneous value of grid current in a gas tube when the anode current starts to flow.

## critical characteristic — cross assembler

**critical grid voltage**—The instantaneous value of grid voltage at which the anode current starts to flow in a gas tube.

**critical high-power level**—The radio-frequency power level at which ionization is produced in the absence of a control-electrode discharge.

**critical inductance**—In an inductor input power supply filter, the minimum value of the input inductor needed to ensure that the current drawn through the rectifier never goes to zero.

**critical item**—*See* critical part.

**critical loads**—Those loads that will not tolerate a loss of power without incurring major losses in the form of product or equipment damage, or without creation of safety hazards. Critical loads can be subclassified as those that are uninterruptible or those that are short-term interruptible for the time it takes transfer switches to operate.

**critical magnetic field**—That field intensity below which, at a specified temperature and in the absence of current, a material is superconducting and above which it is normal.

**critical part**—A part whose failure to meet specified requirements results in the failure of the product to serve its intended purpose. Also called critical item.

**critical path**—The path that determines a circuit's overall clock rate, typically the longest path in the circuit.

**critical potential**—*See* ionization potential.

**critical race**—*See* race

**critical rate of rise of off-state voltage**—The minimum value of the rate of rise of principal voltage that will cause a semiconductor switching device to switch from the off state to the on state under specified conditions.

**critical rate of rise of on-state current**—The maximum value of the rate of rise of on-state current that a thyristor can withstand without deleterious effect.

**critical resistance value**—For a given voltage rating and a given power rating, the one value of resistance that will dissipate full rated power at rated voltage. For values of resistance below the critical value, the maximum (element) voltage is never reached; for values of resistance above the critical value, the power dissipated becomes lower than rated.

**critical temperature**—That temperature below which, in the absence of current and external magnetic fields, a material is superconducting and above which it is normal.

**critical voltage**—Also called cutoff voltage. In a magnetron, the highest theoretical value of steady anode voltage, at a given steady magnetic-flux density, at which electrons emitted from the cathode at zero velocity will fail to reach the anode.

**critical wavelength**—The free-space wavelength corresponding to the critical frequency.

**CRO**—Abbreviation for cathode-ray oscilloscope.

**CROM**—Abbreviation for control read-only memory.

**Crookes' dark space**—*See* cathode dark space.

**Crosby system**—A compatible multiplex FM stereo broadcast technique in which the right and left signals are combined in phase (sum signal) and transmitted on the main carrier, and also combined out-of-phase (difference signal) and transmitted on the subcarrier. The two signals are combined (matrixed) in the receiving apparatus to restore the right and left channels.

**cross alarm**—1. An alarm condition signaled by crossing or shorting an electrical circuit. 2. The signal produced due to a cross alarm condition.

**cross assembler**—1. A symbolic language translator that runs on one type of computer to produce machine

code for another type of computer. 2. A type of assembler program that generates binary code of a program for a computer other than the model with which it is being used; e.g., an 8080 cross assembler might operate on a PDP-8 minicomputer. 3. Frequently used in conjunction with a down-line load capability for remote control of an unattended microprocessor. See assembler; resident assembler.

**crossbanding** — The use of combinations of interrogation and reply frequencies such that either one interrogation frequency is used with several reply frequencies or one reply frequency is used with several interrogation frequencies.

**crossbar** — A type of telephone control switching system using a crossbar or coordinate switch. Crossbar switching systems suit data switching because they have low noise characteristics and can handle Touch Tone® dialing.

**crossbar switch** — 1. A switch having a number of vertical paths, a number of horizontal paths, and an electromagnetically operated mechanism for interconnecting any one vertical path with any one horizontal path. An automatic telephone switching system that uses a crossbar switch. 2. A switch with a plurality of vertical paths and electromechanically operated mechanical means for interconnecting any one of the vertical paths with any of the horizontal paths.

**crossbar switching system** — A method of switching that, when directed by a common control unit, will select and close a path through a matrix arrangement of switches.

**crossbar system** — An automatic telephone switching system in which, generally, the selecting devices are crossbar switches. Common circuits select and test the switching paths and control the selecting mechanisms. The method of operation is one in which the switching information is received and stored by controlling mechanisms that determine the operation necessary to establish a connection.

**cross beat** — A spurious frequency that arises as a result of cross modulation.

**crosscheck** — To check a computation by two different methods.

**cross color** — The interference in a color-television receiver chrominance channel caused by crosstalk from monochrome signals.

**cross-compiler** — A compiler that runs on one computer system but generates machine code for another computer system. Typically it runs on a large computer and generates code for a microcomputer, speeding up software development.

**cross-correlation function** — A measure of the similarity between two signals when one is delayed with respect to the other.

**cross coupling** — Unwanted coupling between two different communication channels or their components.

**cross-current conduction** — Transistor turn-off delay that stems mainly from storage in a converter's switching transistors. The phenomenon appears as a stretching out of the saturated conduction period after base drive is removed.

**crossed-pointer indicator** — A two-pointer indicator used with instrument landing systems to indicate the position of an aircraft with respect to the glide path.

**cross-field device** — An electronic device in which electrons from the cathode are influenced by a magnetic field that acts at right angles to the applied electric field. When electrons leave the cathode in a direction perpendicular to the magnetic field, this field causes a force to act at right angles to the electron motion. The electrons then spiral into orbit around the cathode instead

of moving colinearly with the electric field. Most of the electrons gradually move toward the anode, giving up potential energy to the rf field as they interact with the anode slow-wave structure. The tube structure may be either cylindrical or linear.

**crossfield recording** — A system in which the bias is not applied to the tape by a recording head but by a separate head on the tape's backing side, so that the bias signal will not partially erase high frequencies as they are being recorded.

**crossfire** — Interfering current in one telegraph or signaling channel resulting from telegraph or signaling currents in another channel.

**crossfoot** — 1. In a computer, to add or subtract numbers in different fields of the same punch card and punch the result into another field of the same card. 2. To compare totals of the same numbers obtained by different methods.

**cross hairs** — On a cursor, a horizontal line intersected by a vertical line to indicate a point on the display whose coordinates are desired.

**crosshatching** — 1. In a printed circuit board, the breaking up of large conductive areas where shielding is required. 2. Process of filling in an outline with a series of symbols to highlight part of a design.

**cross magnetostriiction** — Under specified conditions, the relative change of dimension in a specified direction perpendicular to the magnetization of a body of ferromagnetic material when the magnetization of the body is increased from zero to a specified value (usually saturation).

**cross modulation** — 1. A spurious response or form of interference that occurs when the carrier of a desired signal intermodulates with the carrier of an undesired signal. This often happens in early stages of radio receivers, particularly when strong signals from local stations drive these stages into nonlinear operation. 2. A form of interference caused by the modulation of one carrier affecting that of another signal. It can be caused by overloading an amplifier as well as by signal imbalances at the headend.

**cross modulation distortion** — The amount of modulation impressed on an unmodulated carrier when a signal is simultaneously applied to the rf port of a mixer under specified operating conditions. The tendency of a mixer to produce cross modulation is decreased with an increase in conversion compression point and intercept point.

**cross neutralization** — A method of neutralization used in push-pull amplifiers. A portion of the plate-to-cathode ac voltage of each tube is applied to the grid-to-cathode circuit of the other tube through a neutralizing capacitor.

**cross office switching time** — The time required for connection of any input through the switching center to any selected output.

**crossover** — 1. The point where two conductors that are insulated from each other cross. 2. A connection formed between two elements of a circuit by depositing conductive material across the insulated upper surface of another interconnection or element. 3. A point in an integrated or MOS circuit at which an interconnect pattern passes over another conductive part of a circuit but is insulated from it by a thin dielectric layer. See also underpass.

**crossover distortion** — 1. Distortion that occurs in a push-pull amplifier at the points of operation where the input signals cross over (go through) the zero reference points. 2. The type of distortion resulting from class B push-pull power amplifiers owing to the lack of coincidence of the two transfer characteristics at the

crossover point. The effect is reduced by applying a critical value of biasing to optimize the quiescent current and hence "linearize" the middle portion of the transfer characteristic. The situation is further improved by heavy negative feedback and by circuit design, such that the crossover distortion from hi-fi amplifiers is very small.

**crossover frequency**—1. As applied to electrical dividing networks, the frequency at which equal power is delivered to each of the adjacent frequency channels when all channels are terminated in the specified load. *See also* transition frequency. 2. A frequency at which other frequencies above and below it are separated. In a two-way speaker system, for instance, the crossover frequency is the point at which woofer and tweeter response is divided.

**crossover network**—1. An electrical filter that separates the output signal from an amplifier into two or more separate frequency bands for a multispeaker system. 2. A circuit (usually employing capacitors and coils) that feeds low notes to a low-frequency speaker (woofer) and high notes to a high-frequency speaker (tweeter). The crossover frequency is that at which frequency bands divide. Sometimes the audio spectrum is divided into more than two bands to drive more than two speakers. In a three-way system, midrange frequencies go to a midrange driver. Frequencies outside the range of each driver are attenuated at a rate determined by the network design. 3. A frequency at which each of two drivers is receiving half the amplifier's power; below or above that point, one speaker will receive more power than the other.

**crossover spiral**—*See* lead-over groove.

**crosspoint**—The operated contacts on a crossbar switch.

**cross polarization**—1. The component electric field vector normal to the desired polarization component. 2. Describes signals of opposite polarization being transmitted and received. Cross-polarization discrimination refers to the ability of a feed to detect one polarity and reject the opposite-polarity signals.

**cross-reference generator**—A device that permits symbols (labels, variables, constants) to be correlated with their storage locations in a computer.

**cross-sectional area of a conductor**—The summation of all cross-sectional areas of the individual strands in the conductor, expressed in square inches or, more commonly, in circular mils.

**cross software**—Programs that permit a target system to be developed on a host computer with different CPU architecture.

**crosstalk**—1. Interference caused by stray electromagnetic or electrostatic coupling of energy from one circuit to another. 2. Undesired signals from another circuit in the same system. 3. Breakthrough of the signal from one channel to another by conduction or radiation. 4. Transient noise induced on a switching signal by interaction with other switching transitions. 5. Audio interference from one track of a stereo tape to another. Poor head alignment often causes this. 6. Leakage of recorded signal from one channel of a stereo device into the adjacent channel or channels. Crosstalk between stereo channels impairs stereo separation; crosstalk between reverse-direction track signals can be heard, backward, during quieter parts of the desired program. 7. A measure of the amount of signal input to an off channel that appears at the output of a multiplexer, superimposed on the signal passed through the on channel. This is a direct function of the frequency of the signals, since semiconductor switches are capacitively coupled within the IC chip. The higher the frequency, the greater the crosstalk. This phenomenon is similar to the feedthrough problem of signal-handling devices. 8. In a transmission line, the

## crossover frequency — CRT terminal

noise generated in a passive signal line due to information traveling down an active line in the cable. 9. Measurable leakage of optical energy from one optical conductor to another. 10. Optical coupling between a pair of optical fibers caused by light leakage.

**crosstalk coupling**—Also called crosstalk loss.

Cross coupling between speech communication channels or their component parts. Note: Crosstalk coupling is measured between specified points of the disturbing and disturbed circuit and is preferably expressed in decibels.

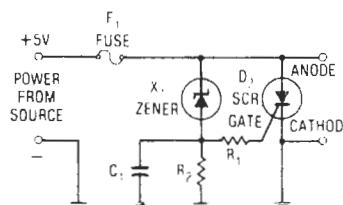
**crosstalk level**—1. The volume of crosstalk energy, measured in decibels, referred to a base. 2. The effective power of crosstalk, expressed in decibels below 1 mW.

**crosstalk loss**—*See* crosstalk coupling.

**crossunder**—1. A connection of two elements of a circuit by a conductive path deposited or diffused into a substrate. 2. A point in an integrated or MOS circuit at which there is a crossing of two conductive paths, one of which is built into the active substrate for interconnection.

**crowbar**—1. A term describing the action that effectively creates a high overload on the actuating member of the protective device. This crowbar action may be triggered by a slight increase in current or voltage. 2. A circuit that shorts the output terminals of a power supply if the output of the power supply rises above a certain preset limit. The crowbar thus brings the output voltage to zero. 3. To place a low-resistance short across the input to a circuit. 4. A protective circuit in a power distribution circuit that shorts the power supply output to ground when an overvoltage condition occurs.

**crowbar circuit**—1. An electronic switching system used to protect high-voltage circuits from damage caused by arc currents. The system places a momentary short across the circuit to be protected. 2. A circuit that protects a circuit or system from dangerously high voltage surges by shutting down the power source.



*Crowbar overvoltage circuit (SCR).*

**crowbar protection circuit**—A protection circuit that by rapidly placing a low resistance across the output terminals of a power supply initiates action that reduces the output voltage to a low value.

**crowbar voltage protector**—A separate circuit that monitors the output of a power supply and instantaneously throws a short circuit (or crowbar) across the output terminals of the power supply whenever a preset voltage limit is exceeded. An SCR is usually used as the crowbar device.

**CRT**—Abbreviation for cathode-ray tube.

**CRT display**—*See* cathode-ray-tube display.

**CRT terminal**—A visual-display terminal with an electrostatic deflection-type display. The term sometimes refers to all video "glass" terminals. These terminals' displays use either screen storage or memory-refreshed, raster-scanning techniques to generate visuals.

**cryoelectrics** — Technology having to do with the characteristics of electronic components at cryogenic temperatures. The branch of electronics that is concerned with applications of cryogenics. A contraction of cryogenic electronics.

**cryogenic** — Of or having to do with temperatures approaching absolute zero.

**cryogenic device** — A device intended to function best at temperatures near absolute zero.

**cryogenic motor** — A motor that operates at a temperature below  $-129^{\circ}\text{C}$  and that uses a cryogenic fluid or gas to cool its windings and bearings.

**cryogenics** — 1. The subject of physical phenomena at temperatures below about  $-50^{\circ}\text{C}$ . More generally, the term is used to refer to methods for producing very low temperatures. Also called cryogeny. 2. The study of the behavior of matter at supercold temperatures. 3. The science and technology applied to the creation of low temperatures (i.e., approaching absolute zero).

**cryogenic temperature** — A temperature close to absolute zero.

**cryogeny** — See cryogenics.

**crysar** — A semiconductor device primarily intended for high-speed computer switching and memory applications. This device operates by the low-temperature avalanche breakdown produced by impact ionization of impurities.

**cryosistor** — A cryogenic semiconductor device in which the ionization between two ohmic contacts is controlled by means of a reverse-biased pn junction. After ionization, the device can act as a three-terminal switch, a pulse amplifier, an oscillator, or a unipolar transistor.

**cryostat** — A refrigerating unit such as that for producing or utilizing liquid helium in establishing extremely low temperatures (approaching absolute zero).

**cryotron** — 1. A superconductive four-terminal device in which a magnetic field, produced by passing a current through two input terminals, controls the superconducting-to-normal transition — and thus the resistance — between the two output terminals. 2. An electrical switching and binary storage instrument that depends on the oscillating of a superconducting component between low and high resistance levels due to alternation in the magnetic field.

**cryotonics** — A contraction of cryogenic electronics.

**cryptanalyst** — A person who solves cryptograms, that is, one who converts secret messages into their original plain-language form without having authorized knowledge of the cryptographic system.

**crypto-** — 1. A prefix used to form words that pertain to the transformation of data to conceal its actual meaning, usually by conversion to a secret code. 2. The science of encrypting data so that only the intended recipient can read it.

**cryptochannel** — Complete system of cryptocommunications between two or more holders.

**cryptogram** — See ciphertext.

**cryptographic system** — An algorithm for converting a message in ordinary language into a secret form.

**cryptologic** — Pertaining to communication intelligence and communication security.

**cryptosecurity** — Component of communication security that results from the provision of technically sound cryptosystems and their proper use.

**crystal** — 1. A solid in which the constituent atoms are arranged with some degree of geometric regularity. In communication practice, a piezoelectric crystal, piezoelectric crystal plate, or crystal rectifier. 2. A thin slab or plate of quartz ground to a thickness that causes it to vibrate at a specific frequency when energy is supplied. It is used as a frequency-control element in radio-frequency oscillators. 3. Quartz crystal whose

piezoelectric vibrational modes provide a highly accurate frequency for clock timing. 4. Solid material in which the atoms or molecules are arranged in a regular three-dimensional lattice array.

**crystal anisotropy** — A force that directs the magnetization of a single-domain particle along a direction of easy magnetization. To rotate the magnetization of the particle, an applied magnetic field must provide enough energy to rotate the magnetization through a difficult crystal direction.

**crystal audio receiver** — Similar to a crystal video receiver except for the path direction bandwidth, which is audio rather than video. See crystal video receiver.

**crystal calibrator** — A crystal-controlled oscillator used as a reference to check and set the frequency tuning of a receiver or transmitter.

**crystal-can relay** — A relay mounted in a can of a specific size and shape; called a crystal can because of its common usage as a mounting for quartz crystals used in frequency-control circuits.

**crystal control** — Control of the frequency of an oscillator by means of a specially designed and cut crystal.

**crystal-controlled oscillator** — See crystal oscillator.

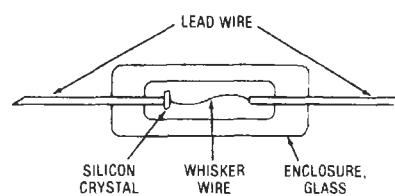
**crystal-controlled transmitter** — A transmitter in which the carrier frequency is controlled directly by a crystal oscillator.

**crystal counter** — An instrument that is used to detect high-energy particles by the pulse of the current formed when a particle passes through a normally insulating crystal to which a potential difference is applied.

**crystal cutter** — A disc cutter in which the mechanical displacements of the recording stylus are derived from the deformities of a crystal having piezoelectric properties.

**crystal detector** — A mineral or crystalline material that allows electrical current to flow more easily in one direction than in the other. In this way, an alternating current can be converted to a pulsating current.

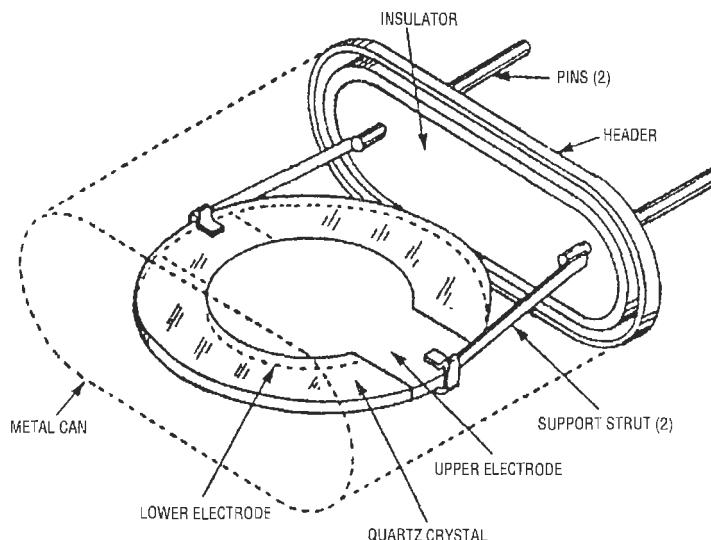
**crystal diode** — 1. A two-electrode semiconductor device that makes use of the rectifying properties of a pn junction (junction diode) or a sharp metallic point in contact with a semiconductor material (point-contact diode). Also called crystal rectifier, diode, and semiconductor diode. 2. A diode rectifier using a point contact on a silicon or germanium crystal. Because of its low capacitance, it will rectify at ultrahigh and superhigh frequencies.



Crystal diode.

**crystal field** — The electrostatic field acting locally within a crystal as a result of the microscopic arrangement of atoms and ions in the lattice.

**crystal filter** — 1. A highly selective circuit capable of discriminating against all signals except those at the center frequency of a crystal, which serves as the selective element. Resonant mechanical section consists of ceramic discs that vibrate at the band of frequencies to be removed. 2. Electrically coupled, two-terminal



Crystal holder.

electroacoustic resonators (crystals) in ladder and lattice configurations. Monolithic filters with quartz substrates are also called crystal filters. 3. A bandpass filter with piezoelectric crystal components for the passage or impedance of electrical signals of various frequencies.

**crystal headphones** — Headphones using Rochelle-salt or other crystal elements to convert audio-frequency signals into sound waves.

**crystal holder** — A case of insulating material for mounting a crystal. External prongs allow the crystal to be plugged into a suitable socket.

**crystal imperfection** — Any deviation in lattice structure from that of a perfect single crystal.

**crystal lattice** — A periodic geometric arrangement of points that correspond to the locations of the atoms in a perfect crystal.

**crystal loudspeaker** — A loudspeaker in which piezoelectric action is used to produce mechanical displacements. Also called piezoelectric loudspeaker.

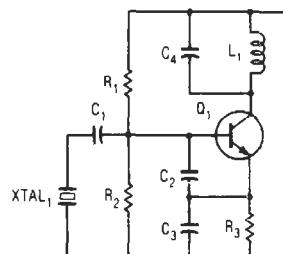
**crystal microphone** — Also called piezoelectric microphone. 1. A microphone that depends for its operation on the generation of an electric charge by the deformation of a body (usually crystalline) having piezoelectric properties. 2. A microphone whose generating element is a crystal or ceramic element, which generates a voltage when bent or stressed.

**crystal mixer** — 1. A mixer circuit with the frequency of the local oscillator being controlled by a crystal. Normally used in superheterodyne radio receivers. 2. A mixer that utilizes the nonlinear characteristic of a crystal diode to mix two frequencies. Frequently used in radar receivers to convert the received radar signal to a lower intermediate-frequency signal by mixing it with a local-oscillator signal.

**crystal operation** — Operation using crystal-controlled oscillators.

**crystal orientation** — For MOS devices, the terms  $\langle 100 \rangle$  and  $\langle 111 \rangle$  are commonly used. This refers to the angle with respect to crystal facets at which the silicon crystal is sliced. Each has a direct effect on MOS transistor characteristics.

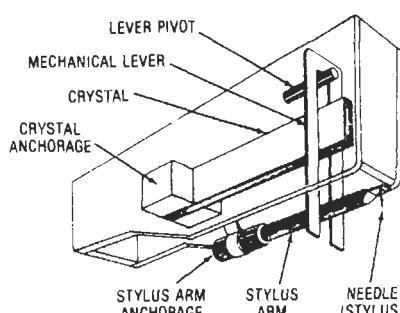
**crystal oscillator** — Also called crystal-controlled oscillator. An oscillator in which the frequency of oscillation is controlled by a piezoelectric crystal.



Crystal oscillator.

**crystal oven** — 1. A container, maintained at a constant temperature, in which a crystal and its holder are enclosed in order to keep their temperature constant and thereby reduce frequency drift. 2. A temperature-controlled container used to stabilize the temperature and resonant frequency of a crystal found in a crystal-controlled oscillator.

**crystal pickup** — Also called piezoelectric pickup. A phonograph pickup that depends for its operation on the generation of an electric charge by the deformation of a body (usually crystalline) having piezoelectric properties.



Crystal pickup.

**crystal pulling**—1. A method of growing crystals in which the developing crystal is gradually withdrawn from a melt. 2. A technique (first developed by J. C. Czochralski) in which a monocrystalline seed is introduced into the top of a body of molten material and then withdrawn slowly to grow, or pull, a large single monocrystal. This technique is used in semiconductor manufacture to produce the uniformly doped monocrystal boules from which most devices are fabricated.

**crystal rectifier**—1. An electrically conductive or semiconductive substance, natural or synthetic, that has the property of rectifying small radio-frequency voltages. *See* crystal diode.

**crystal set**—A simple type of radio receiver having no amplifier stages, and only a crystal-detector stage for demodulation of the received signal.

**crystal shutter**—A mechanical switch for shorting a waveguide or coaxial cable so that undesired rf energy is prevented from reaching and damaging a crystal detector.

**crystal slab**—A relatively thick piece of crystal from which crystal blanks are then cut.

**crystal speaker**—Also called piezoelectric speaker. A speaker in which the mechanical displacements are produced by piezoelectric action.

**crystal-stabilized oscillator**—Abbreviated CSO. A microwave rf source that uses a crystal oscillator operating at some low frequency (usually below 150 MHz) to drive a multiplier to obtain a microwave output frequency. A crystal oscillator can also be used for injection-locked stabilization of a free-running microwave oscillator.

**crystal-stabilized transmitter**—A transmitter employing automatic frequency control, in which the reference frequency is the same as the crystal-oscillator frequency.

**crystal transducer**—*See* piezoelectric transducer.

**crystal video receiver**—A radar receiver consisting only of a crystal detector and video amplifier.

**CSA**—Abbreviation for Canadian Standards Association, a testing and approval agency for products sold in Canada. This is the Canadian equivalent of Underwriters Laboratories in the United States.

**C-scope**—A rectangular radar display in which targets appear as bright spots with azimuth indicated by the horizontal coordinate and elevation angle by the vertical coordinate.

**CSMA**—Abbreviation for carrier sense multiple access. A contention scheme in which stations listen for the presence of a carrier on the channel before sending a packet.

**csv**—Abbreviation for corona start voltage.

**CTCSS**—Abbreviation for Continuous Tone-Coded Squelch System. Also called subaudible tones or PL tones (trademarked name by Motorola). This is a tone that is transmitted in addition to a voice signal. When it is equipped with a CTCSS decoder, a repeater will not function unless it receives both the CTCSS tone and the carrier signal.

**CT-cut crystal**—A natural quartz crystal cut to vibrate below 500 kHz.

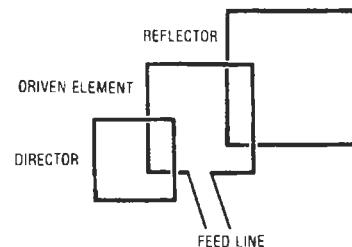
**CTL**—Abbreviation for complementary transistor logic.

**CTS**—Abbreviation for clear to send. A control signal between a modem and a controller used to initiate data transmission over a communication line.

**cubical antenna**—An antenna array whose elements are positioned to form a cube.

**cue**—*See* address.

**cue bus**—In a mixing console, the bus or channel that is used to feed a program to a performer's headphones. Also called foldback.



Cubical antenna.

**cue circuit**—A one-way communication circuit for conveying program control information.

**cue control**—A switch that temporarily disables a recorder's tape lifters during fast-forward and rewind, so the operator can judge what portion of the recording is passing the heads.

**cuff electrode**—An electrode in the shape of the letter "C" designed for application of potentials to small circular bodies, such as peripheral nerves.

**cuing**—1. Locating a particular spot on a recorded tape, preparatory to playing through from that spot. 2. The marking or other identification of particular points or sections of tape to aid in the location of specific, desired selections or portions of the recording. This may be done with grease pencil or other markings directly on the tape, or by making use of a digital index counter, if one exists on the recorder.

**cuing device**—A lever or control that raises and lowers the tonearm without direct handling by the operator. Usually viscous damped for uniform rise and fall times, no matter how rapidly the control is moved.

**CUJT**—Abbreviation for complementary unijunction transistor.

**cup**—A single mechanical section of a potentiometer that may contain one or more electrical resistance elements.

**cup core**—A core that forms a magnetic shield around an inductor. Usually a cylinder with one end closed. A center core inside the inductor is normally used and may or may not be part of the cup core.

**cupping**—Curvature of a recording tape in a direction perpendicular to the length of the tape.

**cup washer**—A washer formed with a recess in one side to retain compression springs or, on binding-post terminals, to prevent escape of connecting wire strands.

**curie**—A unit of radioactivity; 1 curie (Ci) equals  $3.7 \times 10^{10}$  nuclear transformations per second.

**Curie point**—In ferroelectric dielectrics, the temperature or temperatures at which peak values of the dielectric constant occur. Also called Curie temperature. The (critical) temperature at which piezoelectric materials lose their polarization and therefore also their piezoelectric properties.

**Curie temperature**—Temperature in degrees Celsius at which a magnetized sample is completely demagnetized due to thermal agitation. *See* Curie point.

**curl**—The degree to which a wire tends to form a circle after removal from a spool. An indication of the ability of the wire to be wrapped around posts in long runs.

**curls**—Extruded material coming out from the edge of a bond.

**Curpistor**—A subminiature constant-current tube containing two electrodes and filled with radioactive nitrogen.

**current**—1. The movement of electrons through a conductor. Current is measured in amperes, milliamperes, microamperes, nanoamperes, or picoamperes. 2. A movement of electrons, positive ions, negative ions, or holes. 3. The rate of transfer of electricity from one point to another.

**current amplification**—1. The ratio of the current produced in the output circuit of an amplifier to the current supplied to the input circuit. 2. In photomultipliers, the ratio of the signal output current to the photoelectric signal current from the photocathode.

**current amplifier**—1. A device designed to deliver a greater output current than its input current. 2. An amplifier that has a low output impedance and is capable of delivering a heavy current.

**current antinode**—Also called current loop. The point at which current is a maximum along a transmission line, antenna, or other circuit element having standing waves.

**current attenuation**—The ratio of the magnitude of the current in the input circuit of a transducer to the magnitude of the current in a specified load impedance connected to the transducer.

**current-balance relay**—A relay in which operation occurs when the magnitude of one current exceeds the magnitude of another current by a predetermined ratio.

**current-carrying capacity**—1. The maximum current a conductor (or braid) can carry without heating beyond a safe limit. 2. The maximum current that can be continuously carried without causing permanent change in the electrical or mechanical properties of a device or conductor. (As applied to phone jacks, it refers to carrying current without interrupting the circuit.) 3. The maximum current an insulated conductor can safely carry without exceeding its insulation and jacket temperature limitations. 4. The maximum current that can be carried continuously without damage to a device, conductor, or machine. It is mainly determined by the temperature which the insulation can withstand and by the ambient temperature.

**current-carrying rating**—The current that can be carried continuously or for stated periodic intervals without impairment of the contact structure or interrupting capability.

**current-controlled oscillator**—Abbreviated CCO. A circuit that creates an ac output signal whose frequency is a function of the dc input current.

**current density**—1. The amount of electric current passing through a given cross-sectional area of a conductor in amperes per square inch; i.e., the ratio of the current in amperes to the cross-sectional area of the conductor. 2. The ratio of current to surface area.

**current echo**—The signal that on a transmission line is reflected as the result of some discontinuity.

**current feed**—The excitation or feeding of an antenna by connecting the feeder at a point of maximum current, as at the center of a dipole or half-wave antenna.

**current flicker**—Current surges resulting from momentary shorts that can occur within a solid electrolyte capacitor. Under certain conditions, current flicker can avalanche to cause a short, which under low-impedance circuit conditions results in catastrophic destruction of the capacitor.

**current foldback**—In a dc power supply, a self-resetting protective method that reduces the output current to less than full-rated output under overload or short-circuit conditions.

**current generator**—A two-terminal circuit element with a terminal current independent of the voltage between its terminals.

**current hogging**—1. A condition in which one of several parallel logic circuits takes the largest share of

the available current because it has a lower resistance than the other circuits. 2. A condition that exists when several base-emitter junctions are driven from the same output and the input with the lowest base-emitter junction forward potential severely limits the drive current to the other transistor bases.

**current-hogging injection logic**—Abbreviated CHIL. A logic form that combines the input flexibility of current-hogging logic with the performance and packing density of injection logic.

**current limiter**—A device that detects current leakage and prevents potential shock hazard by minimizing or interrupting current flow.

**current-limiter relay**—A relay that opens its contacts when the current in a circuit exceeds a certain preset value.

**current limiting (automatic)**—1. An overload-protection mechanism that limits the maximum output current of a power supply to a preset value and automatically restores the output when the overload is removed. 2. In a dc power supply, a self-resetting safeguard that protects the power supply against short-circuit and over-load conditions by limiting output current to a predetermined maximum value. See also short-circuit protection.

**current-limiting fuse**—A protective device that anticipates a dangerous short-circuit current and opens the circuit, precluding the development of the peak available current.

**current-limiting reactor**—A form of reactor intended for limiting the current that can flow in a circuit under short-circuit conditions.

**current-limiting resistor**—A resistor inserted into an electric circuit to limit the flow of current to some predetermined value. Usually inserted in series with a fuse or circuit breaker to limit the current flow during a short circuit or other fault, to prevent excessive current from damaging other parts of the circuit.

**current-limit sense voltage**—The voltage across the current-limit terminals required to cause a regulator to current limit with a short-circuited output. This voltage is used to determine the value of the external current-limit resistor when external booster transistors are used.

**current loop**—1. Means of communicating data via the presence or absence of current in a two-wire cable. 2. A two-wire transmit/receive interface in which the presence of a 20-mA current level indicates data (a binary 1 or mark) and its absence indicates no data (a 0 or space). Normally used with teletypes, and the only communication method that uses a current signal. See current antinode.

**current margin**—The difference between the steady-state currents flowing through a telegraph receiving instrument that correspond to the two positions of the telegraph transmitter.

**current mirror**—A circuit that relies on the collector current matching of two transistors (one strapped as a diode) when connected together base to base and emitter to emitter.

**current-mode logic**—Abbreviated CML. A non-saturating logic circuit that employs the characteristics of a differential amplifier circuit in its design. Because it is nonsaturating, it is a very fast switching logic design with low logic swings. The gate input element is the base of a transistor, with a separate transistor for each input.

**current node**—A point at which current is zero along a transmission line, antenna, or any other circuit element that has standing waves.

**current noise**—Also called excess noise. A low-frequency noise caused by current flowing in a resistor, particularly in film and carbon resistors. The amount of energy varies widely with the type and construction of the

resistor. This low-frequency noise is generally measurable only in the region below 100 kHz; the noise power varies inversely with frequency and is a function of both the current in the resistor and the value of the resistor.

**current penetration**—The depth a current of a given frequency will penetrate into the surface of a conductor carrying the current.

**current probe**—A type of transformer, usually having a snap-around configuration, used for measuring the current in a conductor.

**current pump**—A circuit that drives, through an external load circuit, an adjustable, variable, or constant value of current regardless of the reaction of that load to the current, within rated limits of current, voltage, and load impedance.

**current rating**—1. The maximum continuous current that can be carried by a conductor without degradation of the conductor or its insulation properties. 2. Maximum current that a device is designed to conduct for a specified time at a specified operating temperature. 3. The maximum continuous electrical current recommended for a given wire in a given situation. Expressed in amperes.

**current regulator**—1. A device that functions to maintain the output current of a generator or other voltage source at a predetermined value, or varies the voltage according to a predetermined plan. 2. A regulating device that limits generator output and prevents excessive generator output by repeatedly inserting a resistance into the generator field circuit.

**current relay**—A relay that operates at a predetermined value of current. It can be an overcurrent relay, an undercurrent relay, or a combination of both.

**current saturation**—The condition in which the plate current of a vacuum tube cannot be further increased by increasing the plate voltage.

**current-sensing resistor**—A resistor of low value placed in series with a load to develop a voltage proportional to the output current. A regulated dc power supply regulates the current in the load by regulating the voltage across this sensing resistor.

**current-sensitivity**—The current required to give standard deflection on a galvanometer.

**current sink**—1. A point toward which conventional current flows (electrons flow away from it). 2. An output type of sensor or analog device in which current flows from the load and into the output of the device at a low voltage when it is turned on.

**current-sinking logic**—Also called input-coupled logic. A logic form that requires that current flow out of the input of a circuit and back into the output of the preceding stage, which serves as a current sink instead of a source.

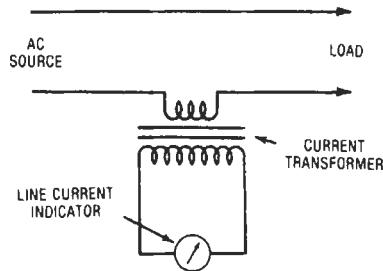
**current source**—1. A point from which conventional current flows (electrons flow toward it). 2. An output type of switch or analog device in which current flows from it into the load at a high voltage when it is turned on.

**current-sourcing logic**—Also called collector-coupled logic. A logic form in which current flows from the output of a circuit and is forced into the input of a similar circuit to activate the circuit that drives.

**current-stability factor**—In a transistor, the ratio of a change in emitter current to a change in reverse-bias current between the collector and base.

**current-transfer ratio**—The ratio of an optocoupler's output current to input current at a specified bias. See beta.

**current transformer**—A transformer, intended for measuring or control purposes, designed to have its primary winding connected in series with a circuit carrying the current to be measured or controlled.



Current transformer.

**current-type telemeter**—A telemeter in which the magnitude of a single current is the translating means.

**cursor**—1. A mechanically or electronically generated line that moves back and forth over another surface to delineate accurate readings. 2. A mechanical bearing line on a plan position indicator-type display for reading target bearing. 3. A visual movable pointer on a CRT used by the PC programmer to indicate where an instruction is to be added to the PC program. The cursor is also used during editing functions. 4. A small lighted line or square that appears on a video display screen at the point where the next character will appear. 5. A manually movable illuminated or flashing marker on a computer screen used to indicate the location of the next point at which an action will take place. 6. A means for indicating on a CRT screen the point at which data entry or editing will occur. The intensified element may be at constant high intensity or flashing (alternate high intensity and normal intensity). If flashing, additional data may be necessary to complete the instruction. 7. An indicator that marks the current working position on a display. 8. A blinking character that indicates where the next keyboard stroke will appear. 9. A position marker on a video display.

**cursor and update**—Circuitry that allows a user to add new material into a video terminal's memory and display. The cursor, which locates the current entry location, is generally a blinking underline, although some are overlines or boxes.

**curve tracer**—An instrument capable of producing a display of one current or voltage as a function of a second voltage or current, with a third voltage or current as a parameter.

**customer set**—See subscriber set.

**cut and paste**—To move graphics and/or text from one location to another.

**Cutler antenna**—A rear feed for a paraboloidal antenna reflector. It consists of a support waveguide with a terminating cavity containing two resonant slots, one on either side of the support waveguide, that face the reflector. Each slot is parallel to the broad faces of the feed waveguide.

**Cutler feed**—A resonant cavity, at the end of a waveguide, that feeds radio-frequency energy to the reflector of the antenna assembly of some airborne antennas.

**cutoff**—1. Minimum value of bias that cuts off, or stops, the flow of plate current in a tube. 2. The frequency above or below which a selective circuit fails to respond. 3. The frequency of transmission at which the loss exceeds by 10 decibels that observed at 1000 hertz. 4. The condition when the emitter-base junction of a transistor has zero bias or is reverse biased and there is no collector current. 4. The frequency at which the modulus of measured parameter has decreased to  $1/\sqrt{2}$  of its low-frequency value. (For a transistor, the cutoff

frequency usually applies to the short-circuit small-signal forward current transfer ratio for either the common-base or common-emitter configuration.)

**cutoff attenuator**—A variable length of waveguide used below the cutoff frequency of the waveguide to introduce variable nondissipative attenuation.

**cutoff current**—Transistor collector current with no emitter current and normal collector-to-base bias.

**cutoff field**—See critical field.

**cutoff frequency**—1. The frequency at which the gain of an amplifier falls below 0.707 times the maximum gain. 2. The frequency that marks the edge of the passband of a filter and the beginning of the transition to the stopband. 3. With respect to a line, the upper frequency limit, usually of a loaded transmission circuit, beyond which the attenuation rises very rapidly. 4. That frequency beyond which no appreciable energy is transmitted. It may refer to either an upper or lower limit of a frequency band.

**cutoff limiting**—Keeping the output of a vacuum tube below a certain point by driving the control grid beyond cutoff.

**cutoff voltage**—1. The electrode voltage that reduces the dependent variable of an electron-tube characteristic to a specified value. See also critical voltage. 2. The voltage at which the discharge is considered complete. This need not be a very low voltage.

**cutoff wavelength**—The ratio of the velocity of electromagnetic waves in free space to the cutoff frequency of a waveguide.

**cutout**—1. An electrical device that interrupts the flow of current through any particular apparatus or instrument, either automatically or manually. 2. Pairs brought out of a cable and terminated at some place other than at the end of the cable.

**cutout relay**—A device in the circuit between a generator and battery that closes to allow the generator to charge the battery and opens when the generator stops.

**cut over**—To transfer from one system to another.

**CUTS**—Abbreviation for computer user tape system. A standard method of recording data in serial form on an audiocassette recorder. Data is recorded at 300 baud by recording 8 pulses at 2400 Hz for a mark, or 4 pulses of 1200 Hz for a space.

**cut-signal branch operation**—In systems in which radio reception continues without cutting off the carrier, the cut-signal branch operation technique disables a signal branch in one direction when it is enabled in the other to preclude unwanted signal reflections.

**cutter**—Also called mechanical recording head. An electromechanical transducer that transforms an electrical input into a mechanical output (for example, the mechanical motion that a cutting stylus inscribes into a recording medium).

**cut-through**—The resistance of a solid material to penetration by an object under conditions of pressure, temperature, etc.

**cut-through flow test**—A test to measure the resistance to deformation of insulation subjected to heat and pressure.

**cutting rate**—The number of lines per inch the lead screw moves the cutting-head carriage across the face of a recording blank. Standard rates are 96, 104, 112, 128, 136, and greater, in multiples of 8 lines per inch. For microgroove recordings, 200 to 300 lines per inch are used.

**cutting stylus**—A special stylus used for cutting of phonograph records in the disc mastering process; it often has a built-in heater element and has special geometry.

**CVD**—Abbreviation for chemical vapor deposition.

**CVD fiber**—A process by which a heated gas produces an oxide deposit to fabricate a glass fiber preform. The deposited glass becomes the core.

**cw**—1. Abbreviation for continuous wave. 2. Abbreviation for clockwise.

**cw jamming**—Transmission of a constant-amplitude, constant-frequency, unmodulated signal for the purpose of jamming a radar receiver by changing its gain characteristics.

**cwp**—Abbreviation for communication word processor. A word processor that can communicate, over special lines or regular telephone lines, with another cwp and with mainframe computers, Telexes and TWXs, photocomposers, optical character reading devices, intelligent copiers, and other terminals. The chief limitation is that the communicating systems must be compatible, meaning they must speak the same electronic language in order to understand each other.

**cw reference signal**—In color television, a sinusoidal signal used to control the conduction time of a synchronous demodulator.

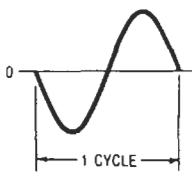
**cxr**—Abbreviation for carrier. A communication signal used to indicate the intention to transmit data on a line.

**cybernetics**—1. The study of systems of control and communications in humans and animals, and in electrically operated devices such as calculating machines. 2. The comparative study of the control and intracommunication of information-handling machines and nervous systems of animals and man in order to understand and improve communication. 3. The science that is concerned with the principles of communication and control, particularly as applied to the operation of machines and the functioning of organisms. 4. Study of multiple feedback loop, self-governing systems, usually of great complexity, as are found in living organisms and advanced human-made control systems. 5. A comparative study of the similarities as well as the differences between humans and machines, with respect to their ability to communicate and control.

**cyberspace**—1. A general term referring to the virtual places that exist only on the Internet. 2. A term coined by William Gibson in his 1984 novel *Neuromancer* to describe a shared virtual environment whose inhabitants, objects, and spaces comprise data that is visualized, heard, and touched. The word *cyberspace* is currently used to describe the whole range of information resources available through computer networks and is often used as a synonym for the Internet. 3. The metaphoric space in which electronic communication takes place. Everything in cyberspace is virtual, that is, not physically real, but a shared experience nonetheless. 4. The “place” one goes to use a computer and modem to communicate with others. Being online puts one in cyberspace.

**cyborg**—Abbreviation for cybernetic organism. 1. An android capable of heuristic (learning by experience) updating of its own resident intelligence. 2. An organism superior in strength and/or perception to ordinary human beings. 3. A human altered or enhanced by mechanical means—somewhere between a man and a robot. The Borg in Star Trek are the best-known example.

**cycle**—1. The change of an alternating wave from zero to a negative peak to zero to a positive peak and back to zero. The number of cycles per second (hertz) is called the frequency. See also alternation. 2. An off-on application of power. 3. A set of operations carried out in a predetermined manner. 4. In computer terminology, a regularly repeated sequence of operations, or the time required for one such sequence. 5. The complete sequence, including reversal, of an alternating electric current. 6. An interval of time in which an operation or set of events is completed.



Cycle, I.

**cycle counter**—A mechanism or device used to record the number of times a specified cycle is repeated.

**cycle criterion**—In computer terminology, the number of times a cycle is to be repeated.

**cycle index**—1. In digital computer programming, the number of times a cycle has been executed. 2. The difference between the number of times a cycle has been executed and the number of times it is desired that the cycle be repeated.

**cycle life**—For rechargeable cells, the total number of discharge/charge cycles before the cell becomes inoperative.

**cycle redundancy check**—Abbreviated CRC. 1. An error detection scheme, usually hardware implemented, in which a check character is generated by taking the remainder after dividing all the serialized bits in a block of data by a predetermined binary number. This remainder is then appended to the transmitted data and recalculated and compared at the receiving point to verify data accuracy. 2. Comparison of the checksum derived from data as it was originally written into storage with the checksum derived from the same data as it is being read out of storage. The first checksum is appended to the data as it enters storage. After reading this data, the controller computes a new checksum from it and compares the two. If the checksums match, the data is correct. A checksum error may indicate a damaged area on the memory, data that has changed since written, or erroneous reading of correct data for which a retry may work.

**cycle reset**—To return a cycle index to its initial value.

**cycle shift**—In a computer, the removal of the digits of a number of characters from a word from one end of the number or word and their insertion, in the same sequence, at the other end.

**cycle stealing**—1. A memory cycle stolen from the normal CPU operation for a direct memory access (DMA) operation. 2. A computer memory access technique in which an I/O processor is synchronized to the general processor's memory cycles in such a way that it steals memory cycles between those of the general processor. This is possible on systems in which the memory cycle time is significantly shorter than the processor execution cycle. 3. A characteristic of DMA channels. An I/O device can delay CPU use of the I/O bus for one or more bus cycles while it accesses system memory.

**cycle time**—1. The interval of time between the occurrence of corresponding parts of successive cycles. 2. The length of time required to obtain information from a memory and then write information back into the memory. Also called read-write cycle time, since it is normally equal to the sum of the write time and the read time. If system memory is core, the read cycle time includes a write-after-read (restore) subcycle. Cycle time is often used as a measure of computer performance, since this is a measure of the time required to fetch an instruction. 3. Time interval during which any set of operations is repeated regularly in the same sequence. 4. The time needed for a CPU to go through a complete operation cycle. 5. The total time required by a device

(usually a memory) to complete its cycle and become available again. Typically, the access time will be shorter than the cycle time, though they may sometimes be equal.

**cycle timer**—A controlling mechanism that opens or closes contacts according to a preset cycle.

**cyclically magnetized condition**—The condition of a magnetic material after being under the influence of a magnetizing force varying between two specific limits until, for each increasing (or decreasing) value of the magnetizing force, the magnetic-flux density has the same value in successive cycles.

**cyclic code**—Positional notation, not necessarily binary, in which quantities differing by one unit are represented by expressions that are identical except for one place or column, and the digits in that place or column differ by only one unit. Cyclic codes are often used in mechanical devices because no ambiguity exists at the changeover point between adjacent quantities.

**cyclic decimal code**—A four-bit binary code word only one digit of which changes state between one sequential code word and the next, and which translates to decimal numbers. It is categorized as one of a group of unit-distance codes.

**cyclic memory**—A memory that continuously stores information but provides access to any piece of stored information only at multiples of a fixed time called the cycle time.

**cyclic shift**—A shift in which the data moved out of one end of the storing register is reentered into the other end, as in a closed loop.

**cycling**—1. A rhythmic variation, near the desired value, of the factor under control. 2. A periodic change from one value to another of the controlled variable in an automatic control system. 3. A periodic oscillation in an automatically controlled system between the high limit and the low limit over which the controls operate.

**cycling vibration**—Sinusoidal vibration applied to an instrument and varied in such a way that the instrument is subjected to a specified range of vibrational frequencies.

**cycloconverter**—A step-down static frequency converter that produces a constant or a precisely controllable output frequency from a variable-frequency ac power input. In general, the frequency ratio chosen is 3 to 1 or greater.

**cyclogram**—An oscilloscope display obtained by monitoring two voltages having a direct cyclic relationship to each other.

**cyclograph**—A device in which an electron beam moves in two directions, at right angles.

**cyclometer register**—A set of four or five wheels numbered from 0 to 9 inclusive on their edges, and enclosed and connected by gearing so that the register reading appears as a series of adjacent digits.

**cyclotron**—1. A device consisting of an evacuated tank in which positively charged particles (for example, protons, deuterons) are guided in spiral paths by a static magnetic field while being highly accelerated by a fixed-frequency electric field. 2. Type of accelerator of nuclear particles (protons or deuterons) that uses an oscillating electric field and a fixed magnetic field to accelerate the particles. See accelerator.

**cyclotron frequency**—The frequency at which an electron traverses an orbit in a steady, uniform magnetic field and zero electric field. Given by the product of the electronic charge and the magnetic flux density, divided by  $2\pi$  times the electron mass.

**cyclotron-frequency magnetron oscillations**—Those oscillations having substantially the same frequency as that of the cyclotron.

**cyclotron radiation**—The electromagnetic radiation emitted by charged particles orbiting in a magnetic field at speeds relatively slow compared with the speed of light. It arises from the centripetal acceleration of the particle moving in a circular orbit, as in a cyclotron.

**cyclotron resonance**—The effect characterized by the tendency of charged carriers to spiral around an axis in the same direction as an applied magnetic field, with an angular frequency determined by the value of the applied field and the ratio of the charge to the effective mass of the charge carrier.

**cylindrical (or circular) connectors**—Separable plugs and receptacles, both housed in cylindrically shaped metal or plastic shells. Shells may stand alone or may be mounted on panels, bulkheads, or walls. When mated, the shells are joined by a coupling ring of threaded, bayonet, or push-pull design. The receptacle (female) contacts are imbedded in an insert of plastic or vitreous insulating material (usually for hermetically sealed connectors) in the shell. The plug (male) contacts are cantilevered cylindrical pins, also partly imbedded in an insert of insulating

### cyclotron radiation — Czochralski technique

material. Contact terminations are either soldered or crimp connected to lead-in wires.

**cylindrical-film storage**—A computer storage device, each storage element of which is a short length of glass tubing with a thin film of nickel-iron alloy on its outer surface. Wires running through the tubing act as bit and sense lines, and conducting straps at right angles to the tubing function as word lines.

**cylindrical reflector**—A reflector that is part of a cylinder, usually parabolic.

**cylindrical wave**—A wave whose equiphasic surfaces form a family of coaxial cylinders.

**Czochralski crystal**—A crystal grown by slowly withdrawing a seed crystal from a melt while the melt is held slightly above the melting point of the material. High-quality, low-dislocation-density crystals of germanium and silicon are grown in this manner.

**Czochralski technique**—A method of growing large, single crystals by pulling them from a molten state. Usually used for growing single crystals of germanium and silicon.

# D

**D**—Symbol for electrostatic flux density, deuterium, dissipation factor, or drain electrode.

**DAA**—Abbreviation for data access arrangement. 1. A direct interface attachment that connects a data communications device to a telephone line. It protects the public telephone network from a sudden surge of power or interference from the device that is coupled to the line. 2. A telephone-switching-system protective device used to attach uncertified non-telephone-company-manufactured equipment to the carrier network.

**DABS**—Abbreviation for discrete address beacon system. A sophisticated ground surveillance equipment and complementary airborne transponder. DABS includes a two-way automatic ground-to-air data link.

**DAC**—Abbreviation for digital-to-analog converter. Also abbreviated dac or d/a converter.

**d/a converter**—See digital-to-analog converter.

**d/a decoder**—A device that changes a digital word to an equivalent analog value.

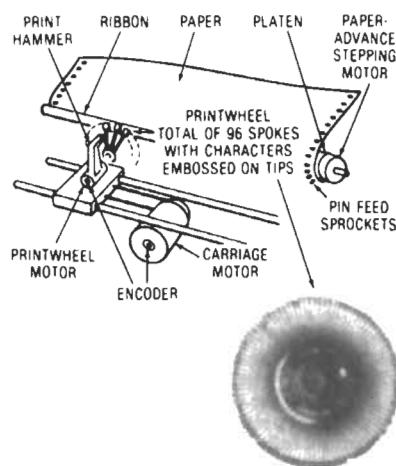
**Dag**—Trademark of Acheson Industries, Inc. Abbreviation for Aquadag.

**daisy chain**—1. In a computer, a bus line that is interconnected with units in such a way that the signal passes from one unit to the next in serial fashion. 2. A method for prioritizing interrupts. Each unit capable of requesting an interrupt can either pass on the processor acknowledge or block it. In this way the unit that is electrically closest to the processor has highest priority. 3. A method of propagating signals along a bus, often used in applications in which devices not requesting a daisy-chained signal respond by passing the signal on. The first device requesting the signal responds to it by performing an action and breaks the daisy-chained signal continuity. This scheme permits assignment of device priorities based on the electrical position of the device along the bus.

**daisy wheel**—1. A letter-quality, impact-printing mechanism whose printing element consists of a flat, rimless, metal or plastic wheel with letters molded at the ends of the spokes. The wheel rotates until the

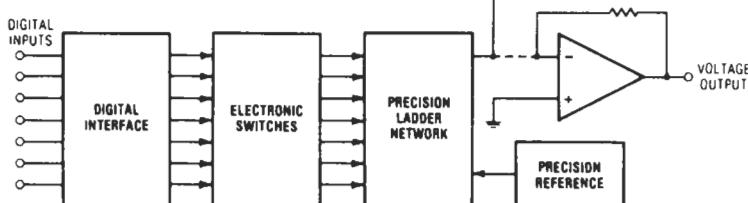
required character is in position, and a hammer flies out and hits it, impacting the character onto paper. 2. The print element for a daisy-wheel printer. Print wheels are interchangeable, allowing the operator to select an appropriate font.

**daisy-wheel printer**—1. An impact printer that prints fully formed characters one at a time by rotating a circular print element composed of a series of individual spokes, each containing two characters. 2. A printer that produces letter-quality type when characters, mounted in a circle, strike an inked ribbon. It is rarely used anymore.



*Daisy-wheel printer.*

**Damon effect**—The change in susceptibility of a ferrite caused by a high rf power input.



*d/a decoder.*

**damped natural frequency**—1. The frequency at which a system with a single degree of freedom will oscillate, in the presence of damping, after momentary displacement from the rest position by a transient force. 2. The rate of free oscillation of a sensing element in the presence of damping.

**damped oscillation**—The oscillation that occurs when the amplitude of the oscillating quantity decreases with time. If the rate of decrease can be expressed mathematically, the name of the function describes the damping. Thus, if the rate of decrease is expressed as a negative exponential, the system is said to be an exponentially damped system.

**damped waves**—Waves in which successive cycles at the source progressively diminish in amplitude.

**dampen**—1. To diminish progressively in amplitude; usually said of waves or oscillations. 2. To deaden vibrations.

**damper diode**—See freewheeling diode.

**damper tube**—The tube that conducts in the horizontal-output circuit of a television receiver when the current in the horizontal-deflecting yoke reaches its negative peak. This causes the sawtooth deflection current to decrease smoothly to zero instead of continuing to oscillate.

**damper winding**—Also called amortisseur winding. 1. In electric motors, a permanently short-circuited winding, usually uninsulated, arranged so that it opposes rotation or pulsation of the magnetic field with respect to the pole shoes. 2. A winding of copper bars or rods (squirrel cage) embedded in the pole face of synchronous motors and generators. Used as a starting winding on synchronous motors; acts as the squirrel cage of an induction motor. After the synchronous motor is up to speed, tends to prevent oscillations and hunting—a damping effect that gives it its name.

**damping**—1. The reduction of energy in a mechanical or electrical oscillating system by absorption, conversion into heat, or by radiation. 2. Act of reducing the amplitude of the oscillations of an oscillatory system, hindering or preventing oscillation or vibration, or diminishing the sharpness of resonance of the natural frequency of a system. 3. The dissipation of kinetic energy in a system by a controlled energy-absorbing medium. A system can be described as being either critically damped, over-damped, or underdamped. 4. The manner in which the pointer settles to its steady indication after a change in the value of the measured quantity. Two general classes of damped motion are (*a*) periodic, in which the pointer oscillates about the final position before coming to rest; and (*b*) aperiodic, in which the pointer comes to rest without overshooting the rest position. Sometimes referred to as overdamping. 5. The energy-dissipating characteristic that, together with natural frequency, determines the upper

## damped natural frequency — damping ratio

limit of frequency response and the response time characteristics of a transducer. 6. The application of a mechanical resistance, such as a rubber or silicone material, to the cantilever pivot of a pickup to reduce the amplitude of the resonance between the tip mass and the compliance of the vinyl record material (which usually occurs between 15 and 30 kHz). 7. The suppression of oscillations, or ringing, in the rotary of a stepping motor caused by sudden changes in velocity. Damping can be accomplished by adding mechanical or viscous fluid dampers or by electronically shaping and controlling the energizing field power.

**damping coefficient**—The ratio of actual damping to critical damping.

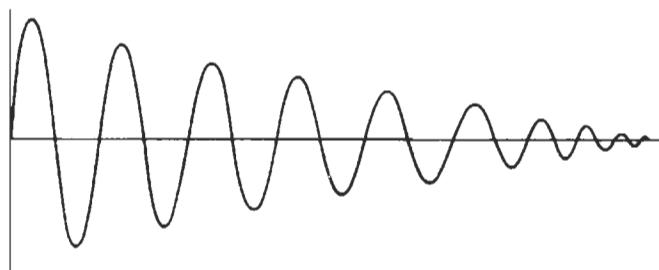
**damping constant**—The Napierian logarithm of the ratio of the first to the second of two values of an exponentially decreasing quantity separated by a unit of time.

**damping diode**—A vacuum tube that damps the positive or negative half-cycle of an ac voltage.

**damping factor**—1. For any underdamped motion during any complete oscillation, the quotient obtained by dividing the logarithmic decrement by the time required by the oscillation. 2. Numerical quantity indicating ability of an amplifier to operate a speaker properly. Values over 4 are usually considered satisfactory. 3. The ratio of rated load impedance to the internal impedance of an amplifier. 4. The ratio (larger to smaller) of the angular deviations of the pointer of an electrical indicating instrument on two consecutive swings from the equilibrium position. 5. See decrement, 1. 6. The ratio of load or speaker impedance to the amplifier's output impedance. Thus, the smaller the output impedance the greater the damping factor. The damping factor increases with increase of voltage negative feedback; with the large amounts of feedback applied to transistor hi-fi amplifiers, the source or output impedance can be as low as 0.1 ohm, giving a damping factor of 80, referred to as an 8-ohm load. 7. The standard damping constant of a second-order feedback system. In a phase-locked loop, it refers to the ability of the loop to respond quickly to an input signal frequency without excessive overshooting.

**damping magnet**—A permanent magnet and a movable conductor, such as a sector or disc, arranged in such a way that a torque (or force) is produced that tends to oppose any relative motion.

**damping ratio**—1. The ratio of the degree of actual damping to the degree of damping required for critical damping. May be affected by changes in ambient temperature. 2. Of a galvanometer, the ratio, expressed as a positive number, of a given deflection to the next deflection in the opposite direction. The greater this ratio, the greater the degree of damping. The natural logarithm of this ratio is called the logarithmic decrement.



Damped oscillation.

**dancer arm** — A device that senses tape tension and signals the reel motor to take up or to supply tape.

**Daniell cell** — A cell having a copper electrode in a copper-sulfate solution and a zinc electrode in a diluted sulfuric acid or zinc-sulfate solution, with the two solutions separated by a porous partition. Generates an essentially constant electromotive force of about 1.1 volts.

**daraf** — The unit of elastance. It equals the reciprocal of capacitance and is actually farad spelled backward.

**dark conduction** — Residual electrical conduction in a photosensitive substance in total darkness.

**dark current** — See electrode dark current.

**dark discharge** — In a gas, an electric discharge that has no luminosity.

**dark-field disc** — A disc used in the optical electronic type of cell counter that controls light transmission.

**dark noise** — The current or pulses produced when the photocathode is shielded from all external optical radiation.

**dark resistance** — The resistance of a photoelectric device in total darkness.

**dark satellite** — A satellite that does not give information to friendly ground stations, either because it is controlled or because it carries inoperative radiating equipment.

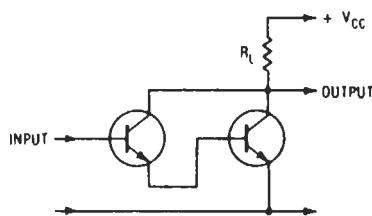
**dark space** — A nonluminous region of a glow-discharge tube.

**dark spot** — A phenomenon sometimes observed in a reproduced television image. It is caused by the formation of electron clouds in front of the mosaic screen in the transmitter camera tube.

**dark-spot signal** — The signal existing in a television system while the television camera is scanning a dark spot.

**dark-trace tube** — A cathode-ray tube with a screen coated with a halide of sodium or potassium. The screen normally is nearly white, and whenever the electron beam strikes, it turns a magenta color that is of long persistence. The screen can be illuminated by a strong light source so that the reflected image may be made intense enough to be projected.

**Darlington amplifier** — Also called Darlington pair, double-emitter follower, or  $\beta$  multiplier. 1. A transistor circuit that, in its original form, consists of two transistors in which the collectors are tied together and the emitter of the first transistor is directly coupled to the base of the second transistor. Therefore, the emitter current of the first transistor equals the base current of the second transistor. This connection of two transistors can be regarded as a compound transistor with three terminals. 2. A two-transistor amplifier connected so that the amplification of the amplifier equals the product of the individual transistors' amplification. 3. A composite configuration of transistors that provides a high input impedance and a high degree of amplification.



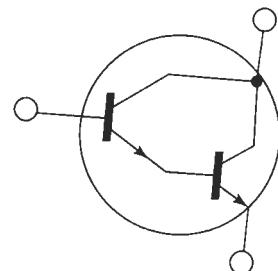
Darlington amplifier.

**Darlington-connected phototransistor** — A phototransistor whose collector and emitter are connected to the collector and base, respectively, of a second transistor. The emitter current of the input transistor is amplified by the second transistor, and the device has a very high sensitivity to light.

**Darlington connection** — A form of compound connection in which the collectors of two or more transistors are connected together and the emitter of one is connected to the base of the next. Two transistors connected in this way constitute a Darlington pair.

**Darlington pair** — See Darlington amplifier.

**Darlington transistor** — A three terminal device that consists of two transistors connected so that the emitter of the first transistor is connected to the base of the second transistor. Such a direct coupled configuration has much higher current gain than can be achieved by a single transistor.



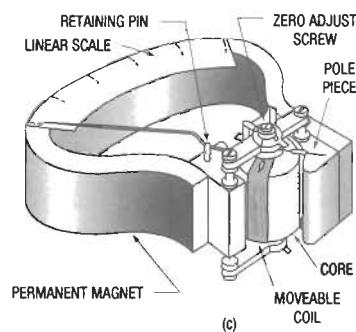
Darlington transistor.

**D'Arsonval current** — A high-frequency, low-voltage current of comparatively high amperage.

**D'Arsonval galvanometer** — A dc galvanometer consisting of a narrow rectangular coil suspended between the poles of a permanent magnet.

**D'Arsonval instrument** — See permanent-magnet moving-coil instrument.

**D'Arsonval movement** — A meter movement consisting essentially of a small, lightweight coil of wire supported on jeweled bearings between the poles of a permanent magnet. When the direct current to be measured is sent through the coil, its magnetic field interacts with that of the permanent magnet and causes the coil and attached pointer to rotate.



D'Arsonval movement.

**DASD** — Abbreviation for direct-access storage device. Any storage device utilizing addressing to let users enter or retrieve data without reference to their physical location. For example, a RAM.

**dash** — Term used in radiotelegraphy. It consists of three units of a sustained transmitted signal followed by one unit during which no signal is transmitted.

**dashpot** — 1. A device using a gas or liquid to absorb energy from or retard the movement of the moving parts of a circuit breaker or other electrical or mechanical device. 2. A cylinder and piston device using gas or a liquid to retard the movement of a relay or circuit breaker.

**DAT** — See digital audio tape.

**data** — 1. A general term used to denote any or all numbers, letters, symbols, or facts that refer to or describe an object, idea, condition, situation, or other factors. It connotes basic elements of information that can be processed or produced by a computer. Sometimes *data* is considered to be expressible only in numerical form, but *information* is not so limited. 2. A general term for any type of information. 3. Inputs in the form of a character string that may have significance beyond their numerical meaning. 4. Any representations, such as characters or analog quantities, to which meaning might be assigned.

**data access arrangement** — A protective connecting arrangement that serves as an interface between a customer-provided modem and the switched network. See DAA.

**data acquisition** — 1. The process by which events in the real world are translated to machine-readable signals. The term usually refers to automated systems in which sensors of one type or another are attached to machinery. 2. The simultaneous collection of data from external sensors, usually in analog form. 3. The function of obtaining data from sources external to a computer system, converting it to binary form, and processing it.

**data acquisition and control systems** — Assemblies of electronic and mechanical components used to monitor and control complex processes. These systems include the following:

- Process sensors that measure such parameters as temperature, pressure, voltage, and current
- Transmitters that convert measurement data to electrical or pneumatic signals and controls
- Digital computers that test set points, program sequential events, and perform calculations
- Software that provides the computer with instructions and routines
- Process actuators, such as solenoids, relays, valves, and motors, that modify the process in response to computer-generated commands
- Process interface devices, such as analog-to-digital converters, that link transmitters and actuators with digital computers
- Human interface devices, such as printers, keyboards, CRT terminals, switches, alphanumeric displays, chart recorders, and alarms, that facilitate human intervention

**data acquisition and conversion system** — A method of processing analog signals and converting them into digital form for subsequent processing or analysis by computer or for data transmission.

**data acquisition system** — 1. A system in which a computer at a central computing facility gathers data from multiple remote locations. 2. System for recording data, usually in digital form, from several sources; can include computing functions.

**data bank** — A comprehensive collection of libraries of data. For example, one line of an invoice may form an item, a complete invoice may form a record, a complete

set of such records may form a file, the collection of inventory control files may form a library, and the libraries used by an organization are known as its data bank. Synonymous with database.

**database** — Also data base. 1. The entire body of data that has to do with one or more related subjects. Typically, it consists of a collection of data files (such as a company's complete personnel records concerning payroll, job history, accrued vacation time, etc.) stored in a computer system so that they are readily available. 2. A block of computer memory containing information about one given thing. 3. The collection of current variable data elements defined and maintained by the user. 4. A collection of data, consisting of at least one file, that is sufficient for a given purpose or for a given data-processing system. 5. A large and complete collection of information that covers a variety of subject areas. For instance, a medical diagnostic database might contain symptoms for all common diseases or injuries. 6. A collection of data fundamental to a system or to an enterprise. Made up of comprehensive files of information having predetermined structure and organization and able to be communicated, interpreted, or processed by humans or by automatic means. 7. A collection of related data that can be retrieved from memory at will, such as a mailing list or a list of accounts.

**database management** — 1. A systematic approach to the storage, updating, and retrieval of information stored as data items, usually in the form of records in a file, where many users, or even many remote installations, will use common data banks. 2. A program that enables a computer to store large amounts of information and then sort it in almost any manner. For example, a company's database could give a list of customers by ZIP code, by credit line, alphabetically by name, or by telephone number. The program takes care of managing the storage and retrieval of the data.

**database management system** — Abbreviated DBMS. A group of programs that allow users to store, alter, and retrieve information from a database.

**database relations** — Linkages within a database that logically bind two or more elements in the database. For example, a nodal line (interconnect) is related to its terminal connection nodes (pins) because they all belong to the same electrical net.

**data block** — Typically, all the data for one item that is entered into a computer for processing, or the computer output that results from processing. An example of an input data block is an individual shipping list; an example of an output data block is a check to be sent.

**data break** — A facility that permits input/output transfers to take place on a cycle-stealing basis without disturbing execution of the program by a computer.

**data bus** — 1. A wire or group of wires used to carry data to or from a number of different locations. 2. The output pins of the MPU chip and associated circuitry used for the transmission of data from one point in the system to another. 3. In fiber optics, an optical waveguide used as a common trunk line to which a number of terminals can be interconnected through optical couplers. 4. A system incorporated into fiber-optic communications characterized by several spatially distributed terminals that are served with the same multiplexed signal.

**data catalog** — A software tool used to list all of the data elements in a database.

**data channel (or communication) equipment** — Abbreviated DCE. Equipment that interfaces a transmission facility to a transmitting/receiving device. A modem is a DCE.

**data code** — A structured set of characters used to stand for the data items of a data element, for example,

the numerals 1, 2, ... 7 used to represent the data items Sunday, Monday, ... Saturday.

**data collection**—Also called data gathering. In a computer, the transferring of data from one or more points to a central point.

**data communication equipment**—See DCE.

**data communications**—1. The technology covering the transfer of data over relatively long distances. 2. Transmission of data in both directions between a central location (host computer) and remote locations (terminals) through communication lines. To facilitate this, interfaces such as modems, multiplexers, concentrators, etc., are required at each end of the lines. 3. The movement of encoded information by means of electrical transmission systems.

**data communications processor**—A small computer used to control the flow of data between machines and terminals over communications channels. It may perform the functions of a concentrator, handshaking, and formatting, but does not include long-term memory or arithmetic functions.

**data compression**—1. The process of reducing the number of recorded or transmitted digital data samples through the exclusion of redundant samples or the use of variable-length characters. 2. A technique that provides for the transmission of fewer data bits than originally required without information loss. The receiving location expands the received data bits into the original bit sequence. 3. A method of reducing the number of bits that are needed to represent information. Data compression allows higher communications speeds and also allows more information to be stored on a disk.

**data control block**—A control block through which the information required by access routines for storage and retrieval of data is communicated to them.

**data conversion**—1. The changing of data from one form of representation to another. 2. Changing numerical information from one format to another via an IC processing chip or other means.

**data display**—Visual presentation of processed data by means of special electronic or electromechanical devices connected (either online or offline) with digital computers or component equipment. Although line printers and punch cards may display data, they usually are categorized as output equipment rather than as displays.

**data distributor**—An array of simple gates that can accept one or more input lines of data and route the data to specific outputs as determined by the levels of control inputs to the array.

**data element**—An element that converts data functions into a usable signal. *See also* element, 2.

**data element dictionary**—A software tool used to describe each data element, i.e., to tell what it is.

**Data Encryption Standard**—See DES.

**data entry**—1. Data entered by an operator from a single data device, such as a card or badge reader, numeric keyboard, or rotary switch. 2. Converting data into a form suitable for entry into a computer system, such as by keying from a terminal onto magnetic disk or tape. 3. Entering data directly into a computer system.

**data entry device**—An electromechanical device to allow manual input of data to a display system. Examples of data entry devices are alphanumeric keys, data tablet, function keys, joystick, mouse, and trackball.

**data file**—A collection of related data records organized in a specific manner, such as a payroll or inventory file.

**data-flow analysis**—Graphical analysis of sequential data patterns, e.g., by tools that identify undefined variables.

**data flowchart**—A flowchart that represents the path of data used in a problem and that defines the major phase of the processing as well as the various data media used.

**data-flow diagram**—An illustration having a configuration such that it suggests a certain amount of circuit operation.

**data-flow machine**—A parallel-processing architecture in which each processor acts on instructions when the data needed become available.

**data format**—The structure and significance of data areas on a storage medium, without reference necessarily to the value of the data contained. Initial values, or limit values, are considered part of a data format definition. The data format itself may have been specified by parameter values at system generation time.

**data gathering**—See data collection.

**data generators**—Specialized word generators in which the programming is designed to test a particular class of device, in which the pulse parameters and timing are adjustable, and in which selected words may be repeated, reinserted later in the sequence, omitted, etc.

**data-handling capacity**—The number of bits of information that may be stored in a computer system at one time. The rate at which these bits may be fed to the input either by hand or with automatic equipment.

**data-handling system**—Semiautomatic or automatic equipment used in the collection, transmission, reception, and storage of numerical data.

**data hierarchy**—A data structure, made up of sets and subsets, in which every subset of a set is of lower rank than the data of the set.

**data highway**—A single-cable data link that provides communication among multiple stations that are separate program counters, computers, and data terminals. It eliminates the need for separate, independently wired data links. Whether communicating or not, all stations may function independently.

**data identifier**—The means of establishing the identity of data by a classification method so that data with close resemblance can be related on a one-to-one or a category basis. Typical identifiers are names, titles, limits or boundaries, classes, and types. Identifiers may also classify the manner of data generation, its completeness, or state of maturity.

**data item**—The simplest type of information dealt with by a computer system (e.g., a name or employee number). A collection of data items constitutes a record (e.g., payroll information on one employee), and a number of related records constitutes a file (e.g., payroll information on all employees of a company).

**data link**—1. Electronic equipment that permits automatic transmission of information in digital form. 2. Equipment, especially transmission cables and interface modules, that permits the transmission of information. 3. A circuit designed to carry digital information, usually by time-division multiplex techniques. Often used to transfer information from one register to another. 4. Any information channel used for connecting data-processing equipment to any input, output, display device, or other data-processing equipment, usually at a remote location.

**data logger**—A system to measure a number of variables and make a written tabulation and/or record in a form suitable for computer input.

**data management**—Those control-program functions that provide access to data sets, enforcement of data-storage conventions, and regulation of the use of input/output devices.

**data organization**—Any of the data-management conventions for determining the arrangement of a data set.

**dataphone**—1. A trademark of American Telephone and Telegraph Co. to identify the data sets made and supplied for use in the transmission of data over the regular telephone network. 2. A telephone equipped with a modem and appropriate switching for both voice and data transmission.

**dataphone digital service**—Abbreviated DDS. An all-digital transmission service offered by Bell Telephone that eliminates the need for special digital-to-analog modems.

**data pointer**—A register holding the memory address of the data (operand) to be used by an instruction. Thus, the register points to the memory location of the data.

**data processing**—1. The handling of information in a sequence of reasonable operations. 2. The execution of a programmed sequence of operations upon data. A generic term for computing in business and other applications. 3. A term used in reference to operations performed by data-processing equipment.

**data-processing center**—An installation of computer equipment that provides computing services for users.

**data-processing machine**—A general name for a machine that can store and process numerical and alphabetical information.

**data-processing system**—A network of machine components that can accept information, process it in accordance with a plan, and produce the desired results.

**data processor**—1. An electronic or mechanical machine for handling information in a sequence of reasonable operations. 2. Any device capable of performing operations on data; e.g., a desk calculator, a tape recorder, an analog computer, or a digital computer.

**data rate**—1. The speed at which data is sent to a receiving computer or device, measured in bits per second. 2. The speed at which digital information is transmitted, expressed in hertz per second or bits per second.

**data reduction**—1. The process of converting a large quantity of information into a more manageable form, usually including a reduction in volume and a simplification of format. 2. The conversion of raw data into a more useful form, such as graphic representations. 3. The process of transforming masses of raw test or experimental data, usually gathered by instrumentation, into a useful, ordered, or simplified form.

**data-reduction system**—Automatic equipment employed to simplify the use and interpretation of a large amount of data gathered by instrumentation.

**data selector**—A decision-making type of digital building block that routes data from any one of several inputs to its output.

**data service unit**—Abbreviated DSU. A device used on transmission facilities specifically designed to transmit digital data. It is equipped with local and remote testing capabilities (normally provided by a modem on an analog or voice transmission facility) and all other signals that are needed to provide a standard interface to terminals.

**dataset**—1. A circuit-terminating device used to provide an interface between a circuit and terminal input/output equipment. 2. A modem. A device that converts the signal of a business machine to signals that are suitable for transmission over communications lines and vice versa. It may also perform other related functions. 3. The complete interface unit supplied by the carrier, including a network control and signaling unit, a

## data organization — data-transmission equipment

modem, and devices to protect the network from signals that might interfere with other users. 4. A device used to encode digital data onto voice phone lines.

**data sheet**—Also called spec sheet. A compilation of terminal information on a specific device defining the electrical and mechanical characteristics of that device.

**data signaling rate**—The data-transmission capacity, expressed in bits per second, of a set of parallel communication channels.

**data sink**—1. A communications device that can accept data signals from a transmission device. Also, it may check the received signals and originate signals for error control. 2. A memory or recording device that can store information for future use. *See also* data source.

**data source**—A communications device that can originate data signals for a transmission device and may accept error control signals. *See also* data sink.

**data stabilization**—Stabilization of a radar display with respect to a selected reference, regardless of changes in the attitude of the vehicle that carries the radar, as in azimuth-stabilized PPI.

**data stream**—Data that is flowing from one point to another in a network. A data stream usually consists of a succession of messages (or data blocks).

**data stream protocol**—The part of a data stream that facilitates the time-critical delivery and synchronization of time-based media.

**data switcher**—A system used to connect network lines to a specific data-processing computer port.

**data synchronizer**—A device that controls and synchronizes the transmission of data between an input/output (I/O) device and the computer system.

**data tablet**—A data entry device consisting of a stylus and a graphic recorder with a coordinate grid similar to the number space of the screen. By pressing the stylus on the tablet, an interrupt is generated and the coordinates of the stylus are stored in special X-Y input registers. The registers are then read by the host computer. The tablet generally replaces the light pen for cursor and tracking symbol movements, and is used extensively in storage-tube display systems, in which light-pen tracking and identification are impossible.

**data terminal**—1. A common point at which data from various sources is collected and transferred; it may include or connect with several types of data-processing equipment. 2. Equipment at the end of a transmission system for the transmission or reception of data. 3. A class of devices characterized by keyboards and CRT displays.

**data termination equipment**—Abbreviated DTE. 1. Any device that generates information to be transmitted over a transmission facility. A terminal is a DTE. 2. Equipment that constitutes the data source and/or data sink and provides the communication control function protocol; it includes any piece of equipment at which a communication path begins or ends.

**data tracks**—Positions of information storage on drum storage devices. Information storage on the drum surface is in the form of magnetized and nonmagnetized areas.

**data transfer**—Moving data from one (or more) registers (or memory locations) to another, or interchanging data between registers (memory locations) in many different ways.

**data transmission**—The sending of information from one place to another or from one part of a system to another.

**data-transmission equipment**—The communications equipment used in direct support of data-processing equipment.

**data transmission system**—Means for transmitting data; for example, dataphone, radio, etc. *See also telemetry.*

**data transmission utilization measure**—In a data-transmission system, the ratio of the useful data output to the total data input.

**data value**—The information contained in data formats. Normally prepared for the generation of specific packages from generic packages.

**data word**—A computer word that contains or represents the data to be manipulated.

**datum reference**—A defined point, line, or plane used to locate the pattern or layer for manufacturing, inspection, or for both purposes.

**daughterboard**—1. A board that mounts on, and connects to, the motherboard, in a computer. Sometimes used for memory upgrades. 2. A small circuit board that is mounted on and adds capability to another circuit board called a motherboard.

**daughter card**—Card or board interfaced with a motherboard or backplane.

**dB**—Abbreviation for decibel. Unit of measurement for power and voltage level.

**dBa**—Abbreviation for decibels adjusted. Used in conjunction with noise measurements. The reference level is -90 dBm, and the adjustment depends on the frequency-band weighting characteristics of the measuring device.

**dBase**—A database management program for PCs.

**dBi**—Decibels of gain relative to an isotropic antenna, or one that radiates equal power in all directions; used to measure antenna gain.

**dBj**—A unit used to express relative rf signal levels. The reference level is 0 dBj = 1000 microvolts. (Originated by Jerrold Electronics.)

**dBk**—Decibels referred to 1 kilowatt.

**dBm**—1. Abbreviation for decibels above (or below) 1 milliwatt. A quantity of power expressed in terms of its ratio to 1 milliwatt. Power-level measurement unit in the telephone industry based on 600-ohm impedance and 1004-Hz frequency; 0 dBm is 1 mW at 1004 Hz, terminated by a 600-ohm impedance. 2. Decibels referenced to 1 milliwatt; used in communication work as a measure of absolute power values. Zero dBm equals 1 milliwatt.

**dB meter**—A meter having a scale calibrated to read directly in decibel values at a specified reference level (usually, 1 milliwatt equals 0 dB).

**DBMS**—*See Database management system.*

**dBm0**—The power in dBm measured at, or referred to, a point of zero relative transmission level.

**dB<sub>r</sub>**—Decibels relative level. Used to define transmission levels at a point in a circuit, with respect to the level at the zero transmission level reference point.

**dBRAP**—Decibels above reference acoustical power, which is defined as  $10^{-16}$  watt.

**dBRN**—Decibels above reference noise. This is a unit used to show the relationship between the interfering effect of a noise frequency, or band of noise frequencies, and a fixed amount of noise power commonly called reference noise. A tone of 1000 hertz having a power level of -90 dBm was selected as the reference noise power because it appeared to have negligible interfering effect and would permit the measurement of interfering effect in positive numbers.

**DBS**—Abbreviation for direct broadcast satellite.

**dBV**—The increase or decrease in voltage independent of impedance levels. A unit of electrical pressure. Decibels referred to a standard of 1 volt.

**dBW**—Decibels referenced to 1 watt.

**dBx**—Decibels above the reference coupling. Reference coupling is defined as the coupling between two circuits that would be required to give a reading of 0 dBa on a two-type noise-measuring set connected to the disturbed circuit when a test tone of 90 dBa (using the same weighting as that used on the disturbed circuit) is impressed on the disturbing circuit.

**dc**—Abbreviation for direct current.

**D cable**—Two-conductor cable, each conductor having the shape of the capital letter D, with insulation between the conductors and between the conductors and the sheath.

**dc amplifier**—*See* direct-current amplifier.

**dc balance**—An adjustment of circuitry to avoid a change in dc level when the gain is changed.

**dc beta**—The dc current gain of a transistor; the ratio of the collector current to the base current that caused it, measured at constant collector-to-emitter voltage.

**dc block**—1. A (coaxial) component employed to prevent the flow of dc or video along a transmission line while allowing the uninterrupted flow of rf. The structure is a short section of coaxial line having a capacitance in series with the center and/or outer conductor. The rf flows with negligible reflection or attenuation, while the video frequencies or dc are blocked. 2. A device that stops the flow of dc power but permits passage of higher-frequency signals.

**dc breakdown**—Voltage at which ionization occurs at a slowly rising dc voltage.

**dcc**—Abbreviation for double cotton-covered.

**dc capacitance**—The capacitance of a capacitor calculated from the ratio of the capacitor charge and the direct voltage measured between the terminations.

**dc capacitor**—A capacitor designed essentially for application with a direct voltage.

**dc circuit breaker**—A device used to close and interrupt a dc power circuit under normal conditions or to interrupt this circuit under fault or emergency conditions.

**dc component**—The average value of a signal. In television it represents the average luminance of the picture being transmitted, and in radar it is the level from which the transmitted and the received pulses rise.

**dc continuity**—A circuit in which an impressed dc current—a reading on a conventional ohmmeter applied across the terminals of a circuit with dc continuity—will result in a deflection of the meter.

**dc coupled**—The connection by a device that passes the steady-state characteristics of a signal and that largely eliminates the transient or oscillating characteristics of the signal.

**dc dump**—The withdrawal of direct-current power from a computer. This may result in loss of the stored information.

**DCE**—Abbreviation for data communication equipment or data channel equipment. Equipment (such as a modem) installed at a user's premises that provides all the functions required to establish, maintain, and terminate a connection and provide signal conversion and coding between the data-terminal equipment and the common carrier's line.

**dc generator**—A rotating electric device for converting mechanical power into dc power.

**dc inserter stage**—A television transmitter stage that adds a dc component known as the pedestal level to the video signal.

**dcl**—Abbreviation for direct current leakage.

**dc leakage current**—Abbreviated dcl. 1. The relatively small direct current through a capacitor when dc voltage is impressed across it. 2. That direct current which passes through the capacitor dielectric when a capacitor

is subjected to a polarized voltage potential across its terminals and has reached a state of charge equilibrium. Usually expressed in microamperes and associated mostly with electrolytic capacitors.

**dcnm**—Abbreviation for dc noise margin.

**dc noise**—The noise arising when reproducing a magnetic tape that has been nonuniformly magnetized by energizing the record head with direct current, either in the presence or absence of bias. This noise has pronounced long-wavelength components that can be as much as 20 dB higher than those obtained from a bulk-erased tape.

**dc noise margin**—Abbreviated dcnm. Noise margin is also called noise immunity. 1. The difference between the normal applied logic levels and the threshold voltage of a digital integrated circuit. 2. The difference between the output voltage level of a driving gate and the input threshold voltage of a driven gate for both the 1 and the 0 states.

**dc operating point**—The dc values of collector voltage and current of a transistor with no signal applied.

**dc overcurrent relay**—A device that functions when the current in a dc circuit exceeds a given value.

**dc patch bay**—Specific patch panels provided for termination of all direct-current circuits and equipment used in an installation.

**dc picture transmission**—Transmission of the dc component of the television picture signal. This component represents the background or average illumination of the overall scene and varies only with the overall illumination.

**dc plate resistance**—The value or characteristic used in vacuum-tube computations. It is equal to the direct-current plate voltage divided by the direct-current plate current and is given the symbol  $R_p$ .

**dc reclosing relay**—A device that controls the automatic closing and reclosing of a dc circuit interrupter, generally in response to load circuit conditions.

**dc resistivity**—The resistance of a body of ferromagnetic material having a constant cross-sectional area, measured under stated conditions by means of direct voltage, multiplied by the cross-sectional area, and divided by the length of the body.

**dc restoration**—The reestablishment by a sampling process of the dc and the low-frequency components of a video signal that have been suppressed by ac transmission.

**dc restorer**—Also called clumper or restorer. A clamping circuit that holds either amplitude extreme of a signal waveform to a given reference level of potential.

**dc shift**—An error in transient response, with a time constant approaching several seconds.

**dc short**—A coaxial component that provides a dc circuit between the center and outer conductors, while allowing the rf signal to flow uninterrupted. The unit has a high-impedance line shunted across the main coax line. This consequently makes the device frequency dependent.

**dc signaling**—A transmission method that utilizes direct current.

**dc test**—A general term for those tests that measure a static parameter such as leakage current.

**DCTL**—Abbreviation for direct-coupled transistor logic.

**dc transducer**—A transducer capable of proper operation when excited with direct current. Its output is given in terms of direct current unless otherwise modified by the function of the stimulus.

**dc transmission**—Transmission of a television signal in such a way that the dc component of the picture signal is still present. This is done to maintain the true level of background illumination.

**dcwv**—Abbreviation for direct-current working volts. The maximum continuous voltage that can be applied to a capacitor.

**DDD**—Abbreviation for direct distance dialing.

**DDP**—Abbreviation for distributed data processing.

**DDS**—See dataphone digital service.

**deac**—See deaccentuator.

**deaccentuator**—Abbreviated deac. A network or circuit employed in frequency-modulated receivers to deemphasize the higher frequencies in the received signal to restore their proper relative amplitude. *See also* deemphasis.

**deactuate pressure**—The pressure at which an electrical contact opens or closes as the pressure approaches the actuation level from the opposite direction.

**dead**—1. Free from any electric connection to a source of potential difference and from electric charge; having the same potential as that of the earth. The term refers only to current-carrying parts that are sometimes alive, or charged. 2. *See* room acoustics.

**dead band**—Also called dead space, dead zone, or switching blank. 1. In a control system, the range of values through which the measurand can be varied without initiating an effective response. 2. A specified range of values in which the incoming signal can be altered without also changing the outgoing response. 3. The angle within which the rotor of a stepper motor can stop—the error band, or band of position uncertainty caused by bearing and load friction, and rotor and load inertia.

**deadbeat**—Coming to rest without vibration or oscillation; i.e., the pointer that a highly damped meter or galvanometer moves to a new position without overshooting and vibrating about its final position.

**deadbeat instrument**—A voltmeter, meter, or similar device in which the movement is highly damped to bring it to rest quickly.

**deadbeat response**—The response of a critically damped stepper motor that provides rotation from one step to another without overshoot or ringing.

**dead break**—An unreliable contact made near the trip point of a relay or switch at low contact pressure. As a result, the switch does not actuate, even though the circuit is interrupted.

**dead-center position**—The place on the commutator of a dc motor or generator at which a brush would be placed if the field flux were not distorted by armature reaction.

**dead end**—1. In a sound studio, the end with the greater sound-absorbing characteristic. 2. In a tapped coil, the portion through which no current is flowing at a particular bandswitch position.

**dead-end tower**—An antenna or transmission-line tower designed to withstand unbalanced mechanical pull from all the conductors in one direction, together with the wind strain and vertical loads.

**deadlock**—1. A situation that occurs when all tasks within a computer system are suspended, waiting for resources that have already been assigned to other tasks that are also waiting for additional resources. Thus, the system can perform no useful work unless tasks are destroyed and their resources reclaimed. 2. A condition in which two processes wait indefinitely for each other. The solution is to allocate resources on a priority basis or to have tie-breaking circuitry.

**deadly embrace**—A situation in which two processes each unknowingly wait for resources held by the other. *See also* deadlock.

**dead range**—*See* dead band.

**dead room**—1. A room for testing the acoustic efficiency or range of electroacoustic devices such as

speakers and microphones. The room is designed with an absolute minimum of sound reflection, and no two dimensions of the room are the same. A ratio of 3 to 4 to 5 is usually employed (e.g., 15 ft  $\times$  20 ft  $\times$  25 ft). The walls, floor, and ceiling are lined with a sound-absorbing material. 2. See anechoic.

**dead short** — A short circuit having minimum resistance.

**dead space** — 1. An area or zone, within the normal range of a radio transmitter, in which no signal is received. 2. See dead band, 2.

**dead spot** — 1. A geographic location in which signals from one or more radio stations are received poorly or not at all. 2. That portion of the tuning range of a receiver in which stations are heard poorly or not at all because of poor sensitivity.

**dead time** — 1. The minimum interval, following a pulse, during which a transponder or component circuit is incapable of repeating a specified performance. 2. Any definite delay intentionally placed between two related actions to avoid overlap that could result in confusion or permit another particular event, such as a control decision or switching event, to occur. 3. Time interval in which no clock phase is active.

**dead volume** — The total volume of the pressure port cavity of a pressure transducer at the rest position (i.e., with no stimulus applied).

**dead zone** — See dead band, 2.

**debicon** — A high-efficiency microwave generator in which use is made of crossed-field effects.

**debouncing** — The elimination of accidental bounce signals characteristic of mechanical switches that bounce repeatedly until the contact is finally closed or opened. Debouncing may be performed by hardware (latch) or software (delay).

**de Broglie wavelength** — The wavelength of radiation that corresponds to a photon whose energy is 1 electron volt: 1.24 micrometer.

**debug** — 1. To examine or test a procedure, routine, or equipment for the purpose of detecting and correcting errors. 2. To detect, locate, and remove mistakes from a program. Debugging programs are available that test for and isolate errors in another program. 3. A method of fault finding in programs, usually using data dumps and breakpoints. This would be handled in software by a debug routine. 4. Checking the logic of a software program to isolate and remove any mistakes. 5. To detect, locate, and remove all mistakes in a computer program and any malfunctions in the computing system itself.

**debugger** — 1. An essential program designed to facilitate software debugging. At a minimum, it provides breakpoints, dump facilities, and register and memory examine/modify. 2. Program that facilitates the testing of the object program on a microcomputer and its input-output devices. Debuggers usually accept commands from the user to perform such functions as (a) displaying or printing out the contents of the microcomputer memories, or the contents of the registers of the central processing unit, (b) modifying the RAM, (c) starting execution of the object program from a specific memory location, and (d) setting a breakpoint or stopping execution of the program when the instruction at a specific memory location is reached in the program or when a given condition is met. 3. A program that allows the user to observe the program flow and results of the program's operation in a step-by-step mode. It may be used to change data or instructions, alter registers, etc. 4. Program that helps track down and eliminate errors that occur in the normal course of program development.

**debugging** — 1. Isolating and removing all malfunctions (bugs) from a computer or other device to restore its

operation. 2. A process of shakedown operation of each finished material that is performed prior to its being placed in use in order to exclude the early failure period. During debugging, weak elements are expected to fail and be replaced by elements of normal quality that are not subject to early failure. 3. Process of detecting, locating, and correcting mistakes in hardware (system wiring) or software (program).

**debugging period** — See early-failure period.

**debugging routines** — Programs that aid in the isolation and correction of malfunctions and/or errors in a unit of equipment or another program.

**debug monitor** — An interactive program that allows the design engineer to intercommunicate in a "friendly" manner (through a terminal device) with the microcomputer system under development and to control closely the execution of an untested microcomputer program in order to check its correct operation.

**debug program** — A special program used to find errors in a program that is being run on a computer. A debug program allows a programmer to correct programming errors in the program being run.

**debunching** — Space-charge effect that tends to destroy the electron bunching in a velocity-modulation vacuum tube by spreading the beam due to mutual repulsion of the electrons.

**Debye effect** — The selective absorption of electromagnetic waves by a liquid made up of molecules with permanent dipole moments.

**Debye length** — Also called Debye shielding distance or plasma length. A theoretical length that describes the maximum separation at which a given electron is influenced by the electric field of a given positive ion.

**Debye shielding distance** — See Debye length.

**decade** — 1. The interval between any two quantities having a ratio of 10:1. 2. A group or assembly of 10 units (e.g., a counter that counts to 10 in one column, or a resistor box that inserts resistance quantities in multiples of powers of 10). 3. Ten times a given quantity or range.

**decade band** — A band having frequency limits related by the equation  $f_b - f_a = 10$ .

**decade box** — A special assembly of precision resistors, coils, or capacitors. It contains two or more sections, each having 10 times the value of the preceding section. Each section is divided into 10 equal parts. By means of a 10-position selector switch or equivalent arrangement, the box can be set to any desired value in its range.

**decade counter** — A logic device that has 10 stable states and may be cycled through these states by the application of 10 clock or pulse inputs. A decade counter usually counts in a binary sequence from state 0 through state 9 and then cycles back to 0. Sometimes referred to as a divide-by-10 counter.

**decade resistance box** — A resistance box containing two or more sets of 10 precision resistors.

**decade scaler** — A decade counter, or scale-of-10 counter. A scaler with a factor of 10. It produces one output pulse for every 10 input pulses.

**decametric waves** — High-frequency band; 3 to 10 MHz.

**decay** — 1. Gradual reduction of a quantity. 2. Exponential reduction in amplitude. To be reduced in an exponential manner, as the current in a circuit decays when the source of potential is removed. 3. The decrease in the radiation intensity of any radioactive material with respect to time. 4. In a storage tube, a change in magnitude or configuration of stored information by any cause other than erasing or writing.

**decay characteristic** — See persistence characteristic (of a luminescent screen).

**decay distance**—The distance between an area of wave generation and a point of passage of the resulting waves outside the area.

**Decca**—A British long-range hyperbolic navigational system that operates in the 70- to 130-kilohertz frequency band. It is a continuous-wave system in which the receiver measures and integrates the relative phase difference between the signal received from two or more synchronized ground stations. One master station and three slave stations are usually arranged in star formation. Operational range is about 250 miles (402 km).

**decelerated electrons**—Electrons that, after traveling at a great rate of speed, strike a target, become quickly decelerated, and cause the target to emit X-rays.

**decelerating electrode**—In an electron-beam tube, an electrode to which a potential is applied to slow down the electrons in the beam.

**deceleration**—The act or process of moving, or of causing to move, with decreasing speed; the state of so moving.

**deceleration time**—1. In a computer, the time interval between the completion of the reading or writing of a record on a magnetic tape and the time when the tape stops moving. 2. The time required to stop a motor, whether free running or with some braking means.

**deception**—Deliberate production of false or misleading echoes on enemy radar by the radiation of spurious signals synchronized to the radar or by the reradiation of the radar pulses from extraneous reflectors.

**deception device**—A device that works to make unfriendly signals either unusable or misleading.

**deception jamming**—See confusion jamming.

**deci-**—Prefix meaning one-tenth ( $10^{-1}$ ).

**decibel**—1. Abbreviated dB. The standard unit for expressing transmission gain or loss and relative power levels. One decibel is one-tenth of a bel. The term *dBm* is used when a power of 1 milliwatt is the reference level. Decibels indicate the ratio of power output ( $P_o$ ) to power input ( $P_{in}$ ):

$$dB = 10 \log_{10}(P_o/P_{in})$$

2. A unit of change in sound intensity. One decibel is approximately the smallest change that the ear can perceive. Larger decibel increments reflect the fact that sound intensity must be squared in order for the ear to perceive a doubling of intensity. An increase in intensity is expressed as a positive number of dBs, a decrease as a negative value. No change in intensity is 0 dB, and 0 is also used to indicate a starting point from which changes are measured. 3. A unit used to measure and compare signal levels on a logarithmic scale. 4. A measure of the ratio between two power levels. Doubling or halving the power corresponds to a 3-dB change, and 10 dB corresponds roughly to the audible effect of doubling or halving the loudness of a signal (although it represents a power ratio of 10:1). Decibels are frequently used to specify variation in signal level throughout a range of frequencies (i.e., 20–20,000 Hz  $\pm 1$  dB) and to specify such other ranges as signal-to-noise ratio. 5. A relative measure of signal or sound intensity or volume. It expresses the ratio of one intensity to another. Can also express voltage and power ratios logarithmically.

**decibel meter**—Also called dB meter. 1. An instrument for measuring the electric power level, in decibels, above or below an arbitrary reference level. 2. Sound-level indicator.

**decibels above or below 1 milliwatt**—The unit used to describe the ratio of the power at any point in

## decay distance — decimal-to-binary conversion

a transmission system to a reference level of 1 milliwatt. The ratio expresses decibels above or below this reference level of 1 milliwatt.

**decibels above or below 1 watt**—A measure of power expressed in decibels to a reference level of 1 watt.

**decibels above reference noise**—An expression used to describe the ratio of the circuit noise level in a transmission system, at any point, to some arbitrarily chosen reference noise. The expression signifies the reading of a noise meter. Where the circuit-noise meter has been adjusted to represent effect under specified conditions, the expression is in adjusted decibels.

**decilog**—A division of the logarithmic scale used for measuring the logarithm of the ratio of two values of any quantity. The number of decilogs is equal to 10 times the logarithm to the base 10 of the ratio. One decilog therefore corresponds to a ratio of  $10^{0.1}$  (i.e., 1.25892+).

**decimal**—1. Pertaining to a characteristic or property involving a selection, choice, or condition in which there are 10 possibilities. 2. Pertaining to the number representation system with a radix of 10. 3. Pertaining to a system of numerical representation in which there are ten symbols, 0, 1, 2, 3, ... 9.

**decimal attenuator**—A system of attenuators arranged so that a voltage or current can be reduced decimaly.

**decimal-binary switch**—A switch by means of which a single input lead is connected to appropriate combinations of four output leads (representing 1, 2, 4, and 8) for each of the decimal-numbered settings of the associated control knob. For example, with the knob in position 7, the input lead would be connected to output leads 1, 2, and 4.

**decimal code**—A code in which each allowable position has one of 10 possible states. The conventional number system with the base 10 is a decimal code.

**decimal-coded digit**—One of ten arbitrarily selected patterns of 1s and 0s that are used to represent decimal digits.

**decimal digit**—One of the numbers 0 through 9 used in the number system with the base 10.

**decimal encoder**—An encoder in which there are 10 output lines, one for each digit from 0 to 9, for each decade of decimal numbers.

**decimal notation**—The writing of quantities in the decimal numbering system.

**decimal numbering system**—The popular numbering system using the Arabic numerals 0 through 9 and thus having a base, or radix, of 10. For example, the decimal number 2345 can be derived in this way:

$$2000 + 300 + 40 + 5 = 2345$$

or

$$2(10^3) + 3(10^2) + 4(10^1) + 5(10^0) = 2345$$

In the decimal system, all numbers are obtained by raising the radix (total number of marks, or 10 in this system) to various powers.

**decimal point**—In a decimal number, the point that marks the place between integral and fractional powers of 10.

**decimal-to-binary conversion**—The mathematical process of converting a number written in the scale of 10 into the same number written in the scale of 2.

Decimal	Binary	Decimal	Binary
0	0	10	101
1	1	11	1011
2	10	12	1100
3	11	13	1101
4	100	14	1110
5	101	15	1111
6	110	16	10000
7	111	32	100000
8	1000	64	1000000
9	1001	128	10000000

**decimetric waves**—1. Electromagnetic waves having wavelengths between 0.1 and 1 meter. 2. Ultrahigh frequency band; 300 MHz to 3 GHz.

**decineper**—One-tenth of a neper.

**decinormal calomel electrode**—A calomel electrode containing a decinormal potassium chloride solution.

**decision**—In a computer, the process of determining further action on the basis of the relationship of two similar items of data.

**decision box**—On a flowchart, a rectangle or other symbol used to mark a choice or branching in the sequence of programming of a digital computer.

**decision element**—In computers or data-handling systems, a circuit that performs a logical operation, such as AND, OR, NOT, or EXCEPT, on one or more binary digits in input information that represent "yes" or "no" and that expresses the result in its output. *See also gate.*

**decision table**—A table of all contingencies that are to be considered in the description of a problem, together with the actions to be taken. Decision tables are sometimes used in place of flowcharts for problem description and documentation.

**deck**—1. In computer usage, a collection of cards, usually a complete set of cards punched for a definite purpose. 2. A term usually applied to a tape machine having no built-in power amplifiers or loudspeakers of its own, but intended rather for feeding a separate amplifier and speaker system, as in a component installation.

**declination**—The offset angle of an antenna from the axis of its polar mount as measured in the meridian plane between the equatorial plane and the antenna main beam.

**declination offset angle**—The adjustment angle of a polar mount between the polar axis and the plane of a satellite antenna used to aim at the geosynchronous arc.

**decode**—1. In a computer, to obtain a specific output when specific character-coded input lines are activated. 2. To use a code to reverse a previous encoding. 3. To determine the meaning of characters or character groups in a message. 4. To determine the meaning of a set of pulses that describes an instruction, a command, or an operation to be carried out.

**decoder**—1. A device for translating a combination of signals into one signal that represents the combination. It is often used to extract information from a complex signal. 2. In automatic telephone switching, a relay-type translator that determines from the office code of each call the information required for properly recording the call through the switching train. Each decoder has means, such as a cross-connecting field, for establishing the controls desired and readily changing them. 3. Sometimes called matrix. In an electronic computer, a network or system in which a combination of inputs is excited at one time to produce a single output. 4. A device that converts coded information into a more usable form, for example, a binary-to-decimal decoder. 5. A circuit that accepts coded input data and activates a specific output(s) in accordance

with the code present at the input. 6. A circuit built into an FM tuner to enable it to translate stereo signal information into two matched audio outputs. 7. A means to extract and process recorded quadraphonic sound information from a complex signal into four matched outputs. 8. A device consisting of gates that is usually connected to the output of a counter. It provides an output when the counter is at a specific count or range of counts. 9. A logic device that breaks the code of an incoming binary signal; i.e., converts the coded information into a more usable form. 10. A logic device that converts data from one number system to another (e.g., an octal-to-decimal decoder). Decoders are also used to recognize unique addresses, such as a device address, and bit patterns. *See code converter.* 11. A circuit that restores a signal to its original form after it has been scrambled. 12. A device that reconstructs an encrypted signal so that it can be clearly received. 13. A television set-top device that enables the home subscriber to convert an electronically scrambled television picture into a viewable signal. (This should not be confused with a digital coder/decoder, known as a codec, which is used in conjunction with digital transmissions.)

**decoding**—1. The process of obtaining intelligence from a code signal. 2. In multiples, a process of separating the subcarrier from the main carrier.

**decoding matrix**—A device for decoding many input lines into a single output line.

**decoding network**—A circuit made so that, when a particular combination of inputs is on, an output appears on one of a number of output lines.

**decollimated light**—In fiber optics, light rays made nonparallel by striae and boundary defects.

**decommutation**—The process of recovering a signal from the composite signal previously created by a commutation process.

**decommutator**—Equipment for separating, demodulating, or demultiplexing commutated signals.

**decomposition**—Breaking down a software specification, in depth and breadth, to determine all required functions and their relationships.

**decoupler**—A circuit for eliminating the effect of coupling in a common impedance.

**decoupling**—1. The reduction of coupling. 2. To isolate two circuits on a common line. A decoupling network is a low-pass filter (*RC* or *RLC*) that does not isolate equally in both directions.

**decoupling circuit**—A circuit used to prevent interaction of one circuit with another.

**decoupling network**—A network of capacitors and chokes or resistors placed into leads that are common to two or more circuits, to prevent unwanted, harmful interstage coupling.

**decoy**—A reflecting object having reflective characteristics of a target, used in radar deception.

**decrement**—1. Progressive diminution in the value of a variable quantity; also the amount by which a variable decreases. When applied to damped oscillations, it is usually called damping factor. 2. A specific part of an instruction word in some binary computers; thus, a set of digits. 3. To reduce the numerical contents of a counter. A decrement of one is usually assumed unless specified otherwise. 4. In an oscillating system with damping (each oscillation has less amplitude than the one preceding it), the ratio of the peak values (voltage, distance, etc.) of two successive half-cycles. It is expressed as a decimal fraction less than 1.

**decremeter**—An instrument for measurement of the logarithmic decrement (damping) of a wave train.

**decryption**—The process of "unscrambling" an encrypted or coded message.

**dedicated**—1. To set apart for some special use. For example, a dedicated microprocessor is one that has been specifically programmed for a single application, such as weight measurement by scale, traffic light control, etc. (ROMs by their very nature [read-only] are dedicated memories.) 2. A piece of equipment that is assigned to one particular use only. Minicomputers are often dedicated. Microprocessors are intended to be dedicated.

**dedicated computer**—A computer whose use is reserved for a particular task.

**dedicated line**—1. A communication line that isn't dialed, also called a leased or private line. 2. A communication line for voice and/or data rented from a communication carrier. 3. Full-term line allocated to one subscriber at a specific degree of conditioning. 4. Leased line, wired directly between communicating systems. It has faster transmission than regular telephone lines and does not require acoustic couplers (types of modems). 5. A permanent circuit for private use. The leased line physically connected between locations, or through a central office, without using the switching equipment. 6. A very common type of transmission facility for data communications. Each line is separate from the dial-up network (DDD) and its associated equipment and has a discrete, permanent path to its destination. Users pay a flat monthly fee for this service. 7. A telephone line that has a continuous connection, maintained by the telephone company.

**dedicated machine**—A PC or other microcomputer designed to handle a special, usually single, task. A dedicated server PC could only be used to service user requests, not as both server and workstation.

**dedicated register**—A register in a computer exclusively used to contain a specific item.

**dee**—A hollow, D-shaped accelerating electrode in a cyclotron.

**dee line**—A structural member that supports the dee of a cyclotron and together with the dee forms the resonant circuit.

**deemphasis**—Also called postemphasis or postequalization. 1. Introduction of a frequency-response characteristic that is complementary to that introduced in preemphasis. 2. Reduction of the level of the higher audio frequencies during FM reception or tape replay so that they compensate for the preemphasis applied to the transmission. This restores an overall uniform response. 3. A form of equalization used in FM tuners, complementary to a preemphasis used in transmission. The purpose is to improve the overall signal-to-noise ratio while maintaining a uniform frequency response. It is expressed in the form of a time constant or product of a resistance and capacitance. Standard FM broadcasts use a 75- $\mu$ s time constant in the United States, and 50  $\mu$ s in Europe, whereas Dolby B transmissions use a 25- $\mu$ s time constant.

**deemphasis network**—A network inserted into a system to restore the preemphasized frequency spectrum to its original form.

**deenergize**—1. To disconnect a device from its power source. 2. To stop the current in a circuit or to remove electrical potential from a circuit, as by opening a switch.

**deep discharge**—The withdrawal of all available electrical energy before recharging a cell or battery.

**deep space net**—A combination of radar and communications stations in the United States, Australia, and South Africa so located as to keep a spacecraft in deep space under observation at all times.

**default**—The value(s) or option(s) that are assumed during operation when not specified.

**default value**—The value that a database element assumes if the user does not specify another value.

**defeat**—The frustration, counteraction, or thwarting of an alarm device so that it fails to signal an alarm when a protected area is entered. Defeat includes both circumvention and spoofing.

**defect**—1. A condition considered potentially hazardous or operationally unsatisfactory and therefore requiring attention. 2. Any nonconformance with the normally accepted characteristics for a unit. *See also* major defect; minor defect.

**defect analysis**—The process of examining technical or management (nontechnical) data, manufacturing techniques, or material to determine the cause of variations of electrical, mechanical, or physical characteristics outside the limitations established at any manufacturing checkpoint.

**defect condition**—Hole conduction in the valence band in a semiconductor.

**Defense Electronic Supply Center**—*See* DESC.

**deferred addressing**—An indirect addressing mode in which the directly addressed location contains the address of the operand, rather than the operand itself.

**deferred entry**—In a computer, an entry into a subroutine as a result of a deferred exit from the program that passes control to the subroutine.

**deferred exit**—In a computer, the transfer of control to a subroutine at a time controlled by the occurrence of an asynchronous event rather than at a predictable time.

**defibrillator**—An electronic device that applies a brief high-voltage potential to the heart by means of electrodes placed on the chest wall. The defibrillator is used to restore regular rhythm to a heart in ventricular fibrillation.

**definite-purpose relay**—A relay with some electrical or mechanical feature that distinguishes it from a general-purpose relay.

**definition**—1. The fidelity with which the detail of an image is reproduced. When the image is sharp (i.e., has definite lines and boundaries), the definition is said to be good. 2. The degree with which a communication system reproduces sound images or messages. 3. The fidelity with which the pattern edges in a printed circuit (conductors, inductors, etc.) are reproduced relative to the original master pattern. 4. The sharpness of a picture subjectively evaluated in terms of its resolution. 5. The sharpness of a screen-printed pattern; the exactness with which a pattern is printed.

**deflecting coil**—An inductor used to produce a magnetic field that will bend the electron beam a desired amount in the cathode-ray tube of an oscilloscope, television receiver, or television camera.

**deflecting electrode**—An electrode to which a potential is applied in order to deflect an electron beam.

**deflecting torque**—*See* torque of an instrument.

**deflection**—Movement of the electron beam in a cathode-ray tube as electromagnetic or electrostatic fields are varied to cause the light spot to traverse the face of the tube in a predetermined pattern.

**deflection circuit**—The circuit that regulates an electron beam's deflection in a CRT.

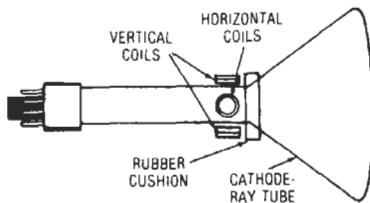
**deflection coil**—One of the coils in the deflection yoke.

**deflection factor**—*See* deflection sensitivity.

**deflection focusing**—The progressive defocusing of a cathode-ray-tube display image that occurs when the deflected electron beam impinges on the CRT screen at a slant.

**deflection plane**—A plane perpendicular to the cathode-ray-tube axis and containing the deflection center.

**deflection plates**—Two pairs of parallel electrodes, the pairs set one forward of the other and at right angles to each other, parallel to the axis of the electron stream



Deflection coils.

within an electrostatic cathode-ray tube. An applied potential produces an electric field between each pair. By varying the applied potential, this field may be varied to cause a desired angular displacement of the electron stream.

**deflection polarity** — The relationship between the direction of displacement of an oscilloscope trace and the polarity of the applied signal wave.

**deflection sensitivity** — Also called deflection factor. The displacement of the electron beam at the target or screen of a cathode-ray tube divided by the change in magnitude of the deflection field. Deflection sensitivity is usually expressed in millimeters (or inches) per volt applied between the deflecting electrodes, or in millimeters (or inches) per ampere in the deflection coil.

**deflection voltage** — The voltage applied to the electrostatic plates of a cathode-ray tube to control the movement of the electron beam.

**deflection yoke** — An assembly of one or more electromagnets for deflecting one or more electron beams.

**defocus-dash mode** — A method of storage of binary digits in a cathode-ray tube. Initially, the writing beam is defocused to excite a small circular area on the screen. For one kind of binary digit the beam remains defocused, and for the other kind of binary digit it is suddenly focused into a concentric dot, which traces out a dash on the screen during the interval of time before the beam is cut off and moved to the next position.

**defocus-focus mode** — A variation of the defocus-dash mode in which the focused dot is not caused to trace a dash.

**defragmentation** — A process in which all the files on a hard disk are rewritten so that all the parts of each file are written to contiguous sectors.

**defruiting** — Method of eliminating asynchronous returns in radar beacon systems.

**degassing** — The process of driving out and exhausting the gases of an electron tube occluded in its internal parts.

**degauss** — To neutralize the existing magnetic field. The term was coined during World War II to describe the neutralizing of a ship's magnetic field by a grid of cables generating an equal but opposite magnetic field.

**degausser** — Also called automatic degausser and bulk eraser. 1. A device to clarify the color picture by means of coils within the set. The coils deactivate the magnetization that builds up around a color TV set when it is moved around or when other electrical devices are brought too close to the receiver. 2. Any device for neutralizing magnetism, as in a recorder head or in a separate unit. Also called a tape eraser, for use with a complete tape recording on its reel. 3. Demagnetizer. See bulk eraser; head demagnetizer.

**degaussing** — Girdling a ship's hull with a web of current-carrying cable that sets up a magnetic field equal in value and opposite in polarity to that induced by the earth's magnetic field, thus rendering the ship incapable of actuating the detonator of a magnetic mine.

**degeneracy** — The condition in which two or more modes have the same resonant frequency in a resonant device.

**degenerate modes** — A set of modes having the same resonance frequency (or propagation constant). The members of a set of degenerate modes are not unique.

**degenerate parametric amplifier** — An inverting parametric device for which the two signal frequencies are identical and equal to one-half the frequency of the pump. (This exact but restrictive definition is often relaxed to include cases in which the signals occupy frequency bands that overlap.)

**degeneration** — See negative feedback.

**degradation** — 1. A gradual decline of quality or loss of ability to perform within required limits. The synonym *drift* is often used for electronic devices. 2. A condition in which the system continues to operate but at a reduced level of service. Unavailability of major equipment subsystems or components is the usual cause. 3. A gradual deterioration in performance as a function of time.

**degradation failure** — Failure of a device because a parameter or characteristic changes beyond some previously specified limit.

**degree day** — The measure of the deviation of the mean daily temperature from a given standard, with each variance from the standard during a single day recorded as one degree day.

**degree of current rectification** — The ratio between the average unidirectional current output and the root-mean-square value of the alternating-current input from which it was derived.

**degree of membership** — The confidence or certainty, expressed as a number from 0 to 1, that a particular value belongs in a fuzzy set.

**degree of voltage rectification** — The ratio between the average unidirectional voltage and the root-mean-square value of the alternating voltage from which it was derived.

**degree rise** — The amount of increase in temperature caused by the introduction of electricity into a unit.

**degrees of freedom** — In a vibrating system, the coordinates necessary to locate the position of the vibrating element at any time. For example, a single-degree-of-freedom system can move along only one axis, in both directions. A two-degrees-of-freedom system will require two coordinates to describe the position of the elements. A multiple-degree-of-freedom system generally has many elements that can move along many axes.

**deinstall** — To remove a program or hardware device from active service.

**deion circuit breaker** — A circuit breaker built so that the arc that forms when the circuit is broken is magnetically blown into a stack of insulated copper plates, giving the effect of a large number of short arcs in series. Each arc becomes almost instantly deionized when the current drops to zero in the alternating-current cycle, and the arc cannot reform.

**deionization** — The process by which an ionized gas returns to its neutral state after all sources of ionization have been removed.

**deionization potential** — The potential at which ionization of the gas within a gas-filled tube ceases and conduction stops.

**deionization time** — The time required for the grid of a gas tube to regain control after the anode current has been interrupted.

**deionized water** — Water that has been treated to remove ions. Deionized water is required in certain electronic applications to prevent contamination of parts coming in contact with the water. See demineralized water.

**dekahexadecimal**—See sexadecimal notation.

**Dekatron**—A cold-cathode counting tube.

**delamination**—1. Separation of conductive patterns from the substrate, or separation of layers of the base material. 2. A separation between any of the layers of a base material or between the laminate and the conductive foil, or both.

**delay**—1. The time required for a signal to pass through a device or conductor. 2. The time interval between the instants at which any designated point in a wave passes any two designated points of a transmission circuit.

**delay circuit**—1. A circuit that delays the passage of a pulse or signal from one part of a circuit to another. 2. An electronic time-delay device that can introduce time delays from a few milliseconds to about 100 milliseconds without significantly degrading signal quality. Can be used to restore acoustics of a large auditorium to recorded programs heard in a normal-sized room.

**delay coincidence circuit**—A coincidence circuit actuated by two pulses, one of which is delayed a specific amount with respect to the other.

**delay counter**—In a computer, a device that can temporarily delay a program a sufficient length of time for the completion of an operation.

**delay distortion**—Also called envelope-delay distortion, phase-delay distortion, or phase distortion. 1. Phase-delay distortion; i.e., departure from flatness in the phase delay of a circuit or system over the frequency range required for transmission, or the effect of such departure on a transmitted signal. 2. Envelope distortion; i.e., departure from flatness in the envelope delay of a circuit or system over the frequency range required for transmission, or the effect of such departure on a transmitted signal. 3. The amount of variation in delay for various frequency components of the facsimile signal, usually expressed in microseconds from an average delay time. 4. The difference between the maximum and minimum phase delay within a specified band of frequencies. 5. Distortion caused by the fact that the higher-frequency components of a signal travel slower over a transmission facility than the lower-frequency components and therefore arrive later and out of phase. Numerically, it is the maximum difference in transmission time between any two frequencies in a specified frequency band, expressed in microseconds. Measured in microseconds of delay relative to the delay at 1700 Hz. Delay distortion doesn't affect voice communication but can seriously impair data transmissions.

**delayed automatic volume control**—Abbreviated delayed AVC. An automatic volume-control circuit that acts only on signals above a certain strength. It thus permits reception of weak signals even though they may be fading, whereas normal automatic volume control would make the weak signals even weaker.

**delayed AVC**—See delayed automatic volume control.

**delayed contacts**—Contacts that are actuated a predetermined time after the start of a (timing) cycle.

**delayed PPI**—A PPI (plan-position indicator) in which the initiation of the time base is delayed.

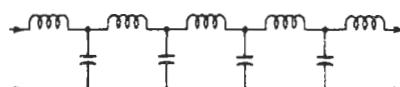
**delayed repeater satellite**—A satellite that stores information obtained from a ground terminal at one location and, upon interrogation by a terminal at a different location, transmits the stored message.

**delayed sweep**—1. In a cathode-ray tube, a type of sweep that is not allowed to begin for a while after being triggered by the initiating pulse. 2. A sweep that has been delayed either by a predetermined period or by a period determined by an additional independent variable.

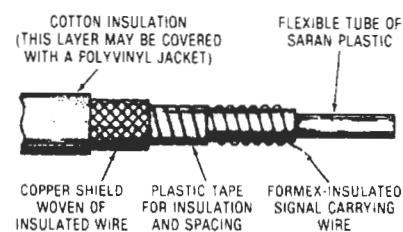
**delay equalizer**—1. A device that adds delay at certain frequencies to a circuit in a way to reduce the delay distortion. 2. A corrective network that is designed to make the phase delay or envelope delay of a circuit or system substantially constant over a desired frequency range. 3. A network that introduces an amount of phase shift complementary to the phase shift in the circuit at all frequencies within the desired band. 4. Selective delaying of various frequency components of the received signal to match the delay of other frequency components caused by envelope delay distortion.

**delay/frequency distortion**—That form of distortion which occurs when the envelope delay of a circuit or system is not constant over the frequency range required for transmissions.

**delay line**—1. A real or artificial transmission line or equivalent component that is used to delay a signal, either linear or digital, for a predetermined length of time. The delay time is defined as the duration of time between the leading edge of the input pulse and the 50-percent point on the leading edge of the output pulse. 2. A specially constructed cable used in the luminance channel of a color receiver to delay the luminance signal. 3. A sequential logic element that has one input channel and in which the state of an output channel at any instant is the same as the state of the input channel at the instant  $t - n$ , where  $n$  is a constant time interval for a given output channel (the input sequence undergoes a delay of  $n$  time units). 4. A device that can cause the transmission of one unit of information to be retarded until another unit can synchronize with it. 5. A device capable of causing an energy impulse to be retarded in time from point to point, thus providing a means of storage by circulating intelligence-bearing pulse configurations and patterns. Examples of delay lines are material media such as mercury, in which sonic patterns may be propagated in time; lumped constant electrical lines; coaxial cables; transmission lines; and recirculating magnetic drum loops. 6. A cable made to provide a very low velocity of propagation with long electrical delay for transmitted signals.



Lumped-constant line.



Early-model delay line.



Modern delay line.

**Delay lines, 1.**

**delay-line memory**—See delay-line storage.

**delay-line register**—An acoustic or electric delay line in an electronic computer, usually one or an integral number of words in length, together with input, output, and circulation circuits.

**delay-line storage**—Also called delay-line memory. In an electronic computer, a storage or memory device consisting of a delay line and a means for regenerating and reinserting information into it.

**delay multivibrator**—A monostable multivibrator that produces an output pulse a predetermined time after it is triggered by an input pulse.

**delay on break**—A term used to describe a mode of operation relative to timing devices. The delay begins when the initiate switch is opened (delay on break of initiate switch).

**delay on energization**—Also known as delay on make. A term used to describe a mode of operation relative to timing devices. The delay begins when the initiate switch is closed, or on application of power to the input.

**delay on make**—Same as delay on energization.

**delay PPI**—A radar indicator in which the start of the display sweep is delayed after the trigger so that distant targets are displayed on a short-range scale that gives an expanded presentation.

**delay relay**—Also called time-delay relay. A relay in which there is a delay between the time it is energized or deenergized and the time the contacts open or close.

**delay time**—1. The amount of time one signal is behind (lags) another. 2. Of a switching transistor, the time interval between the application at the input terminals of a pulse that is switching the transistor from a nonconducting to a conducting state and the appearance at the output terminals of the pulse induced by the charge carriers. The time is usually measured between points corresponding to 10 percent of the amplitude of the applied pulse and of the output pulse. 3. Measurement of the interval between direction of signal to an LED and attainment of 10-percent output current in the photodetector.

**delay timer**—A term sometimes used to designate a timer that is primarily used for energizing (or deenergizing) a load at the end of a timed period. See time-delay relay.

**delay unit**—The unit of a radar system in which pulses may be delayed a controllable amount.

**deleting**—Removing something from a computer. It could be text from a word processing window, or a file from a hard disk drive.

**deletion record**—In a computer, a new record to replace or remove an existing record in a master file.

**delimiter**—Also called separator. 1. In a computer, a character that limits a string of characters and therefore cannot be a member of the string. 2. A flag that separates and organizes items of data. 3. Any means used to separate data items at input. Most frequently used are spaces or commas. The delimiter for the two integers 123 567 is the space between them. 4. A character that separates and organizes elements of a program in a computer. 5. A punctuation character, such as blackslash or comma, that separates one section of a computer command from another. 6. A text character that marks the beginning and/or end of a unit of data or separates different data components. For example, periods are used as delimiters in domain names, hyphens and parentheses are used in phone numbers and social security numbers, and blank spaces and commas are used in written text.

**Dellinger effect**—See radio fadeout.

**delta**—1. The Greek letter delta ( $\Delta$ ) represents any quantity that is much smaller than any other quantity of the same units appearing in the same problem. 2. In a

magnetic cell, the difference between the partial-select outputs of the same cell in a 1 state and in a 0 state. 3. Brainwave signals whose frequency is approximately 0.2 to 3.5 Hz. The associated mental state is usually a deep sleep or a trancelike state.

**delta circuit**—A three-phase circuit in which the windings of the system are connected in the form of a closed ring, and the instantaneous voltages around the ring equal zero. There is no common or neutral wire, so the system is used only for three-wire systems or generators.

**delta connection**—In a three-phase system, the terminal connections. So called because they are triangular, like the Greek letter delta.

**delta-delta monitor**—A monitor in which the red, green, and blue color guns are arranged in a triangle, and a shadow mask with round holes aligns each gun to the proper phosphor dots.

**delta match**—See Y match.

**delta matched antenna**—Also called Y antenna. A single-wire antenna (usually one half-wavelength long) to which the leads of an open-wire transmission line are connected in the shape of a Y. The flared part of the Y matches the transmission line to the antenna. The top of the Y is not cut, giving the matching section its triangular shape of the Greek letter delta, hence the name.

**delta matching transformer**—An impedance device used to match the impedance of an open-wire transmission line to an antenna. The two ends of the transmission line are fanned out so that the impedance of the line gradually increases. The ends of the transmission line are attached to the antenna at points of equal impedance, symmetrically located with respect to the center of the antenna.

**delta modulation**—1. A means of encoding analog signals in control and communication systems. The output of the delta encoder is a single weighted digital pulse train that may be decoded at the receiving end to reconstruct an original analog signal. 2. A type of waveform encoding in which the differences between individual digitized speech samples are encoded. Data point values are determined by changes from preceding data point amplitudes.

**delta modulator**—A closed-loop sampled data control system that transmits binary output pulses whose polarity depends on the difference between the input signal being sampled and a quantized approximation of the preceding input signal. Delta modulation affords a simple, efficient method of digitizing voice for secure, reliable communications and for voice I/O in data processing.

**delta network**—A set of three branches connected in series to form a mesh.

**delta pulse code modulation**—A modulation system that converts audio signals into corresponding trains of digital pulses to provide greater freedom from interference during transmission over wire or radio channels.

**delta tune**—A control or switch similar in function to a clarifier, found on many AM transceivers. It compensates for signals off the center frequency of a CB channel. Although its effective range is about the same as that of a clarifier, adjustment is not as critical.

**delta wave**—A brain wave whose frequency is below 4 hertz.

**dem**—Abbreviation for demodulator.

**demagnetization**—Partial or complete reduction of residual magnetism.

**demagnetization coefficient**—See permeance coefficient.

**demagnetization curve**—In the second quadrant of a hysteresis loop, the portion that lies between the residual induction point,  $B_r$ , and the coercive force point,  $H_c$ .

**demagnetization effect**—1. A decrease in internal magnetic field caused by uncompensated magnetic poles at the surface of a sample. 2. The portion of the normal hysteresis loop in the second quadrant showing the induction,  $B$  (gauss), in a magnetic material as related to the demagnetizing field,  $H$  (oersted). Points on this curve are usually designated by the coordinates  $B_d$  and  $H_d$ . This curve describes the characteristics of a permanent magnet (as contrasted with an electromagnet).

**demagnetizer**—A device that removes residual magnetism from recording or playback tape heads. This magnetism, if not removed, can introduce noise on recordings and cause high-frequency loss.

**demagnetizing coefficient**—See permeance coefficient.

**demagnetizing field**—A magnetizing force applied in such a direction as to reduce the remanent induction in a magnetized body.

**demagnetizing force**—A magnetizing force applied in such a direction that it reduces the residual induction in a magnetized body.

**demand-driven machine**—A parallel-processing architecture in which processors carry out instructions when the results of a processing step are demanded.

**demand factor**—The ratio of the maximum demand of an electrical system, or part of a system, to the total connected load of a system or that part of a system under consideration.

**demand load**—The load that is drawn from the source of supply at the receiving terminals, averaged over a suitable and specified interval of time, expressed in kilowatts, amperes, etc.

**demarcation strip**—A physical interface, usually a terminal board, between a business machine and a common carrier. See also interface, 1.

**Dember effect**—Also known as the photodiffusion effect. The production of a potential difference between two regions of a semiconductor specimen when one is illuminated. This phenomenon is related to the photoelectromagnetic effect, except there is no magnetic field. H. Dember discovered that when an illuminated metal plate producing electrons is bombarded by other electrons from an outside source, the photoelectric emission increases because, in addition to photoelectrons, secondary electrons are also knocked out by bombardment.

**demineralized water**—Water that has been treated to remove the minerals that are normally present in hard water. Demineralized water is required in some electronic applications in which extreme precautions must be taken to prevent contamination. See deionized water.

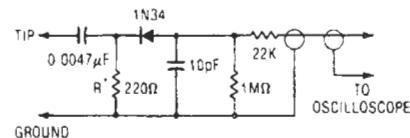
**demodulation**—Also called detection. 1. Operation on a previously modulated wave in such a way that it will have substantially the same characteristics as the original modulating wave. 2. The process by which a wave corresponding to the modulating wave is obtained from a modulated wave. 3. The process of retrieving digital (computer) data from a modulated analog (telephone) signal.

**demodulator**—Abbreviated dem. 1. A device that operates on a carrier wave to recover the wave with which the carrier was originally modulated. 2. A facsimile device that detects an amplitude-modulated signal and produces the modulating frequency as a direct current of varying amplitude. This type of unit is used to provide a keying signal for a frequency-shift exciter unit for radio facsimile transmission. 3. A device that receives tones from a transmission circuit and converts them to electrical pulses, or bits, that may be accepted by a business machine. 4. Circuitry that plays back a CD-4 disc's four signals after reprocessing the base and carrier bands inscribed in each side of the record groove. 5. A

## demagnetization effect — densitometer

functional section of a modem that converts received analog line signals to digital form. 6. A device that separates information from the carrier.

**demodulator probe**—A probe designed for use with an oscilloscope, for displaying modulated high-frequency signals.



\* R' may be increased in value to reduce circuit loading

Demodulator probe.

**demon**—A computer program that waits until an event occurs before running; widely used to circumvent copy-protection procedures.

**de Morgan's theorem**—A theorem that states that the inversion of a series of AND implications is equal to the same series of inverted OR implications, or the inversion of a series of OR implications is equal to the same series of inverted AND implications. In symbols,  $A \cdot B \cdot C = \bar{A} + \bar{B} + \bar{C}$ , or  $\bar{A} + \bar{B} + \bar{C} = A \cdot \bar{B} \cdot \bar{C}$ .

**demountable tube**—A high-power electron tube having a metal envelope with porcelain insulation. Can be taken apart for inspection and for renewal of electrodes.

**demultiplexer**—1. A device used to separate two or more signals that were previously combined by a compatible multiplexer and transmitted over a single channel. 2. A circuit that directs information from a single input to one of several outputs at a time in a sequence that depends on the information applied to the control inputs. 3. A device that reverses the action of a multiplexer, deriving a group of separate channels from the complex multiplex signal. 4. A logic circuit that can route a single line of digital information to other lines. The demultiplexer acts to switch information to many different points. 5. A circuit that applies the logic state of a single input to one of several outputs.

**demultiplexing**—Abbreviated demux. The process of separating a multiplexed signal into its separate intelligence signals.

**demultiplexing circuit**—A circuit that is used to separate the signals that have been combined for transmission by multiplex.

**demux**—See demultiplexing.

**denary band**—A band having frequency limits with the ratio of  $f_b/f_a = 10$ .

**dendrite**—A semiconductor crystal with a heavily branched, treelike structure that grows from the nucleus as the metal becomes solidified.

**dendritic growth**—1. A technique of producing semiconductor crystals in long, uniform ribbons with optically flat surfaces. 2. The electrolytic transfer of metal from one conductor to another, similar to electroplating except that the dendritic growth usually, though not always, forms from cathode to anode. The dendrite resembles a tree in appearance, and when it touches the opposite conductor, there is an abrupt rise in current.

**dense binary code**—A binary code in which all the possible states of the pattern are used.

**densitometer**—An instrument for measuring the optical density (photographic transmission, photographic reflection, visual transmission, and so forth) of a material.

**density** — 1. A measure of the light-transmitting or reflecting properties of an area expressed by the common logarithm of the ratio of incident to transmitted or reflected light flux. 2. The mass per unit volume. The specific gravity of a body is the ratio of a density to the density of a standard substance. Water and air are commonly used as the standard substances. 3. Amount per unit cross-sectional area (e.g., current, magnetic flux, or electrons in a beam). 4. The logarithm of the ratio of incident to transmitted light. *See opacity.*

**density modulation** — Modulation of an electron beam by varying the density of the electrons in the beam with time.

**density packing** — The number of magnetic pulses (representing binary digits) stored on tape or drum per linear inch on a single head.

**density step tablet** — A facsimile test chart consisting of a series of areas that increase in steps from a low value of density to a maximum value of density.

**dentophonics** — The technique of using electronics in broadcasting speech from the mouth. The principle is the same as that of a throat microphone, in which a transducer responds to sound energy transmitted through the tissues as a person speaks.

**dependent linearity** — Nonlinearity errors expressed as a deviation from a desired straight line of fixed slope and/or position.

**dependent mode** — In network analysis, a node having one or more incoming branches.

**deperming** — Another name for demagnetization.

**depletion field-effect transistor** — An active semiconductor device in which the main current is controlled by the depletion width of a pn junction.

**depletion layer** — Also called barrier layer. 1. In a semiconductor, the region in which the mobile-carrier charge density is insufficient to neutralize the net fixed charge density of donors and acceptors. 2. That region in the immediate vicinity of a semiconductor pn junction that becomes exhausted or *depleted* of current carriers in order to set up the internal potential barrier involved in either the balance between diffusion and drift currents present in the equilibrium case, or the imbalance between these currents present in a nonequilibrium situation. Being depleted of carriers, the depletion-layer region is virtually composed of "intrinsic" material, irrespective of the doping levels of the p-type and n-type materials from which it is formed. 3. A zone, several atoms thick, at the junction of n-type and p-type semiconductor materials, in which there are no current carriers, either free electrons or holes, unless biased by a direct voltage. Free electrons in the n-type material are repelled by negative charges in the p-type material, and the holes in the p-type material are repelled by the positive nucleus of atoms in the n-type material.

**depletion-layer capacitance** — Also called barrier capacitance. Capacitance of the depletion layer of a semiconductor. It is a function of the reverse voltage.

**depletion-layer rectification** — Also called barrier-layer rectification. The rectification that appears at the contact between dissimilar materials, such as a metal-to-semiconductor contact or a pn junction, as the energy levels on each side of the discontinuity are readjusted.

**depletion-layer transistor** — Any of several types of transistors that rely directly for their operation on the motion of carriers through depletion layers (for example, a spacistor).

**depletion-mode device** — A field-effect transistor or IC that passes maximum current at zero gate potential, and a decreasing current with applied gate potential.

**depletion-mode field-effect transistor** — 1. A field-effect transistor that exhibits substantial device current ( $I_{DSS}$ ) with zero gate-to-source bias ( $V_{GS} = 0$  V). 2. An MOS transistor normally on with zero gate voltage applied (channel formed during processing). A voltage of the correct polarity applied to the gate will force majority carriers from the channel, thus depleting it and turning the transistor off.

**depletion-mode operation** — The operation of a field-effect transistor such that changing the gate-to-source voltage from zero to a finite value decreases the magnitude of the drain current.

**depletion region** — Also referred to as space-charge, barrier, or intrinsic region. The region, extending on both sides of a reverse-biased semiconductor junction, in which all carriers are swept from the vicinity of the junction; that is, the region is depleted of carriers. This region takes on insulating characteristics and is capable of isolating semiconductor regions from each other. Depletion regions make planar bipolar integrated circuits possible.

**depletion-type field-effect transistor** — A field-effect transistor having appreciable channel conductivity for zero gate-source voltage; the channel conductivity may be increased or decreased according to the polarity of the applied gate-source voltage.

**depolarization** — The process of preserving the activity of a primary cell by the addition of a substance to the electrolyte. This substance combines chemically with the hydrogen gas as it forms, thus preventing excessive buildup of hydrogen bubbles.

**depolarize** — To make partially or completely unpolarized.

**depolarizer** — A chemical substance, usually manganese dioxide, added to a dry or primary cell to remove the polarizing chemical products resulting from discharge, and thus to keep the discharge rate constant; to prevent formation of hydrogen bubbles at the positive electrode.

**deposited carbon** — Resistive element made of a thin film of crystalline carbon or a carbon alloy sputtered onto a ceramic rod.

**deposition** — The application of a material to a substrate through the use of chemical, vapor, electrical, vacuum, or other processes.

**depth of cut** — The depth to which the recording stylus penetrates the lacquer of a recording disc.

**depth of field** — 1. The in-focus range of a lens or optical system. It is measured from the distance behind an object to the distance in front of the object when the viewing lens shows the object to be in focus. 2. The distance between the first object in focus and the last object in focus within a scene as viewed by a particular lens; it can vary with the quality and focal length of the lens or with its f-stop setting.

**depth of heating** — The depth at which effective dielectric heating can be confined below the surface of a material when the applicator electrodes are placed adjacent to only one surface.

**depth of modulation** — In a radio-guidance system obtaining directive information from the two spaced lobes of a directional antenna, the ratio of the difference in total field strength of the two lobes to the field strength of the greater lobe at a given point in space.

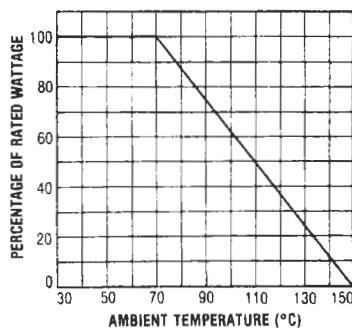
**depth of penetration** — The thickness of a layer extending inward from the surface of a conductor and having the same resistance to direct current as the whole conductor has to alternating current of a given frequency. *See also skin depth.*

**de-Q** — To reduce the  $Q$  of a tuned circuit, as generally applied to carrier-current transmission systems.

**derate** — 1. To use a device at a lower current or voltage than it is capable of handling in order to reduce the

probability of failure or to permit its use under a condition of high ambient temperature. 2. To change the rating or value to a lower rating in consideration of other affecting factors.

**derating**—1. The reduction in rating of a device or component, especially the maximum power-dissipation rating at higher temperatures. 2. Deliberately understressing components so as to provide increased reliability. (This requires the selection of components of higher stress than is required for normal operation.) For example, using a  $\frac{1}{2}$ -watt resistor in circuit conditions demanding a  $\frac{1}{4}$ -watt dissipation. This process is recognized as an effective and well-established method of achieving reliable designs. The ratio of applied stress to rated stress is the stress ratio; thus, in the example above this would be 0.25/0.5, or 50 percent derated in terms of power. 3. The intentional reduction of stress-to-strength ratio in the application of an item, usually for the purpose of reducing the occurrence of stress-related failures.



*Derating curve.*

**derating factor**—The factor by which the ratings of component parts are reduced to provide additional safety margins in critical applications or when the parts are subjected to extreme environmental conditions for which their normal ratings do not apply.

**derivative action**—*See* rate action.

**derivative control**—Automatic control in which the rate of correction is determined by the rate at which the error producing it changes.

**derived center channel**—A monophonic composite signal derived from the sum or difference of the left and right stereo channels, often fed to an extra speaker to fill in an aural hole between the left and right speakers. The signal from a voltage-derived center-channel output must be fed to an external power amplifier before it can drive a speaker. A power-derived center channel can drive a speaker directly.

**DES**—Abbreviation for Data Encryption Standard. A scheme approved by the National Bureau of Standards that encrypts data for security purposes. For use within the United States by the NSA (National Security Agency); DES is the data-communications encryption standard specified by Federal Information Processing Systems (FIPS) Publication 46.

**DESC**—Abbreviation for Defense Electronic Supply Center. 1. The agency that sets military specifications for all electronic components and verifies performance to these requirements. 2. Government agency that controls procurement policies and monitors quality for military electronics contracts.

**desensitization**—1. The saturation of one component (an amplifier, for instance) by another so that the

## derating — desktop computer

first cannot perform its proper function. 2. The effect on a receiver section tuned to one channel that is caused by a strong signal on another channel. It is an AGC-type effect whereby the desired signal's strength appears to be decreased by the presence of a nearby signal. This effect influences a receiver's overall selectivity. 3. The tendency of a receiver to fail to recognize valid DTMF signals in the presence of such factors as dial tone, pilot signals, or data signals. 4. The reduction in sensitivity of a receiver caused by either noise or rf overload from a nearby transmitter.

**desiccant**—A substance used as a drying agent because of its affinity for water.

**design-center rating**—Limiting values of operating and environmental conditions that should not be exceeded under normal conditions in a bogey electronic device of a specified type as defined by its published data. These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

**design compatibility**—Electromagnetic compatibility achieved by incorporating in all electromagnetic radiating and receiving apparatus (including antennas) characteristics or features for elimination or rejection of undesired self-generated or external signals in order to enhance operating capabilities in the presence of natural or human-made electromagnetic noise.

**design engineer**—An engineer who has been assigned to design a specific product for a specific application.

**design for maintainability**—Those features and characteristics of design of an item that reduce requirements for tools, test equipment, facilities, spares, highly skilled personnel, etc., and improve the capability of the item to accept maintenance actions.

**design-maximum ratings**—Limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data; they should not be exceeded under the worst probable conditions.

**design-maximum rating system**—*See* design-center rating. These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

**Desk-Fax**—Trade name of Western Union Telegraph Co. for a small facsimile transceiver employed principally in short-line telegraph service.

**desktop computer**—1. A self contained, totally integrated system that comes complete with central processor, read/write memory, external mass storage in the form of a cassette tape or diskette system, keyboard, computer language and operating system in firmware (usually in the form of read-only memory), connectors for external devices, and an output display such as a CRT, LED readout, or printer. When the computer is turned on, it is ready to solve problems. The operating system and language do not have to be loaded. Compiling is done automatically. Because of this integrated structure, a user can edit and execute complex commands by way of short, simple instructions. The internal operating system will recognize typing or syntax errors and give an easy-to-understand explanation on the display or printout. Also, the computer can prompt the user to supply subsequent inputs so that steps are not missed or implemented out of sequence.

Especially significant in design applications is the unit's ability to accept changes in problem parameters while a program is running. 2. A complete microprocessor-based system that is fairly easy to use by noncomputer experts. 3. A computer designed for scientific/engineering problems that are too complex for personal calculators or that require peripherals or interfacing capabilities for data acquisition or instrumentation control. Desktop computers have full, high-level programming languages, much larger memories than personal calculators, built-in mass storage devices, and I/O ports for interfacing to peripherals or other instruments. Some have impressive graphics capabilities for plotting, drawing, graphing, and lettering. 4. A complete, highly integrated system ready to use as it comes out of the box. It has an input device (a keyboard), a display device (a cathode-ray tube or single-line display), mass storage (magnetic cards, cassettes, floppy discs, CD-ROMs, etc.), a processor, memory, connectors for external I/O (input/output) devices, a power supply, and a language that resides in ROM (read-only memory) all housed in a single package that literally sits on a desk. Of course, the desktop computer may also have special peripherals, such as plotters, digitizers, and other instruments. One can simply connect the external I/O devices and peripherals, if any, turn the power on, and use the machine.

**desktop publishing**—Abbreviated DTP. The creation on personal computers of publication-quality printed documents that combine text and graphics.

**desoldering**—Process of disassembling soldered parts in order to repair, replace, inspect, or salvage them. Typical desoldering methods are wicking, pulse vacuum (solder sucker), heat and pull, and solder extraction.

**destaticization**—Treatment of a material to minimize the accumulation of static electricity and, as a result, the amount of dust that adheres to the material because of such static charges.

**destination address**—In computer systems having a source-destination architecture, the destination address is the address of the device register or memory location to which data is being transferred.

**destination register**—In a computer, a register into which data is being placed.

**Destriau effect**—Sustained emission of light by suitable phosphor powders embedded in an insulator and subjected only to the action of an alternating electric field.

**destructive readout**—1. The destruction of data in a storage device by the act of reading the data. For example, reading data from a core memory clears the addressed location. When destructive readouts are used, data (modified or unmodified) is written back into the same location. 2. A characteristic of a memory. The memory is said to have a destructive readout if information retrieved from memory must be written back in immediately after it is used or else it is lost. A core memory has destructive readout. Computers with destructive readouts contain special circuits to write information back into memory after readout.

**destructive-readout memory**—See DRO memory.

**destructive test**—Any test resulting in the destruction or drastic deterioration of the test specimen.

**detail**—A measure of the sharpness of a recorded facsimile copy or reproduced image. Generally related to the number of lines scanned per inch. Defined as the square root of the ratio between the number of scanning lines per unit length and the definition in the direction of the scanning line.

**detail contrast**—The ratio of the amplitude of the high-frequency components of a video signal to the amplitude of the reference low-frequency component.

**detail enhancement**—Also called image enhancement. A system in which each element of a video picture is analyzed in relation to adjacent horizontal and vertical elements. When differences are detected, a detail signal is generated and added to the luminance signal to enhance it.

**detection**—See demodulation.

**detection range**—The greatest distance at which a sensor will consistently detect an intruder under a standard set of conditions.

**detectophone**—An instrument for secretly listening in on a conversation. A high-sensitivity, nondirectional microphone is concealed in the room and connected to an amplifier and headphones or recorder remotely located. Sometimes the microphone feeds into a wireless transmitter that broadcasts over power lines, to permit the listener to be farther away.

**detector**—1. A device for effecting the process of detection or demodulation. 2. A mixer or converter in a superheterodyne receiver; often referred to as a first detector. 3. A device that produces an electrical output that is a measure of the radiation incident on the device. 4. A rectifier tube, crystal, or dry disc by which a modulation envelope on a carrier or the simple on-off state of a carrier may be made to drive a lower-frequency device. 5. A device that converts light signals from optical fibers to electrical signals that can be further amplified to allow reproduction of the original signal. 6. A device that converts optical power to other forms. See photodetector.

**detector balance bias**—A controlling circuit used in radar systems for antoclutter purposes.

**detector circuit**—That portion of a receiver which recovers the modulation signal from the rf carrier wave.

**detector diode**—A diode, often associated with microwave circuits, that converts rf energy into dc or video output.

**detector power efficiency**—The ratio of the change in dc power in the load resistance produced by the ac signal to the available power from a sinusoidal voltage generator when the diode is operated under specified conditions.

**detector probe**—A probe containing a high-frequency rectifying element such as a crystal diode or a tube. Used with an oscilloscope, vacuum-tube voltmeter, or signal tracer for recovering the modulation from a carrier.

**detector quantum efficiency**—The ratio of the number of carriers generated to the number of photons absorbed.

**detector voltage efficiency**—The ratio of the dc load voltage to the peak sinusoidal input voltage under specified circuit conditions.

**detent**—1. A stop or other holding device, such as a pin, lever, etc., on a ratchet wheel. 2. Switch action typified by a gradual increase in force to a position at which there is an immediate and marked reduction in force. 3. A bump or raised section projecting from the surface of a spring or other part. 4. A device that holds a part, control, or assembly in a given position. For example, some connectors use locking detents on the plug half and indents on the cap half to hold the halves together in proper mated position.

**detent torque**—A measure of the maximum torque that can be applied to the shaft of a deenergized stepper motor before it begins to rotate.

**deterministic signal**—A signal whose future behavior can be predicted precisely.

**detritus**—Loose material dislodged during resistor trimming but remaining in the trimmed area.

**detune**—1. To change the inductance and/or capacitance of a tuned circuit and thereby cause it to be resonant

at other than the desired frequency. 2. To adjust a circuit so that it does not respond to (is not resonant at) a particular frequency.

**detuning stub** — A quarter-wave stub for matching a coaxial line to a sleeve-stub antenna. The stub tunes the antenna itself and detunes the outside of the coaxial feed line.

**Deutsches Institut für Normung** — *See DIN.*

**deviation** — 1. The difference between the actual and specified values of a quantity. 2. The difference, usually the absolute difference, between a number and the mean of a set of numbers, or between a forecast value and the actual datum. 3. In FM transmissions and reception, the increase or decrease of signal carrier frequency from the nominal; also applied to drifting. Standard maximum deviation rating is  $\pm 75$  kHz for FM radio. 4. A departure from specification requirements for which approval is obtained from the consumer prior to occurrence of the departure.

**deviation absorption** — Absorption that occurs at frequencies near the critical frequency. Occurs in conjunction with the slowing up of radio waves near the critical frequency, upon reflection from the ionosphere.

**deviation distortion** — Distortion caused by inadequate bandwidth, amplitude-modulation rejection, or discriminator linearity in an FM receiver.

**deviation ratio** — In frequency modulation, the ratio of the maximum change in carrier frequency to the highest modulating frequency.

**deviation sensitivity** — The smallest frequency deviation that produces a specified output power in FM receivers.

**device** — Also called item. 1. A single discrete conventional electronic part such as a resistor or transistor, or a microelectronic circuit. 2. Any subdivision of a system. 3. A mechanical, electrical, and/or electronic contrivance intended to serve a specific purpose. 4. The physical realization of an individual electrical element in a physically independent body, which cannot be further reduced or divided without destroying its stated function. This term is commonly applied to active devices. Examples are transistors, pnpn structures, tunnel diodes, and magnetic cores, as well as resistors, capacitors, and inductors. It is not, for example, an amplifier, a logic gate, or a notch filter. 5. An electronic part consisting of one or more discrete active or passive elements. 6. A unit of processing equipment in a computer system external to the CPU; synonymous with the term *peripheral*.

**device adaptor** — *See interface adaptor.*

**device channel** — A dedicated channel associated with a device; connects a file variable to that device.

**device complexity** — The number of circuit elements within an integrated circuit.

**device cutoff** — The condition of an electronic device in which its conduction is either zero or relatively insignificant. With semiconductor devices such as FETs, bipolar transistors, and thyristors, cutoff is normally that condition in which the device passes only leakage currents.

**device independence** — In a computer, the ability to request input/output operations without regard to the nature of the input/output devices.

**device register** — An addressable register used to store status and control information or data for transfer into or out of a device.

**device under test** — Abbreviated DUT. A finished assembled device, or an untested die on a wafer.

**Dewar flask** — A container with double walls. The space between the walls is evacuated, and the surfaces bounding this space are silvered.

**dewetted surface** — 1. A surface that was initially wetted, i.e., a surface on which the solder flowed uniformly. 2. A condition that results when molten solder has coated a surface and then receded, leaving irregularly shaped mounds of solder separated by areas covered with a thin solder film; base metal is not exposed.

**dew point** — 1. The temperature at which condensation first occurs when a vapor is cooled. 2. The temperature at which moisture begins to condense out of a vapor. The relative humidity is then 100 percent.

**df** — Abbreviation for direction finder or dissipation factor.

**df antenna** — Any antenna combination included in a direction finder for obtaining the phase or amplitude reference of the received signal. May be a single or orthogonal loop, an adcock, or spaced differentially connected dipoles.

**df antenna system** — One or more df antennas and their combining circuits and feed systems, together with the shielding and all electrical and mechanical items up to the receiver input terminals.

**D flip-flop** — A flip-flop whose output is determined by the input that appeared one pulse earlier; for example, if a 1 appeared at the input, the output after the next clock pulse would be 1.

**DHG** — Abbreviation for digital harmonic generation.

**DI** — Abbreviation for dielectric isolation. A fabrication technique by which components in an integrated circuit are electrically isolated from each other by an insulator (dielectric material). DI surrounds the sides and bottom of each transistor with a layer of silicon dioxide (glass). DI has proven particularly advantageous for fabricating high-performance analog ICs. The conventional DI fabrication process for bipolar ICs begins with a wafer of n-type silicon. The side of the wafer that will eventually be the bottom is deeply etched (in V-shaped grooves) to form the sidewall pattern, then silicon dioxide and polycrystalline silicon are grown to fill the etched moats and to thicken the eventual DI substrate. The opposite side of the wafer is polished until the insulating sidewalls appear at the wafer surface. Conventional diffusion and metallization processes follow to complete the IC.

**diac** — 1. Two-lead alternating-current switching semiconductor. 2. *See three-layer diode.* 3. A bidirectional breakdown diode that conducts only when a specified breakdown voltage is exceeded.

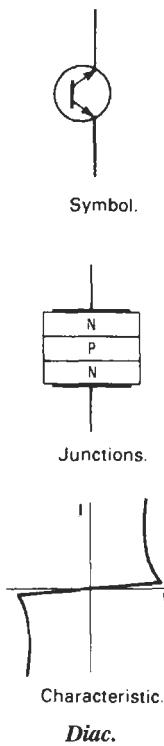
**diagnostic** — 1. Having to do with the detection and isolation of a malfunction or error in a computer. 2. A message output by a compiler or assembler indicating that a computer program contains a mistake. 3. Software designed to locate either a fault in the equipment or an error in programming.

**diagnostic code** — An alphanumeric or word display that indicates a system condition such as a malfunction. The code is either self-explanatory or used to refer to further instructions that are explained in an operator guide.

**diagnostic function test** — A program for testing overall system reliability.

**diagnostic program** — 1. Special program for checking computer's hardware for proper operation. For example, there are CPU diagnostic checks, memory diagnostic checks, and so on. 2. A test program to help isolate hardware malfunctions in the programmable controller and application equipment. 3. A troubleshooting aid for locating hardware malfunctions in a system, or a program to aid in locating coding errors in newly developed programs.

**diagnostic routine** — 1. An electronic-computer routine designed to locate a malfunction in the computer, a mistake in coding, or both. 2. *See debug.*



**diagnostics**—1. Information on what tests a device failed and how they were failed, used to aid in troubleshooting. 2. An output from a tool, indicating software discrepancies and other attributes. 3. Methods used for detecting and isolating faults in a unit under test. 4. Computer system support tasks (usually supplied with an operating system) that test memory, interrupts, timers, and peripheral devices. 5. Programs or procedures used to test a piece of equipment, a communications link or network, or any similar system.

**diagnostic test**—A test performed for the purpose of isolating a malfunction in the unit under test.

**diagnostic testing**—Testing designed to locate and identify errors in a computer routine, hardware component, or communication network.

**diagonal horn antenna**—A horn antenna whose cross sections are all square and in which the electric vector is parallel to a diagonal. The radiation pattern in the far field has almost perfect circular symmetry.

**diagonal pliers**—Pliers with cutting jaws at an angle to the handles to permit cutting off wires close to terminals or printed circuit boards.

**diagram**—1. Schematics, prints, charts, or any other graphical representation, the purpose of which is to explain rather than to represent. 2. A schematic representation of a sequence of subroutines designed to solve a problem. 3. A coarser and less symbolic representation than a flowchart, frequently including descriptions in English words. 4. A schematic drawing showing an electrical circuit, or a logical drawing showing logical arrangements within a circuit.

**dial**—1. A means for indicating the value to which a control knob has been set. 2. A calling device that generates the required number of pulses in a telephone set and thereby establishes contact with the party being called.

**dial cable**—See dial cord.

**dial central office**—A telephone or teletypewriter office at which is located the automatic equipment necessary for connecting two or more user stations together by wires for communication purposes.

**dial cord**—Also called dial cable. A braided cord or flexible wire cable connected to a tuning knob so that turning the knob will move the pointer or dial that indicates the frequency to which an analog radio receiver is tuned. Also used for coupling two shafts together mechanically.

**dialer**—1. A device that detects and reports emergencies by automatic dialing of telephone numbers. When an emergency is detected, the dialer usually begins playing a prerecorded tape containing the telephone number or numbers to be called (in the form of a series of pulses) and the emergency message. When the number has been dialed, the tape continues to play the prerecorded message. 2. See automatic dialer.

**dialing area**—The area within which a telephone company customer may make calls by dialing without using area codes.

**dialing key**—A dialing method in which a set of numerical keys instead of a dial is used to originate dial pulses. Generally, it is used in connection with voice-frequency dialing.

**dial jacks**—Strips of jacks associated with and bridged to a regular outgoing trunk jack circuit so that connections between the dial cords and the outgoing trunks can be made.

**dial key**—The key unit of the subscriber's cord circuit that is used to connect the dial to the line.

**dial leg**—The circuit conductor brought out for direct-current dial signaling.

**dial light**—A small pilot lamp that illuminates the tuning dial of a radio receiver.

**dialyl phthalate**—A thermosetting resin that has excellent electrical insulation properties.

**dial office**—Telephone central office operating on dial signals.

**dialog**—Interchange of information between program and user. The program gives prompts or messages, and the user responds by entering appropriate data.

**dialog box**—1. An on-screen message box in a graphical user interface that allows users to input more specific information than standard commands. 2. An on-screen box that conveys or requests information from the user.

**dial pulse**—A momentary interruption in the direct current in the loop of a calling telephone, produced by the opening and closing of the dial pulse springs of a calling telephone in response to the dialing of a digit. The current in the calling-line loop is interrupted as many times as there are units in the digit dialed; i.e., dialing the digit 7 generates seven dial pulses (interruptions) in current flowing through the loop of the calling telephone.

**dial pulsing**—The transmission of telephone address information by the momentary opening and closing of a dc circuit a specified number of times, corresponding to the decimal digit that is dialed. This is usually accomplished, as with an ordinary telephone dial, by manual operation of a finger wheel.

**dial register**—See standard register of a motor meter.

**dial telephone system**—Telephone system in which telephone connections between customers are ordinarily established by electronic and mechanical apparatus controlled by manipulations of dials operated by the calling parties.

**dial tone**—1. A hum or other tone employed in a dial telephone system to indicate that the line is not busy and that the equipment is ready for dialing. 2. A tone

indicating that automatic telephone switching equipment is ready to receive dial signals, tones, or pulses.

**dial-up**—1. The use of a dial or push-button telephone for initiating a station-to-station call. 2. Two simplex transmission paths between central offices and a full-duplex path in each subscriber loop. 3. Use of a phone to initiate a call.

**dial-up connection**—A connection from a computer using a modem to a host computer over standard telephone lines.

**dial-up line**—Also called switched line. A communication line accessible via dial-up facilities, typically the public telephone network.

**diamagnetic**—1. Term applied to a substance with a negative magnetic susceptibility. 2. Bars of certain elements, such as zinc, copper, lead, and tin, when freely suspended in a magnetic field arrange themselves at right angles to the lines of force of the magnetic field, i.e., they are magnetized in the opposite direction to the magnetizing field. These elements are said to be diamagnetic.

**diamagnetic material**—1. A material that is less magnetic than air, or in which the intensity of magnetization is negative. There is no known material in which this effect has more than a very feeble intensity. Bismuth is the leading example of materials of this class. 2. A material having a permeability less than that of vacuum:  $\mu < 1$  gauss/oersted. For practical evaluation, a nonmagnetic material.

**diamagnetism**—1. A phenomenon whereby the magnetization induced in certain substances opposes the magnetizing force. 2. The negative susceptibility exhibited by certain substances. The permeability of such substances is less than unity.

**diamond antenna**—Also called a rhombic antenna. A horizontal antenna having four conductors that form a diamond, or rhombus.

**diamond lattice**—The crystal structure of germanium and silicon (as well as a diamond).

**diamond stylus**—A phonograph pickup with a ground diamond as its point.

**diapason**—The unique fundamental tone color of organ music.

**diaphragm**—1. A flexible membrane used in various electroacoustic transducers for producing audio-frequency vibrations when actuated by electric impulses, or electric impulses when actuated by audio-frequency vibrations. 2. In electrolytic cells, a porous or permeable membrane, usually flexible, separating the anode and cathode compartments. 3. In waveguide technique, a thin plate, or plates, placed transversely across the waveguide, not completely closing it, and usually introducing a reactance component. *See also iris.* 4. A sensing element consisting of a membrane placed between two volumes. The membrane is deformed by the pressure differential applied across it.

**diathermal apparatus**—Apparatus for generating heat in body tissue by high-frequency electromagnetic radiation.

**diathermy**—1. The therapeutic use of an oscillating electric current of high frequency to produce localized heat in body tissues. 2. The use of radio-frequency fields to produce deep heating in body tissues. The output of a powerful rf oscillator is applied to a pair of electrodes, known as pads, between which the portion of the body to be treated is placed. The body tissues thus become the dielectric of a capacitor, and dielectric losses cause heating of the tissues.

**diathermy interference**—A form of television interference caused by diathermy equipment, resulting in a horizontal herringbone pattern across the picture.

**diathermy machine**—A medical apparatus consisting of an rf oscillator frequently followed by rf amplifier stages, used to generate high-frequency currents that produce heat within some predetermined part of the body for therapeutic purposes.

**dibit**—A group of two bits. In four-phase modulation, each possible dibit is encoded in the form of one of four unique phase shifts of the carrier. The four possible states for a dibit are 00, 01, 10, and 11.

**DIC**—Dielectrically isolated integrated circuit. Also abbreviated DIIC.

**dice**—The plural of die.

**dichroic**—Pertaining to the quality of dichroism.

**dichroic filter**—1. An optical filter capable of transmitting all frequencies above a certain cutoff frequency and reflecting all lower frequencies, thus being either a high-pass or a low-pass filter. 2. A filter used to selectively transmit light according to its wavelength and not its plane of vibration.

**dichroic mirror**—1. A special mirror through which all light frequencies pass except those for the color that the mirror is designed to reflect. 2. A semitransparent mirror used to selectively reflect light according to its wavelength and not its plane of vibration.

**dichroism**—Also called dichromatism or polychromatism. 1. A property of an optical material that causes light of some wavelengths to be absorbed when the incident light has its electric-field vector in a particular orientation and not absorbed when the electric-field vector has other orientations. 2. In anisotropic materials, such as some crystals, the selective absorption of light rays vibrating in one particular plane relative to the crystalline axes, but not those vibrating in a plane at right angles thereto. As applied to isotropic materials, this term refers to the selective reflection and transmission of light as a function of wavelength regardless of its plane of vibration. The color of such materials, as seen by transmitted light, varies with the thickness of material examined.

**dichromatism**—*See* dichroism.

**dicing**—The process of sawing a crystal wafer into blanks.

**dictionary**—In digital computer operations, a list of mnemonic code names together with the addresses and/or data to which they refer.

**diddle**—Automatic transmission of letter or figure characters by a terminal unit if no characters are ready for transmission (most often used with a FIFO memory).

**die**—1. Sometimes called chip. A tiny piece of semiconductor material, broken from a semiconductor slice, on which one or more active electronic components are formed. (Plural: dice.) 2. A portion of a wafer bearing an individual circuit, or device cut or broken from a wafer containing an array of such circuits or devices. 3. An uncased discrete or integrated device obtained from a semiconductor wafer. *See chip.* 4. A single miniature active or passive component. So named because the circuits are batch fabricated by diffusion processes on a silicon wafer, which is then cut into individual components. Examples: transistors, diodes, integrated circuits, diffused resistors.

**die attach**—The operation of mounting chips to a substrate. Methods include gold-silicon eutectic bonding, various solders, and conductive (and nonconductive) epoxies.

**die bond**—1. Attachment of a die or chip to the hybrid substrate. 2. A process in which chips are attached to a substrate (gold, epoxy, wax, etc.). The joint between a die and the substrate.

**die bonding**—1. The method by which a semiconductor die, or chip, is attached to a mechanical support. 2. Attaching a semiconductor chip to the substrate with

an epoxy, eutectic, or solder alloy. 3. The attachment of a die to a gold base, such as a substrate pad, or to a header. Heat, pressure, and a mechanical scrubbing action are used to create a gold-silicon eutectic bond between the die and base.

**dielectric** — 1. The insulating (nonconducting) medium between the two plates of a capacitor. Typical dielectrics are air, wax-impregnated paper, plastic, mica, and ceramic. A vacuum is the only perfect dielectric. 2. A medium capable of recovering, as electrical energy, all or part of the energy required to establish an electric field (voltage stress). The field, or voltage stress, is accompanied by displacement or charging currents. 3. The insulating material between the metallic elements of an electromechanical component or any of a wide range of thermoplastics or thermosetting plastics. 4. Any insulating medium that intervenes between two conductors and permits electrostatic attraction and repulsion to take place across it. 5. A material having the property that energy required to establish an electric field is recoverable, in whole or in part, as electric energy. 6. A material medium in which an electric field can exist in the stationary state. 7. Characteristic of materials that are electrical insulators or in which an electric field can be sustained with a minimum dispersion of power. Such materials exhibit nonlinear properties, such as anisotropy of conductivity or polarization, or saturation phenomena. 8. An insulator. Localized regions of dielectric materials are used in semiconductor devices, for example, to provide electrical isolation between dice, between metal interconnect layers, and between the gate electrode and the channel.

**dielectric absorption** — Also called dielectric hysteresis (short-term effect), or dielectric soak (long-term effect). 1. A characteristic of dielectrics that determines the length of time a capacitor takes to deliver the total amount of its stored energy. It manifests itself as the reappearance of potential on the electrodes after the capacitor has been discharged. Its magnitude depends on the charge and discharge time of the capacitor. 2. That property of an imperfect dielectric as a result of which all electric charges within the body of the material caused by the application of an electric field are not returned to the field. 3. Reluctance of a capacitor to give up all the electrons stored when the capacitor is discharged. Primarily caused by a polarization effect of dielectric dipoles and to a lesser extent by free electrons in the dielectric requiring a finite time to move to the electrode. The recovery voltage appearing after discharge divided by the charging voltage and expressed as a percentage is called the percent dielectric absorption. 4. The property of a capacitor with slow polarization of its dielectric that results in voltage appearance on the capacitor electrodes after its short-term discharge through a low resistance.

**dielectric amplifier** — An amplifier employing a device similar to an ordinary capacitor, but with a polycrystalline dielectric that exhibits a ferromagnetic effect.

**dielectric analysis** — Method of directly monitoring resin cooking, resin staging, and resin curing. Such analysis eliminates many of the variables influencing the selection of a given set of fabrication conditions. Dielectric analyzers consist of a press with heated platens, a clamshell autoclave, and a DTA/dielectric cell.

**dielectric anisotropy** — The difference between the dielectric along the director and the dielectric perpendicular to the director of a liquid crystal system.

**dielectric antenna** — An antenna in which a dielectric is the major component producing the required radiation pattern.

**dielectric breakdown** — 1. An abrupt increase in the flow of electric current through a dielectric material as

the applied electric field strength exceeds a critical value. 2. A complete failure of a dielectric material characterized by a disruptive electrical discharge through the material due to a sudden and large increase in voltage.

**dielectric breakdown voltage** — Also called electric breakdown voltage, breakdown voltage, or hi-pot. 1. The voltage between two electrodes at which electric breakdown of the specimen occurs under prescribed test conditions. 2. The voltage at which a dielectric material punctures. 3. The voltage required to cause electrical failure or breakthrough of insulation. Usually expressed as a voltage gradient (volts per mil).

**dielectric capacity** — The inductivity or specific inductive capacity of a substance, being its ability to convey the influence of an electrified body.

**dielectric constant** — Also called permittivity, specific inductive capacity, or capacitivity. 1. The ratio of the capacitance of a capacitor with the given dielectric to the capacitance of a capacitor having air for its dielectric but otherwise identical. Symbol: K. 2. That property of a dielectric that determines the electrostatic energy stored per unit volume for a unit potential gradient. 3. The property of a material that determines the amount of electrostatic energy that can be stored when a given voltage is applied.

**dielectric crystal** — A crystal that is characterized by its relatively poor electrical conductance.

**dielectric current** — The current flowing at any instant through the surface of an isotropic dielectric that is in a changing electric field.

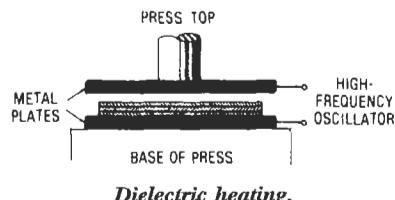
**dielectric dissipation** — See loss tangent.

**dielectric dissipation factor** — The cotangent of the dielectric phase angle of a material.

**dielectric fatigue** — The property of some dielectrics in which the insulating quality decreases after a voltage has been applied for a considerable length of time.

**dielectric guide** — A waveguide made of a solid dielectric material through which the waves travel.

**dielectric heating** — A method of raising the temperature of a nominally insulating material by sandwiching it between two plates to which an rf voltage is applied. The material acts as a dielectric, and its internal losses cause it to heat up.



*Dielectric heating.*

**dielectric hysteresis** — 1. Short-term effect of dielectric absorption. 2. A lagging of an electric field in a dielectric behind the alternating voltage that produces it. It causes a loss similar to that of magnetic hysteresis. 3. See also dielectric absorption.

**dielectric isolation** — 1. The electrical isolation of monolithic integrated circuit elements from each other by dielectric material rather than by reverse-biased pn junctions. 2. The use of silicon dioxide barriers created during silicon IC processing to provide isolation between components on a chip.

**dielectric lens** — A lens used with microwave antennas; it is made of dielectric material so that it refracts

radio waves similar to the way an optical lens refracts light waves.

**dielectric loss**—1. The power dissipated by a dielectric as the friction of its molecules opposes the molecular motion produced by an alternating electric field. 2. The time rate at which electric energy is transformed into heat in a dielectric when it is subjected to a changing electric field.

**dielectric loss angle**—Also called dielectric phase difference. The complement of the dielectric phase angle (i.e., the dielectric phase angle minus 90°).

**dielectric loss factor**—Also called dielectric loss index. The product of the dielectric constant of a material times the tangent of the dielectric loss angle.

**dielectric loss index**—The product of a medium's relative permittivity and the tangent of its dielectric loss angle. *See* dielectric loss factor.

**dielectric matching plate**—In waveguide technique, a dielectric plate used as an impedance transformer for matching purposes.

**dielectric mirror**—A highly frequency-selective, multilayer dielectric reflector acting by partial reflection of light at the interface between materials of unequal refractive indices.

**dielectric phase angle**—The angular difference in phase between the sinusoidal alternating voltage applied to a dielectric and the component of the resultant alternating current having the same period.

**dielectric phase difference**—*See* dielectric loss angle.

**dielectric polarization**—*See* polarization, 3.

**dielectric power factor**—The cosine of the dielectric phase angle, or sine of the dielectric loss angle.

**dielectric process**—Also called electrographic process. A nonimpact printing technique in which specially treated paper consisting of a conductive base layer coated with a nonconductive thermoplastic material is used to hold an electric charge applied directly by a set of electrode styli. The electric charge corresponds to the latent image of the original. After charging, the image is produced by a toner system similar to that used in electrostatic copying devices. The dielectric process employed on general-purchase nonimpact printers, facsimile devices, and some photocopiers.

**dielectric rating**—Standard test voltages and frequencies above which failure occurs between specified points in a relay structure.

**dielectric resonator**—A high-*Q*, temperature-stable ceramic microwave resonator that is used in microwave oscillator circuits. It can exist in any regular geometrical form and resonates in various modes at frequencies determined by its dimensions and shielding conditions.

**dielectric-rod antenna**—An antenna in which propagation of a surface wave on a tapered dielectric rod produces an endfire radiation pattern.

**dielectric soak**—Long-term effect of dielectric absorption. *See* dielectric absorption.

**dielectric strength**—Also called electric strength, breakdown strength, electric field strength, and insulating strength. 1. The maximum voltage a dielectric can withstand without rupturing. 2. Maximum potential gradient that a dielectric can withstand before it ruptures or a conducting path forms through it. Normally expressed as the ratio of breakdown voltage to the dielectric thickness (volts per mil). 3. The property of a dielectric to withstand an electrical stress. 4. The ratio of dielectric breakdown to the thickness of the insulating materials. 5. The ultimate breakdown voltage of the dielectric or insulation of the resistor when the voltage is applied between the case and all terminals that are tied together. Dielectric strength is

usually specified at sea level and simulated high-altitude air pressures.

**dielectric susceptibility**—The ratio of the polarization in a dielectric to the electric intensity responsible for it.

**dielectric tests**—1. Tests that consist of the application of a voltage higher than the rated voltage for a specified time for the purpose of determining the adequacy against breakdown of insulating materials and spacings under normal conditions. 2. The testing of insulating materials by the application of a constantly increasing voltage until failure occurs.

**dielectric waveguide**—A waveguide constructed from a dielectric (nonconductive) substance.

**dielectric wedge**—A wedge-shaped piece of dielectric material used in one waveguide to match its impedance to that of another waveguide.

**dielectric wire**—A dielectric waveguide used for short-distance transmission of UHF radio waves between parts of a circuit.

**dielectric withstanding voltage**—Maximum potential gradient that a dielectric material can withstand without failure.

**difference**—The signal energy representing the differences in information between the signals in two or more stereo channels. A difference signal is produced when stereo signals differing in electrical polarity or in intensity are mixed together in opposing polarity.

**difference amplifier**—The basic input stage of most operational amplifiers. An amplifier with an inverting and a noninverting input. The output voltage is a function of the voltage difference between the two inputs. *See* differential amplifier.

**difference channel**—In a stereophonic sound system, an audio channel that handles the difference between the signals in the left and right channels.

**difference detector**—A detector circuit in which the output is a function of the difference between the peak or rms amplitudes of the input waveforms.

**difference frequency**—1. A signal representing, in essence, the difference between the left and right sound channels of a stereophonic sound system. 2. One of the output frequencies of a converter. It is the difference between the two input frequencies.

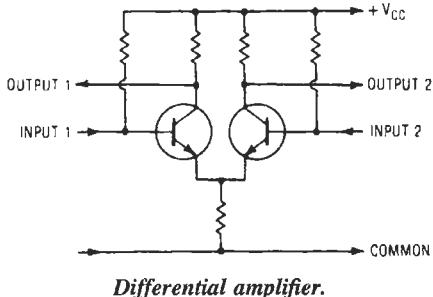
**difference in depth modulation**—In directive systems employing overlapping lobes with modulated signals, a ratio obtained by subtracting from the percentage of modulation of the larger signal the percentage of modulation of the smaller signal and dividing by 100.

**difference of potential**—The voltage or electrical pressure existing between two points. It will result in a flow of electrons whenever a circuit is established between the two points.

**difference signal**—In a quadraphonic sound system, a signal arrived at by subtracting left or right back-channel signal from its respective front-channel signal. Left front and left back signals, if added to left front minus left back signals, yield a left front channel; if subtracted, they yield a left back channel.

**differential**—1. A planetary gear system that adds or subtracts angular movements transmitted to two components and delivers the answer to a third. Widely used for adding and subtracting shaft movements in servo systems and for addition and subtraction in computing machines. 2. In electronics, the difference between two levels. 3. A method of signal transmission through two wires that always have opposite states. The signal data is the polarity difference between the wires: whenever either is high, the other is low. Neither wire is grounded. 4. Describing any device whose operation is dependent on the difference between two quantities.

**differential amplifier**—1. An amplifier with two similar input circuits so connected as to respond to the difference between two voltages (or currents) and effectively suppress voltages or currents that are alike in the two input circuits. 2. A circuit that amplifies the difference between two input signals.



Differential amplifier.

**differential analyzer**—A mechanical or electrical device primarily designed and used to solve differential equations.

**differential angle**—The total angle from the operation to the releasing position in a mercury switch.

**differential capacitance**—The derivative with respect to voltage of a capacitor charge characteristic at a given point on the curve.

**differential capacitance characteristic**—The function that relates differential capacitance to voltage.

**differential capacitor**—A variable capacitor having two similar sets of stator plates and one set of rotor plates. When the rotor is turned, the capacitance of one section is increased and the capacitance of the other section is decreased. The sum of the two capacitance values remains substantially constant at all settings, however.

**differential comparator**—1. A circuit in which differential-amplifier design techniques are applied to the comparison of an input voltage with a reference voltage. When the input voltage is lower than the reference voltage, the circuit output is in one state; when the input voltage is higher than the reference voltage, the output is in the opposite state. Commonly used for pulse-amplitude detector circuits, a-d conversion, and differential receivers for data transmission in noisy environments over a twisted-pair line. 2. A differential circuit for indicating when two input signals are essentially equal, as in a differential pair.

**differential cooling**—A lowering of temperature that takes place at a different rate at various points on an object or surface.

**differential delay**—The difference between the maximum and minimum frequency delays occurring across a band.

**differential discriminator**—A discriminator that passes only pulses having amplitudes between two predetermined values, neither of which is zero.

**differential duplex system**—A duplex system in which the sent currents divide through two mutually inductive sections of the receiving apparatus. These sections are connected to the line and to a balancing artificial line in opposite directions. Hence, there is substantially no net effect on the receiving apparatus. The received currents pass mainly through one section, or through the two sections, in the same direction and operate the apparatus.

**differential equation**—A generalization of the algebraic equation in which the unknowns are not simply numbers, but functions of one or more independent variables. Not only the unknown function or functions appear explicitly in the differential equation, but also the first- and possibly higher-order derivatives with respect to the independent variable or variables.

**differential flutter**—Speed-change errors that occur at different magnitudes, frequencies, or phases across the width of a magnetic tape.

**differential gain**—1. The ratio of the differential output signal of a differential amplifier divided by the differential input signal causing that output. 2. Variation in the gain of a transmission system with changing modulation.

**differential gain control**—Also called gain sensitivity control. A device for altering the gain of a radio receiver in accordance with an expected change of signal level in order to reduce the amplitude differential between the signals at the receiver output.

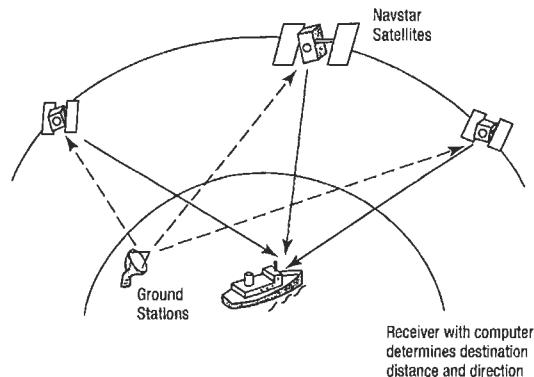
**differential galvanometer**—A galvanometer having two similar but opposed coils, so that their currents tend to neutralize each other. A zero reading is obtained when the currents are equal.

**differential gap**—1. The difference between two target values, one of which applies to an upswing of conditions and the other to a downswing. 2. The span between on and off switching points. For example, a room thermostat set for 70° might switch the furnace on at 68° and off at 72°, resulting in a 4° differential. See also dead band.

**differential gear**—In an analog computer, a mechanism that relates the angles of rotation of three shafts. Usually it is designed so that the algebraic sum of the rotations of two shafts is equal to twice the rotation of the third. The device can be used for addition or subtraction.

**differential generator**—A synchro differential generator driven by a servo system.

**differential GPS**—A technique using the global positioning satellite (GPS) network, in which a fixed ground GPS receiver (for precisely known three-dimensional coordinates locally) determines corrections to be applied to local aircraft (or other mobile units) using satellite guidance.



Differential global positioning system (GPS).

**differential impedance**—The internal impedance observed between the input terminals of an operational amplifier.

**differential input**—1. An input circuit that rejects voltages that are the same at both input terminals and amplifies the voltage difference between the two input terminals. May be either balanced or floating and may also be guarded. 2. An input applied between two terminals of an operational amplifier, neither of which is at ground (earth) potential.

**differential-input amplifier**—An amplifier in which the output is ideally a function only of the difference between the signals applied to its two inputs, both signals being measured with respect to a common low or ground reference point.

**differential-input capacitance**—The capacitance between the inverting and noninverting input terminals.

**differential-input impedance**—1. The impedance between the inverting and noninverting input terminals of a differential amplifier. 2. The impedance measured between the positive and the negative input terminals of an operational amplifier.

**differential-input measurement**—Also called floating input. A measurement in which the two inputs to a differential amplifier are connected to two points in a circuit under test and the amplifier displays the difference voltage between the points. In this type of measurement, each input of the amplifier acts as a reference for the other, and ground connections are used only for safety reasons.

**differential-input rating**—The maximum differential input that may be applied between the two terminals of an operational amplifier.

**differential-input resistance**—The resistance between the inverting and noninverting input terminals of a differential amplifier. *See* input resistance.

**differential-input voltage**—The maximum voltage that can be applied across the input terminals of a differential amplifier without damaging the amplifier.

**differential-input voltage range**—The range of voltages that may be applied between input terminals without forcing the circuit to operate outside its specifications.

**differential-input voltage rating**—The maximum allowable signal that may be applied between the inverting and noninverting inputs of a differential amplifier without damaging the amplifier.

**differential instrument**—A galvanometer or other measuring instrument having two circuits or coils, usually identical, through which currents flow in opposite directions. The difference, or differential effect, of these currents actuates the indicating pointer.

**differential keying**—A method of obtaining chirp-free break-in keying of a cw transmitter by turning the oscillator on quickly before the keyed amplifier stage can pass any signal, and turning it off quickly after the keyed amplifier stage has cut off.

**differential linearity**—The measure of linearity among digital states in a/d and d/a converters. If the differential linearity is specified as  $\pm \frac{1}{2}$  lsb, the step size from one state to the next may range from  $\frac{1}{2}$  to  $\frac{3}{2}$  of an ideal 1-lsb step.

**differential microphone**—*See* double-button carbon microphone.

**differential-mode gain**—Abbreviated DMG. 1. The ratio of the output voltage of a differential amplifier to the differential-mode input voltage. 2. The voltage gain exhibited by an operational amplifier in response to differential-mode signals.

**differential-mode input**—The voltage difference between the two inputs of a differential amplifier.

**differential-mode signal**—1. A signal that is applied between the two ungrounded terminals of a balanced three-terminal system. 2. In an amplifier with a

## differential input — differential synchro

differential input, a signal that appears at inverting and noninverting inputs with opposite phase but identical frequency and amplitude. It is not necessarily referred to ground.

**differential modulation**—A type of modulation in which the choice of the significant condition for any signal element is dependent on the choice for the previous signal element.

**differential nonlinearity**—The difference between actual analog voltage change and the ideal (1 lsb) voltage change at any code change of a digital-to-analog converter.

**differential output voltage**—The difference between the values of the two ac voltages that are present in phase opposition at the output terminals of an amplifier when a differential voltage is applied to the input terminals of the amplifier.

**differential pair**—A pair of transistors sharing a common emitter circuit but with two independent base inputs.

**differential permeability**—1. The ratio of the positive increase of normal induction to the positive increase of magnetizing force when these increases are minute. 2. The slope of the normal induction curve.

**differential phase**—1. The difference in phase shift through a television system for a small, high-frequency sine-wave signal at two stated levels of a low-frequency signal on which the first signal is superimposed. 2. In a color TV signal, the phase change of the color subcarrier introduced by the overall circuit, measured in degrees as the picture signal on which it rides is varied from blanking to white level.

**differential phase-shift keying**—Abbreviated DPSK. A modulation scheme in which the information is conveyed by changes in carrier phase during one interval relative to the preceding interval.

**differential pressure transducer**—A pressure transducer that accepts simultaneously two independent pressure sources, and the output of which is proportional to the pressure difference between the sources.

**differential protective relay**—A protective device that functions on a percentage of phase angle or other quantitative difference of two currents or of some other electrical quantities.

**differential relay**—A relay with multiple windings that functions when the voltage, current, or power difference between the windings reaches a predetermined value. The power difference may result from the algebraic addition of the multiple inputs.

**differential resistance**—The resistance measured between the terminals of a diode under small-signal and specified bias conditions.

**differential resolver**—A servo unit with a two-phase stator and a three-phase rotor that is used as a transolver, with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

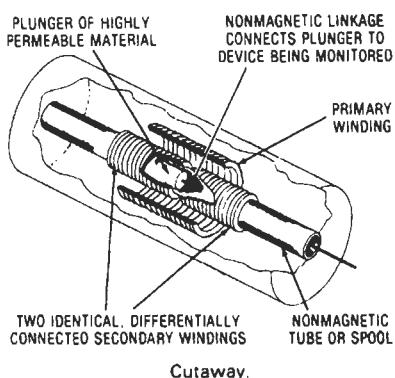
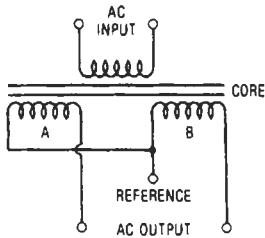
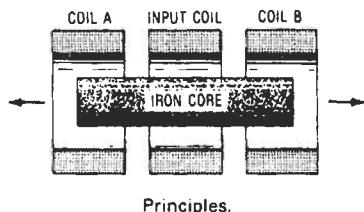
**differential selsyn**—A selsyn in which both the rotor and the stator have similar windings that are spread  $120^\circ$  apart. The position of the rotor corresponds to the algebraic sum of the fields produced by the stator and rotor.

**differential stage**—A symmetrical amplifier stage in which two inputs are balanced against each other so that when there is no input signal, or equal input signals, there is no output signal. An input-signal unbalance, including a signal to only one input, produces an output signal proportional to the difference between the input signals.

**differential synchro**—*See* synchro differential generator; synchro differential motor.

**differential transducer**—A device capable of simultaneously measuring two separate stimuli and providing an output proportionate to the difference between them.

**differential transformer**—Also called linear variable-differential transformer. 1. A transformer used to join two or more sources of signals to a common transmission line. 2. An electromechanical device that continuously translates displacement of position change into a linear ac voltage.



Differential transformer, 1.

**differential voltage**—For a glow lamp, the difference between the breakdown and maintaining voltage.

**differential voltage gain**—1. The ratio of the change in output-signal voltage at either terminal of a differential device to the change in signal voltage applied to either input terminal, all voltages measured to ground. 2. The ratio of the differential output voltage of an amplifier to the differential input voltage of the amplifier. If the amplifier has one output terminal, the differential voltage gain is the ratio of the ac output voltage (with respect to ground) to the differential input voltage.

**differential winding**—A coil winding so arranged that its magnetic field opposes that of a nearby coil.

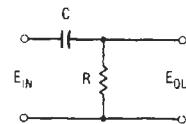
**differential-wound field**—A type of motor or generator field having both series and shunt coils connected so they oppose each other.

**differentiate**—1. To distinguish. 2. To find the derivative of a function. 3. To deliver an output that is the derivative with respect to time of the input.

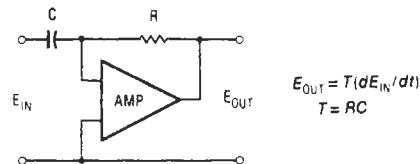
**differentiating circuit**—Also called differentiating network and differentiator. A circuit whose output voltage is proportional to the rate of change of the input voltage. The output waveform is then the time derivative of the input waveform, and the phase of the output waveform leads that of the input by 90°. An RC circuit gives this differentiating action.

**differentiating network**—See differentiating circuit.

**differentiator**—See differentiating circuit.



No amplification.



Amplification.

Formula.

Differentiator.

**diffracted wave**—A radio, sound, or light wave that has struck an object and been bent or deflected other than by reflection or refraction.

**diffraction**—1. The bending of radio, sound, or light waves as they pass through an object or barrier, thereby producing a diffracted wave. 2. The phenomenon whereby waves traveling in straight paths bend around an obstacle. See X-ray crystallography.

**diffuse**—1. To undergo or cause to undergo diffusion. 2. Light that has been either inadvertently or purposely scattered. Such diffused light propagates in many directions and is not intensely polarized when it illuminates surfaces. With diffused light, a high brightness level may be achieved with minimal glare.

**diffused-alloy transistor**—Also called drift transistor. A transistor in which the semiconductor wafer is subjected to gaseous diffusion to produce a nonuniform base region, after which alloy junctions are formed in the same manner as for an alloy-junction transistor. It may also have an intrinsic region to give a pnp unit.

**diffused-base transistor**—Also called graded-base transistor. A type of transistor made by combining diffusion and alloy techniques. A nonuniform base region and the collector-to-base junction are formed by gaseous dissemination into a semiconductor wafer that constitutes the collector region. Then the emitter-to-base junction is formed by a conventional alloy process on the base side of the diffused wafer.

**diffused device**—A semiconductor device in which a base, usually of silicon, has successive layers of p

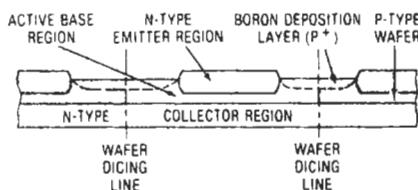
and n characteristics diffused upon and into the base by means of a series of masks and around which p and n materials, usually phosphorous and boron, adhere to the base by gaseous diffusion in a high-temperature furnace. It is possible to build areas of resistance, capacitance, and active diodes and transistors into the base, creating an entire circuit. Performance is poor in the presence of radiation.

**diffused-emitter-and-base transistor** — Also called double-diffused transistor. A semiconductor wafer that has been subjected to gaseous dissemination of both n- and p-type impurities to form two pn junctions in the original semiconductor material.

**diffused-emitter-collector transistor** — A transistor whose emitter and collector are both produced by diffusion.

**diffused junction** — 1. Type of pn junction, made by using masks to control the diffusion of impurities into monocrystalline semiconductor material. 2. A junction formed by the diffusion of an impurity within a semiconductor crystal.

**diffused-junction rectifier** — A semiconductor diode in which the pn junction is produced by diffusion.



Diffused-junction silicon transistor wafer.

**diffused-junction transistor** — A transistor in which the emitter and collector electrodes have been formed by diffusion of an impurity into the semiconductor wafer without heating.

**diffused-layer resistor** — A resistor formed by including an appropriate pattern in the photomask to define diffusion areas.

**diffused mesa transistor** — A transistor in which the collector-base junction is formed by gaseous diffusion, and the emitter-base junction is formed either by gaseous diffusion or by an evaporated metal strip. The collector-base junction is then defined by etching away the undesired parts of the emitter and base regions, thus producing a mesa.

**diffused metal-oxide semiconductor** — See DMOS.

**diffused planar transistor** — A transistor made by two gaseous diffusions, but in which the collector-base junction is defined by oxide masking. Junctions are formed beneath this protective oxide layer, with the result that the device has lower reverse currents and good dc gain at low currents.

**diffused sound** — Sound that has uniform energy density, meaning that the energy flux is equal in all parts of a given region.

**diffused transistor** — A transistor in which the emitter and collector junctions are both formed by diffusion.

**diffused transmission** — The total net transmission, by a medium or device, of light that is neither perfectly Lambertian nor parallel. Often used interchangeably with the term *gross transmission*.

**diffuser** — A device used to scatter or disperse light emitted from a source, usually by the process of diffuse transmission.

**diffuse scan** — A reflective scan technique in which reflection from a nearby nonshiny surface illuminates a photosensor.

**diffuse transmission** — Transmission accompanied by diffusion or scatter to the extent that there is no regular or direct transmission.

**diffusion** — 1. The movement of carriers from a region of high concentration to regions of lower concentration. 2. The tendency of entities such as current carriers to diffuse themselves, or move in directions that increase the uniformity with which their number occupy the available space. Hence, carrier diffusion is a mechanism whereby carriers tend to move downhill along concentration gradients, away from regions of high concentration and toward regions of low concentration. 3. A thermally induced process in which one material permeates another. In silicon processing, doping impurities diffuse into the silicon at elevated temperatures to form the desired junctions. The same impurities penetrate silicon dioxide much more slowly, and therefore silicon dioxide on the surface of the silicon acts as a mask to determine the areas into which diffusion occurs. 4. A high-temperature process involving the movement of controlled densities of n-type or p-type impurity atoms into the solid silicon slice in order to change its electrical properties. 5. The process of adding impurities to a semiconductor material in order to affect its characteristics. 6. One method of modifying the impurity doping of a semiconductor crystal, which makes use of the fact that excited dopant atoms, like carriers, have a tendency to diffuse away from regions of high concentration and toward regions of low concentration. The technique involves prolonged exposure of the semiconductor crystal to a concentrated vapor of the dopant at elevated temperatures, whereupon dopant atoms diffuse into the crystal structure. The resulting doping gradient is roughly exponential, with highest density at the surface.

**diffusion and oxidation systems** — Equipment in which nonconductive materials are made semiconductive by diffusing controlled amounts of selected impurities into the surface and oxidizing the surface of silicon selectively to provide a protective or insulative layer. Diffusion and oxidation are accomplished by exposing the silicon wafer to specific atmospheres in a high temperature furnace.

**diffusion bonding** — Formation of a metallurgical joint between similar or dissimilar metals by the process of interdiffusion of atoms across the joint interface in either the solid or liquid state. The term generally is applied to, but is not limited to, solid-state diffusion. The joining surfaces must be brought within atomic distances through the application of pressure.

**diffusion capacitance** — The capacitance of a forward-biased pn junction.

**diffusion constant** — The quotient of diffusion-current density in a homogeneous semiconductor, divided by the charge-carrier concentration gradient. It is equal to the drift mobility times the average thermal energy per unit charge of carriers.

**diffusion current** — 1. The current produced when charges move by diffusion. 2. The flow of a particular type of carrier in a semiconductor due to a concentration difference in that type of carrier. Carriers will flow from an area of high concentration to an area of low concentration.

**diffusion furnace** — System designed for enclosed elevated temperature processing of solid-state devices and systems in gaseous atmospheres. Diffusion furnaces are operated at temperatures from 1000 to 1300°C to achieve

doping of semiconductor substrates by one of a number of processes. Oxidation is a process that puts a protective layer of silicon oxide on the wafer that is used either as an insulator or to mask out certain areas when doping. Deposition systems, of which there are three (liquid, gaseous, solid), are used to deposit impurities on the silicon wafer. Other systems include a drive-in system, used to diffuse impurities into the wafer to a specified level, and an alloy system that is used in a final step of the metallization process.

**diffusion length** — In a homogeneous semiconductor, the average distance the minority carriers move between generation and recombination.

**diffusion process** — Doping of a semiconductor material by injection of an impurity into the crystal lattice at an elevated temperature. Usually, the semiconductor crystal is exposed to a controlled surface concentration of dopants.

**diffusion transistor** — A transistor in which current depends on the diffusion of carriers, donors, or acceptors, as in a junction transistor.

**diffusion under the epitaxial film** — See DUF.

**diffusion window** — In a semiconductor, the opening etched through the oxide to permit the diffusion of the emitter and base.

**digiralt** — A system of high-resolution radar altimetry in which pulse-modulated radar and high-performance time-to-digital conversion techniques are combined.

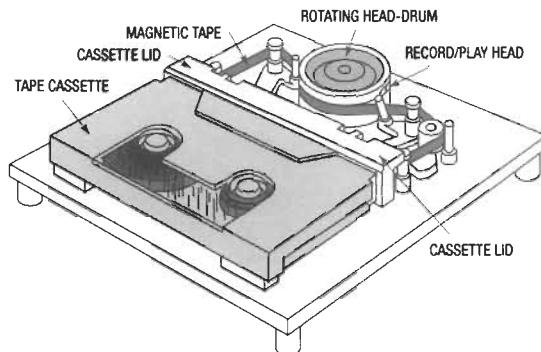
**digit** — 1. One of the symbols, 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9, used in numbering in the scale of 10. One of these symbols, when used in a scale of numbering to the base  $n$ , expresses integral values ranging from 0 to  $n - 1$  inclusive. 2. A character used to represent a nonnegative integer smaller than the radix, e.g., either 0 or 1 in binary notation or 0 to F in hexadecimal. 3. In a dial telephone system, one of the successive series of pulses incoming from a dial for operation of a switching train.

**digital** — 1. Using numbers expressed in digits and in a certain scale of notation to represent all the variables that occur in a problem or calculation. 2. Of or pertaining to the class of devices or circuits in which the output varies in discrete steps (i.e., pulses or on/off operation). 3. Of or pertaining to an element or circuit whose output is utilized as a discontinuous function of its input. 4. Circuitry in which data-carrying signals are restricted to either of two voltage levels, corresponding to logic 1 or 0.5. The representation of numerical quantities by means of discrete numbers. It is possible to express in binary digital form all information stored, transferred, or processed by dual-state conditions; e.g., on/off, open/closed, octal, and BCD values. 5. Referring to communications procedures, techniques, and equipment by which information is encoded as either a binary 1 or a binary 0; the representation of information in discrete binary form, discontinuous in time.

**digital absorbing selector** — A dial switch that sets up and then falls back on the first of two digits dialed; it then operates on the next digit dialed.

**digital audio tape** — Abbreviated DAT. 1. A digital recording audio format that combines the 16-bit audio quality of compact discs with the recording capability of analog cassettes. 2. A stereo tape format that records sound in digital code and is smaller in size than an audio cassette. A 4-mm DAT drive holds over 1 gigabyte of data and is used as a high-capacity backup medium for computers and as a master source medium for sending data to a CD manufacturer.

**digital broadband technology** — The technology used in the transmission of digital signals through fiber-optic cables.



Digital audio tape (DAT) transport system.

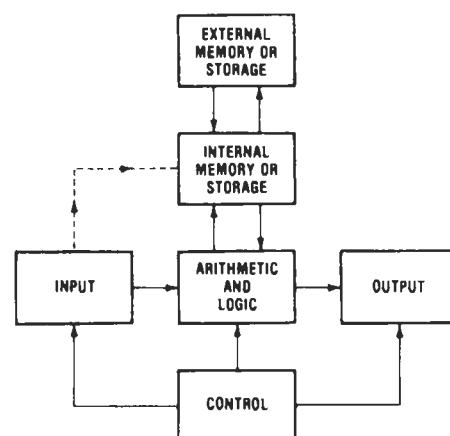
**digital circuit** — 1. A circuit that operates like a switch (it is either on or off) and can make logical decisions. It is used in computers or similar decision-making equipment. The more common families of digital integrated circuits (called logic forms) are RTL, DTL, HTL, ECL, and TTL. 2. A circuit that has only two stable states, operating in the manner of a switch, that is, it is either on or off, or high or low (i.e., high voltage or low voltage).

**digital clock** — A series of synchronized pulses that determine the bit times (data rate) of a digital pattern.

**digital communication** — 1. The transmission of intelligence by the use of encoded numbers—usually uses the binary rather than decimal number system. 2. A system of telecommunications employing a nominally discontinuous signal that changes in frequency, amplitude, or polarity.

**digital communications interface equipment** — Line interface equipment, including modems.

**digital computer** — 1. An electronic calculator that operates with numbers expressed directly as digits, as opposed to the directly measurable quantities (voltage, resistance, etc.) in an analog computer. In other words, the digital computer counts (as does an adding machine); the analog computer measures a quantity (as does a voltmeter). 2. A computer that processes information in numerical form. Electronic digital computers generally use binary or decimal notation and solve problems by repeated high-speed use of the fundamental arithmetic



Digital computer block diagram.

processes of addition, subtraction, multiplication, and division. 3. A computer system in which circuit operation is based on specific signal levels. In a binary digital computer, there are two such signal levels, one at or near zero and the other at a defined voltage. 4. A device that performs sequences of arithmetic and logic operations on discrete data. 5. A type of data-processing equipment that counts, utilizing numbers to express the values and quantities. General-purpose digital computers include central storage units and peripheral control units and are designed to solve a wide class of problems. A common feature of general-purpose equipment is the ability to externally modify the program of instructions. Special-purpose digital computers are not intended for a typical commercial physical environment and include rugged computers for military and space applications. An analog computer measures cost or conditions. Hybrid computers utilize both modes. 6. A computer that solves problems by operating on discrete representing variables by performing arithmetic and logic processes on this data.

**digital data**—1. Data represented in discrete, discontinuous form, as contrasted with analog data represented in continuous form. Digital data is usually represented by means of coded characters (e.g., numbers, signs, symbols, etc.). 2. Any data that is expressed in digits. The term usually implies the use of binary digits.

**digital data-handling system**—The electronic equipment that receives digital data, operates on it in a suitable manner, records it in a suitable manner on a suitable medium, and presents it directly to a computer or a display.

**digital delay line**—See active delay line.

**digital delay module**—See active delay line.

**digital delay unit**—See active delay line.

**digital device**—1. Typically, an IC that switches between two exclusive states or levels, usually represented by logical 1 or 0. 2. An electronic device that processes electrical signals that have only two states, such as on or off, high or low voltages, or positive or negative voltages. In electronics, *digital* normally means binary or two-state.

**digital differential analyzer**—A special-purpose digital computer that performs integration and that can be programmed for the solution of differential equations in a manner similar to that of an analog computer.

**digital disc recording**—An analog disc recording that has been made from a master tape recording that was digitally recorded.

**digital filter**—1. A linear computation or algorithm performed on a selected series in the form of an input signal that produces a new series as output. The computational device may be a specifically designed electronic system or a conventional computer. 2. Network that operates on discrete samples of a signal to achieve a desired transfer-function operation on that signal. Digital filters divide into two classes: nonrecursive filters produce an output that is a function of only the previous and present inputs; recursive filters produce an output that is a function of both the past and present inputs and outputs.

**digital filtering**—1. A computational process or algorithm by which a sampled signal or sequence of numbers, acting as input, is transformed into a second sequence of numbers called the output. The computational process may correspond to high-pass, low-pass, bandpass, or bandstop filtering, integration, differentiation, or something else. The second sequence can be used for further processing, as in a fast-Fourier-transform analyzer, or it can be converted to an analog signal, producing a filtered version of the original analog signal. 2. The process of smoothing, spectrally shaping, or removing noise from a signal. Digital filters are basically mathematical functions

## digital data — digital output

that are performed on the digital data stream; their characteristics can be altered under software control, which adds to their overall flexibility. Finite impulse response (FIR) and infinite impulse response (IIR) are examples of digital filter functions.

**digital frequency monitor**—A special-purpose digital counter that permits a train of pulses to pass through a gate for a predetermined time interval, counts them, and indicates the number counted.

**digital harmonic generation**—Abbreviated DHG. The use of circuit elements whose outputs are discontinuous functions of their inputs to produce signals that are an integral multiple of the (fundamental) input signal.

**digital image analysis**—Technology to measure and standardize the output of a computer-interfaced vidicon system.

**digital imaging**—The process by which an image that is in electronic form (e.g., a bit-mapped graphic) is altered.

**digital information display**—The presentation of digital information in tabular form on the face of a digital information display tube.

**digital integrated circuit**—1. A switching-type integrated circuit. 2. An integrated circuit that processes electrical signals that have only two states, such as on or off, high or low voltages, or positive or negative voltages. In electronics, *digital* normally means binary or two-state. 3. A monolithic group of logic elements. May be small-scale integration (e.g., SSI gates, flip-flops, latches), medium-scale integration (e.g., MSI decoders, adders, counters), or large-scale integration (e.g., LSI memories, microprocessors). 4. A class of integrated circuits that processes digital information (expressed in binary numbers). The processing operations are arithmetic (such as addition, subtraction, multiplication, and division) or logical (in which the circuit senses certain patterns of input binary information and indicates the presence or absence of those patterns by appropriate output binary signals).

**digital integrator**—Device for summing or totalizing areas under curves that gives numerical readout. See also integrator.

**digital logic modules**—Circuits that perform basic logic decisions (AND, OR, NOT); used widely for arithmetic and computing functions, flip-flops, half-adders, multivibrators, etc. See also logic system.

**digitally programmable oscillator**—A voltage-controlled oscillator designed to accept a digital tuning word instead of the usual analog signal. Internal digital-to-analog (d/a) converter circuits transform the digital input to an analog voltage. Tuning-curve linearization is usually accomplished through a digital memory. The frequency speed is primarily limited by the d/a circuits.

**digital modulation**—A method of transmitting human voice or other analog signals using a binary code (0s and 1s). Digital transmission offers a cleaner signal than analog technology.

**digital multimeter**—Abbreviated DMM. A test instrument used to measure voltage, current, and resistance. The readout of measured values is shown on a digital display which is typically a liquid crystal display (LCD).

**digital optical processing**—The scanning of photographs or transparencies of images, either by a vidicon camera or flying-spot scanner, for the conversion of the images to digital form for storage on magnetic tape.

**digital output**—An output signal that represents the size of a stimulus or input signal in the form of a series of discrete quantities that are coded to represent digits in a system of numerical notation. This type of output is to be distinguished from one that provides a continuous output signal.

**digital panel meter**—Abbreviated DPM. 1. A compact electronic measuring system capable of converting an electrical variable into an unambiguous, accurate numerical reading. Consists of a solid-state analog-to-digital converter and a logic-driven numerical display that can provide readings with accuracies of 0.1 to 0.005 percent of full scale, without the need for eye-straining interpolation. 2. A meter with digital-numerical readout, capable of indicating a range of values from zero to rated maximum, in increments of one least-significant digit.

**digital phase shifter**—A device that provides a signal phase shift by the application of a control pulse. A reversal of phase shift requires a control pulse of opposite polarity.

**digital plotter**—An output unit that graphs data via an automatically controlled pen. Data is normally plotted as a series of incremental steps.

**digital position transducer**—A device that converts motion or position into digital information.

**digital programmable delay line**—*See* active delay line.

**digital radio**—1. Microwave radio in which one or more properties (amplitude, frequency, and phase) of the rf carrier are quantized by the modulating signal. 2. Radio whose instantaneous rf carrier can assume one of a discrete set of amplitude levels, frequency shifts, or phase shifts as a result of the modulating signal. 3. Radio in which the rf carrier, or even the baseband signal, is quantized by means of a modem. In such a radio the rf carrier is still quantized, but baseband or intermediate-frequency filtering can be used to provide some bandwidth control and thereby reduce rf filtering requirements. 4. Any radio that transmits a signal whose informational content is, in whole or in part, digital in format.

**digital readout indicator**—An indicator that reads directly in numerical form, as opposed to an analog indicator needle and scale.

**digital recording**—A technique for recording information as discrete points onto magnetic recording media.

**digital rotary transducer**—A rotating device utilizing an optical sensor that produces a serial binary output as a result of shaft rotation.

**digital set top**—Also referred to generically as a set-top unit (STU). Television set-top units that accept digital video as well as analog (traditional) video. Some digital set-top units enable interactivity and therefore support shopping, banking, games, etc.

**digital signal**—1. An electrical signal with two states—on or off, high or low, positive or negative—such as could be obtained from a telegraph key or two-position toggle switch. *Digital* normally means binary or two-state. 2. Representation of information by a set of discrete values in accordance with a prescribed law. These values are represented by numbers.

**digital signals**—1. Discrete or discontinuous signals whose various states are discrete intervals apart. 2. Signals made up of discontinuous pulses whose information is contained in their durations, periods, and/or amplitudes.

**digital signature**—1. A numerical representation of a set of logic states, typically used to describe the logic-state history at one device under test output pin during the complete test program. 2. A personal authentication method based on encryption and secret authorization codes used for “signing” electronic documents.

**digital simulation**—*See* simulation.

**digital speech communications**—Transmission of voice signals in digitized or binary form.

**digital status contact**—A logical (on/off) input used mainly to sense the status of remote equipment in process control systems.

**digital storage oscilloscope**—A special oscilloscope that adapts analog monitoring and recording systems to the capture and analysis of all types of one-shot physical phenomena.

**digital switch**—1. A means to interconnect two or more circuits whose information is represented in digital form, using a time-divided network consisting of nonlinear elements. 2. An automatic switching center capable of switching digital signals. It may be a circuit switch or a message switch.

**digital switching**—Switching of messages digitally by use of integrated electronic circuits for logic and memory, rather than by electromechanical switches.

**digital synthesizer**—A means of generating several different frequencies without using separate oscillators governed by crystals specially ground for each frequency. A digital synthesizer uses only one reference crystal, a phase-locked loop, and a digital counter to generate a large number of stable frequencies. These circuits are used to reduce dependence on individual crystals, which are relatively expensive.

**digital telephone dialer**—An automatic telephone dialer that uses a digital code.

**digital television**—Abbreviated DTV. 1. A television system in which reduction or elimination of picture redundancy is obtained by transmitting only the information needed to define motion in the picture, as represented by changes in areas of continuous white or black. 2. An umbrella term used to describe the digital television system adopted by the FCC in December 1996.

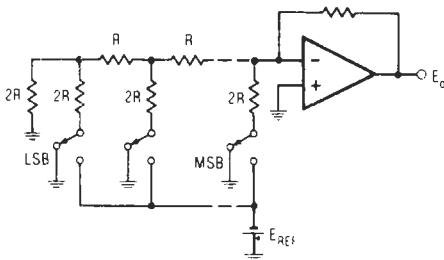
**digital thermometer**—Electronic temperature-measuring device that reads and/or prints out numerically.

**digital-to-analog conversion**—The generation of analog (usually variable-voltage) signals in response to a digital code.

**digital-to-analog converter**—Abbreviated DAC, dac, or d/a converter. 1. A computing device that changes digital quantities into physical motion or into a voltage (i.e., a number output into turns of a potentiometer). 2. A unit or device that converts a digital signal into a voltage or current whose magnitude is proportional to the numeric value of the digital signal. For example:

<i>Digital Input</i>	<i>Analog Output</i>
0101 (binary 5)	2 volts
01010 (binary 10)	4 volts
10100 (binary 20)	8 volts

3. A circuit that accepts the discrete, binary outputs of computers and changes them into continuous analog quantities. In general, DACs convert mathematical results into usable electrical quantities. Digital-to-analog converters are used to generate and modulate waveforms, stimulate devices under test, drive motors, or display information. They have applications in process and industrial control systems, cathode-ray-tube displays, and digitally programmed power supplies. Most DACs consist of three major blocks: a precision reference, a set of resistors forming a ladder network, and switches that connect or disconnect the resistor ladder and the reference. Some DACs also include an output amplifier that buffers the current from the ladder and interfaces it to the circuits at the DAC's output. 4. An interface that converts data in a digital form to data in analog form. Used to permit analog output from a digital computer.



Digital-to-analog converter.

**digital-to-disc recording**—A recording technique in which a digital master tape is transferred to a conventional master lacquer disc for the manufacturing of phonograph records.

**digital transmission**—1. A mode of transmission in which all information to be transmitted over the facility is first converted into digital form and then sent down the line as a stream of pulses. (Such transmission may imply a serial bit stream, but parallel forms are also possible.) When noise and distortion threaten to destroy the integrity of the pulse stream, the pulses are detected and regenerated. 2. The transmission of a signal in which information is represented by a code of discrete elements. Compare with *analog transmission*.

**digital versatile disc**—See DVD.

**digital video disc**—See DVD.

**digital voltmeter**—1. An indicator that provides a digital readout of measured voltage rather than a pointer indication. 2. An electronic instrument that converts an analog voltage of unknown magnitude into a digital display of known value.

**digit compression**—In a computer, any of several techniques used to pack digits.

**digitization**—1. The conversion of black-and-white artwork and continuous-tone photographs to a series of binary numbers that can be stored and processed in a computer system. 2. The process of converting analog video, images, or audio into digital format (i.e., 1s and 0s).

**digitize**—1. To transform information from the analog (continuous wave-like signal) into a digital format, i.e., into a series of 1s and 0s. 2. To convert an image or signal into digital code for input into a computer; to scan an image, trace a picture on a graphics tablet, or convert camera images. 3. To convert an analog measurement of a physical variable into a number expressed in digits in a scale or notation. 4. To translate a quantitative measurement into a coded numerical equivalent. 5. To convert drawing or picture information into digital form.

**digitized image**—An image that has been converted into a series of discrete units that are represented in a computer by the binary digits 1 and 0; such an image can then be manipulated for various purposes.

**digitized speech**—A numerical representation of speech in which the amplitude of the speech waveform has been recorded at regular intervals. Speech is typically sampled from 8000 to 12,500 times per second.

**digitizer**—1. A device that converts analog data into numbers expressed in digits in a system of notation. 2. A device that transforms graphical data into planar coordinate information that can be read and understood by a computer. These coordinates are usually presented as *x* and *y* coordinates based on the position of a cursor on the surface, or platen, of the digitizer. The cursor has a viewing area with a crosshair for alignment with the point of interest on the document, and is

## digital-to-disc recording — D-indicator

coupled either mechanically or electrically to a position-sensing device that provides the positional information to the computer. 3. A device that converts coordinate information into numeric form readable by a digital computer. 4. A computer peripheral device that converts an analog electrical signal into numeric form readable by a digital computer. 5. A device that translates input into digital form, to make it possible, for example, to enter sketches into a computer.

**digitizing**—1. The process of converting an analog signal to a digital signal. 2. Any method of reducing feature locations on a flat plane to digital representation of *x* and *y* coordinates. 3. The process of converting graphic representations, such as pictures and drawings, into digital data that can be processed by a computer system.

**digitron display**—In a calculator, a type of display in which all digits appear in the same plane. Similar to mosaic lamp display.

**digit selector**—In a computer, a device for separating a card column into individual pulses that correspond to punched row positions.

**digit-transfer bus**—The main wire or wires used to transfer information (but not control signals) among the various registers in a digital computer.

**diheptal base**—Also called diheptal socket. A vacuum-tube base having 14 pins (such as the base of a cathode-ray tube).

**diheptal socket**—See diheptal base.

**DILC**—Dielectrically isolated integrated circuits. Devices isolated from each other by a layer of dielectric insulation, usually glass, rather than by the more conventional reverse-biased pn junction. This “insulated substrate” structure is far more radiation resistant than junction-isolated units, making DILCs valuable in military and aerospace applications.

**dimensional stability**—1. The ability of a body to maintain precise shape and size. 2. A measure of dimensional change caused by such factors as temperature, humidity, chemical treatment, age, or stress, usually expressed as units per unit.

**dimension ratio (L/D)**—The ratio of the length of a magnet in the direction of magnetization to its diameter. Or, the ratio of the length of the magnet to the diameter of a circle having an area equal to the cross-sectional area of the magnet. Used as figure of merit to find a magnet's composite permeance coefficient.

**diminished-radix complement**—See radix-minus-one complement.

**dimmer**—1. A device for controlling the amount of light emitted by a luminaire. Common types employ resistance, autotransformer, magnetic amplifier, silicon-controlled rectifier or semiconductor, thyratron, or iris control elements. 2. An electric or electronic device that regulates the voltage going to a light source as a means of varying the intensity of the light emitted by the source.

**dimmer curve**—The performance characteristic of a light dimmer expressed as a graph of the light output of a dimmer-controlled lamp versus the setting of the control in terms of an arbitrary linear scale of 0 to 10.

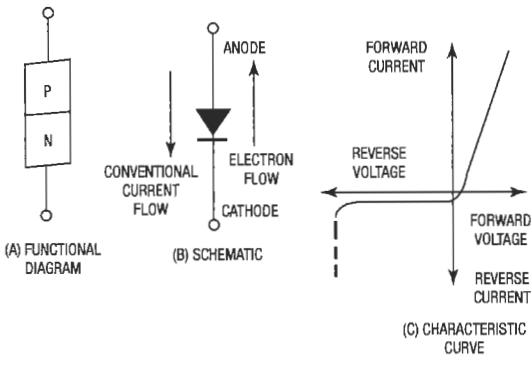
**DIN**—1. The abbreviation for the association in West Germany that determines the standards for electrical and other equipment in that country, Deutsches Institut für Normung (German Institute for Standards). Similar to the American National Standards Institute. 2. A set of standards and specifications promulgated by German manufacturers and covering such audio-related matters as connectors, frequency weighting, measurement techniques, and specifications.

**D-indicator**—A radar indicator that combines types B and C indicators. The signal appears as a bright spot, with azimuth angle as the horizontal coordinate and

elevation angle as the vertical coordinate. Each horizontal trace is expanded vertically by a compressed time sweep to facilitate separation of the signal from noise and to give a rough range indication.

**DIN jack**—A system of multipin jacks and plugs allowing several connections to be made at once. Named after the German Institute for Standards (DIN).

**diode**—1. An electron tube having two electrodes: a cathode and an anode. 2. See crystal diode. 3. A two-element electron tube or solid-state device. Solid-state diodes are usually made of either germanium or silicon and are primarily used for switching purposes, although they can also be used for rectification. Diodes are usually rated at less than one-half ampere. 4. A two-terminal electronic device that will conduct electricity much more easily in one direction than in the other. 5. A semiconductor device with two terminals and a single junction, exhibiting varying conduction properties depending on the polarity of the applied voltage. 6. A two-terminal semiconductor device exhibiting a nonlinear voltage-current characteristic; it has the asymmetrical voltage-current characteristic exemplified by a single pn junction.



Diode.

**diode amplifier**—A parametric amplifier that uses a special diode in a cavity. Used to amplify signals at frequencies as high as 6000 MHz.

**diode assembly**—A single structure of more than one diode.

**diode characteristic**—The composite electrode characteristic of a multielectrode tube, taken with all electrodes except the cathode connected together.

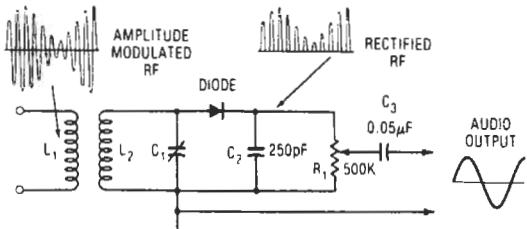
**diode demodulator**—Also called diode detector. A demodulator in which one or more semiconductor or electron-tube diodes are used to provide a rectified output that has an average value proportional to the original modulation.

**diode detector**—See diode demodulator.

**diode gate**—An AND gate that uses diodes as switching elements.

**diode isolation**—A method in which a high electrical resistance between an IC element and the substrate is obtained by surrounding the element with a reverse-biased pn junction.

**diode laser**—Also called laser diode, injected laser, coherent electroluminescence device, semiconductor laser. A pn junction semiconductor electron device that converts direct forward-bias electrical input (pump power) directly into coherent optical output power via a process of stimulated emission in the region near the junction.



Diode detector.

**diode limiter**—A circuit employing a diode and used to prevent signal peaks from exceeding a predetermined value.

**diode logic**—An electronic circuit using current-steering diodes in an arrangement such that the input and output voltages have relationships that correspond to AND or OR logic functions.

**diode matrix**—1. A two-dimensional array of diodes used for a variety of purposes, such as decoding and read-only memory. 2. A hardware pattern in which diode leads may be inserted to change solid-state control logic.

**diode mixer**—A diode that mixes incoming radio-frequency and local-oscillator signals to produce an intermediate frequency.

**diode modulator**—A modulator in which one or more diodes are employed to combine a modulating signal with a carrier signal. It is used chiefly in low-level signaling because it has inherently poor efficiency.

**diode pack**—A combination of two or more diodes integrated into a solid block.

**diode peak detector**—A diode used in a circuit to indicate when audio peaks exceed a predetermined value.

**diode-pentode**—A vacuum tube having a diode and a pentode combined in the same envelope.

**diode rectification**—The conversion of an alternating current into a unidirectional current by means of a two-element device such as a crystal, vacuum tube, etc.

**diode switch**—A diode in which positive and negative biasing voltages (with respect to the cathode) are applied in succession to the anode in order to pass and block, respectively, other applied waveforms within certain voltage limits. In this way, the diode acts as a switch.

**diode-transistor logic**—Abbreviated DTL. 1. A logic circuit that uses diodes at the input to perform the electronic logic function that activates the circuit transistor output. In monolithic circuits, the DTL diodes are a positive-level logical AND function or a negative-level OR function. The output transistor acts as an inverter to result in the circuit becoming a positive NAND or a negative NOR function. 2. Any logic gate circuit that uses several diodes to perform the AND or OR function, followed by one or more transistors to add power to (and possibly invert) the output. Formerly very popular in digital systems, but now largely superseded by TTL circuits. 3. Logic employing diodes at the input with transistors used as amplifiers and resistor pull-up on the output.

**diode-triode**—A vacuum tube having a diode and triode combined in the same envelope.

**diopter**—1. The unit of optical measurement that expresses the refractive power of a lens or prism. 2. A measure of lens power equal to the reciprocal of the lens focal length in meters.

**dip**—1. A drop in the plate current of a class C amplifier as its tuned circuits are being adjusted to resonance. 2. The angle between the direction of the

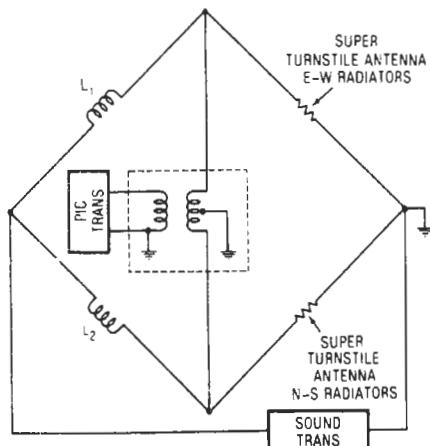
earth's magnetic field and the horizontal as measured in a vertical plane.

**DIP**—Abbreviation for dual in-line package.

**dip coating**—1. A method of applying an insulating coating to a conductor by passing it through an applicator containing the insulating medium in liquid form. The insulation is then sized and passed through ovens to solidify. This medium can be used for magnet wire. 2. A process of applying a relatively thin (less than 50 mils) conformal coating to a part or assembly. The final coating thickness is determined by the viscosity of the coating material, rate of withdrawal, temperature, and the number of coats. 3. Method in which an object is coated by dipping into plastisol or organosol.

**dip encapsulation**—A type of conformal coating. An embedding process in which the insulating material is applied by immersion and without the use of an outer container. The coating conforms generally with the contour of the embedding part or assembly.

**diplexer**—1. A coupling unit that allows more than one transmitter to operate together on the same antenna. 2. A device that enables two (radio) transmitters operating at different frequencies to use the same antenna simultaneously.



Diplexer circuit.

**diplex operation**—1. The simultaneous transmission or reception of two messages from a single antenna or on a single carrier. 2. The operation of two radio transmitters on different frequencies into the same antenna simultaneously.

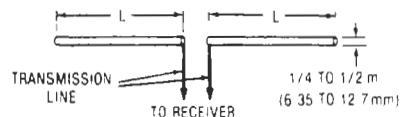
**diplex radio transmission**—Simultaneous transmission of two signals by using a common carrier wave.

**diplex reception**—The simultaneous reception of two signals having some feature in common, for example, a single receiving antenna or a single carrier frequency.

**dipole**—1. A molecule that has an electric moment. For a molecule to be a dipole, the effective center of the positive charges must be at a different point than the center of the negative charges. 2. A form of speaker that radiates in approximately equal amounts to the rear and the front. 3. See dipole antenna.

**dipole antenna**—Also called dipole. A straight radiator usually fed in the center. Maximum radiation is produced in the plane normal to its axis. The length specified is the overall length.

## DIP — direct broadcast satellite



$$2L = 1/2 \text{ WAVELENGTH} \times 0.95$$

$$L(\text{ft}) = 234/\text{FREQ(MHz)}$$

$$L(\text{cm}) = 7224/\text{FREQ(MHz)}$$

Dipole antenna.

**dipole disc feed**—An antenna, consisting of a dipole near a disc, used to reflect energy to the disc.

**dipping**—The process of impregnating or coating insulating materials or windings by the simple method of immersion in the liquid insulating material. A step in the process of treating insulating materials or electrical components by immersion in a liquid insulation, followed by draining and curing to provide increased electrical and mechanical protection.

**dip soldering**—1. The process of soldering component leads, terminals, and hardware to the conductive pattern on the bottom of a printed circuit board by dipping that side into molten solder or floating it on the surface. 2. A process of joining metals, previously cleaned and fluxed, by immersing them wholly or partially into molten solder. The filling of the joint is by capillary attraction. 3. A process whereby items to be soldered are brought in contact with the surface of a static pool of molten solder for the purpose of soldering the entire exposed conductive pattern in one operation. 4. Soldering by dipping fluxed and fixtured parts in a solder pot. 5. The simplest form of mass soldering. It involves the lowering of a prefluxed assembly onto a solder bath surface. The assembly is then submerged sufficiently for the solder to spread and form the required joints but not flow over the top surface of a printed wiring board.

**dip solder terminal**—The terminals on a connector that are inserted into holes in the printed circuit board and then soldered in place.

**direct**—A method of expressing an absolute address in an MPU instruction where the actual address would be specified in hexadecimal in the instruction.

**direct access**—The process of storing data in, or getting data from, a storage device in such a manner that surrounding data need not be scanned to locate the desired data. The time required to get desired data from the storage device is independent of the location of the data.

**direct-access device**—See random-access device.

**direct-access file**—A file in which each record may be accessed directly, regardless of its relative position in the file.

**direct-access storage**—Also called random-access storage. Pertaining to the process of obtaining data from or placing data into storage in which the time required for such access is independent of the location of the data most recently obtained or placed in storage.

**direct-acting recording instrument**—An instrument in which the marking device is mechanically connected to or directly operated by the primary detector.

**direct address**—An address that specifies the location in a computer of an instruction operand.

**direct addressing**—The standard addressing mode in a computer. It is characterized by an ability to reach any point in main storage directly. Direct addressing is sometimes restricted to the first 256 bits in main storage.

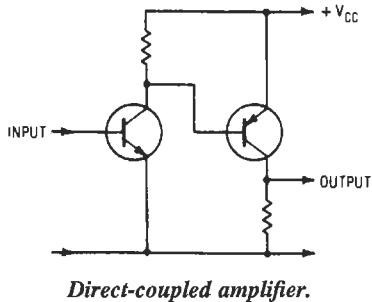
**direct broadcast satellite**—Abbreviated DBS. 1. A satellite that allows the use of inexpensive home

reception dishes to receive its high-power signals, including software and data. 2. A term commonly used to describe Ku-band broadcasts via satellite directly to individual end users. The DBS band ranges from 11.7 to 12.75 GHz.

**direct capacitance**—1. The capacitance between two conductors, excluding stray capacitance that may exist between the two conductors and other conducting elements. 2. The capacitance measured directly from conductor to conductor through a single insulating layer.

**direct-connect modem**—A modem that connects directly to a phone line via modular connectors, rather than going through a telephone headset and an acoustic coupler.

**direct-coupled amplifier**—1. A direct-current amplifier in which the plate of one stage is coupled to the grid of the next stage by a direct connection or a low-value resistor. 2. An amplifier in which the output of one stage is connected to the input of the next stage without the use of intervening coupling components.



Direct-coupled amplifier.

**direct-coupled transistor logic**—Abbreviated DCTL. A NOR-gate type of bipolar logic in which the output of one gate is coupled directly to the input of the succeeding gate. This form of logic evolved into resistor-transistor logic because of the difficulty in mass producing transistors within the close tolerances necessary for direct coupling.

**direct coupling**—1. The association of two or more circuits by means of an inductance, a resistance, a wire, or a combination of these so that both direct and alternating currents can be coupled. 2. Interstage coupling or speaker coupling with no intervening transformer or capacitor. To the speaker it ensures that the damping factor remains high at low frequencies (but increasing power supply impedance at low frequencies can influence this), while direct coupling generally minimizes low-frequency phase shift and encourages enhanced bass performance. 3. The connection of two circuits in such a way that both ac and dc currents can flow. Neither a transformer nor a capacitor can be used in series with the signal-carrying wires since these components do not pass dc.

**direct current**—Abbreviated dc. 1. An essentially constant-value current that flows in only one direction. 2. A flow of continuous electric current in one direction as long as the circuit is closed (as opposed to alternating current). 3. A current that flows in only one direction in an electric circuit. It may be continuous or discontinuous, and may be constant or varying.

**direct-current amplifier**—Also called dc amplifier. An amplifier capable of boosting dc voltages. Resistive coupling only is generally employed between stages, but sometimes will be combined with other forms.

**direct-current erasing head**—A head that uses direct current in magnetic recording to produce the magnetic field required for erasure. Direct-current erasing is achieved by subjecting the medium to a unidirectional field. Such a medium is therefore in a different magnetic state from one erased by alternating current.

**direct-current generator**—1. A rotating machine that changes mechanical into electrical energy in the form of direct current. This is accomplished by commutating bars on the armature. The bars make contact with stationary brushes, from which the direct current is taken. 2. A rotary machine having a commutator that generates direct current when its armature is rotated in a magnetic field by an engine or motor. The commutator reverses the alternating current generated in the armature winding to produce direct current at the machine's output terminals.

**direct-current resistance**—Abbreviated DCR. The resistance offered by any circuit to direct current.

**direct-current restorer**—The means by which a direct-current or low-frequency component is reinserted after transmission. Used in a circuit incapable of transmitting slow variations, but capable of transmitting components of higher frequency.

**direct-current transmission**—Of television, that form of transmission in which a fixed setting of the controls makes any instantaneous value of signal correspond to the same value of brightness at all times.

**direct data entry**—The entry of data directly into a computer through machine-readable source documents or through the use of online terminals.

**direct digital control**—Time-sharing, or multiplexing, of a computer among many controlled loops.

**direct distance dialing**—Abbreviated DDD. 1. A telephone exchange service that enables the telephone user to call other subscribers outside his or her local area without operator assistance. 2. Direct distance dialing by subscribers over the nationwide intertoll telephone network. *See also* area code.

**direct drive**—A drive system used to rotate a turntable, in which the platter is driven directly by the motor shaft at the exact speed required. These designs usually include electronic motor control.

**direct-drive torque motor**—A servoactuator that can be directly attached to the load it is to drive. It converts electrical signals directly into sufficient torque to maintain the desired accuracy in a positioning or speed control system.

**direct electromotive force**—A unidirectional electromotive force in which the changes in values are either zero or so small that they may be neglected.

**direct grid bias**—The dc component of grid voltage; commonly called grid bias.

**direct-insert subroutine**—*See* open subroutine.

**direct inward dialing**—A service allowing outside parties to call directly to extensions on the customer's premises.

**direction**—The position of one point in space with respect to another.

**directional**—Having radiative characteristics that vary with direction.

**directional antenna**—An antenna that radiates radio waves more effectively in some directions than in others. (The term is usually applied to an antenna whose directivity is larger than that of a half-wave dipole.)

**directional beam**—An electromagnetic wave that is concentrated in a given direction.

**directional coupler**—1. A junction consisting of two waveguides coupled together in such a manner that a traveling wave in either guide will induce a traveling wave in the same direction in the other guide. 2. A bilateral

electrical network that may be used as a hybrid power splitter, power adder, or mixer.

**directional filter**—Also called directional separation filter. A filter used to separate the two frequency ranges in a carrier system in which one range of frequencies is used for transmission in one direction and another range of frequencies for transmission in the opposite direction.

**directional gain**—See directivity index.

**directional homing**—The procedure of following a path in such a way that the target is maintained at a constant relative bearing.

**directional hydrophone**—A hydrophone having a response that varies significantly with the direction of incidence of sound.

**directional lobe**—See lobe.

**directional microphone**—1. A microphone whose response varies significantly with the direction of sound. See also bidirectional microphone; semidirectional microphone; unidirectional microphone. 2. A microphone that is more sensitive to sounds coming from certain directions than to sounds coming from other directions. Such microphones can be aimed so their most sensitive sides face the sound source, while their least sensitive sides face sources of noise or other undesired sound. See cardioid microphone; figure-8 microphone.

**directional pattern**—Also called radiation pattern. A graphical representation of the radiation or reception of an antenna as a function of direction. Cross sections are frequently given as vertical and horizontal planes, and principal electric and magnetic polarization planes.

**directional phase shifter**—A passive phase-shifting device in which the phase change for transmission in one direction is different from the phase change for transmission in the opposite direction.

**directional power relay**—A device that functions on a desired value of power flow in a given direction, or upon reverse power resulting from arcback in the anode or cathode circuits of a power rectifier.

**directional relay**—A relay that functions in conformance with the direction of power, voltage, current, pulse rotation, etc. See also polarized relay.

**directional separation filter**—See directional filter.

**direction angle**—The angle between the antenna base line and a line connecting the center of the base line with the target.

**direction cosine**—The cosine of the angle between the base line and the line from the center of the base line to the target.

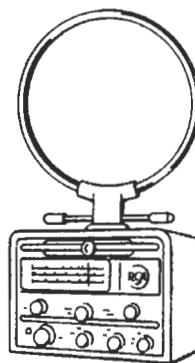
**direction finder**—Abbreviated df. Also called radio compass. Apparatus for receiving radio signals and taking their bearings in order to determine their points of origin.

**direction finding**—The principle and practice of determining a bearing by radio means, using a discriminating antenna system and a radio receiver so that the direction of an arriving wave, and ostensibly the direction or bearing of a distant transmitter, can be determined.

**direction of lay**—1. The lateral direction in which the strands of a conductor run over the top of the cable conductor as they recede from an observer looking along the axis of the conductor or cable. Also applies to twisted cable. 2. The direction, either right-hand (clockwise) or left-hand (counterclockwise), in which a conductor or group of conductors spiral around a cable core as they travel away from the observer.

**direction of polarization**—For a linearly polarized wave, the direction of the electrostatic field.

**direction of propagation**—At any point in a homogeneous, isotropic medium, the direction of the time-average energy flow. In a uniform waveguide, the



Direction finder.

direction of propagation is often taken along the axis. In a uniform lossless waveguide, the direction of propagation at every point is parallel to the axis and in the direction of time-average energy flow.

**direction rectifier**—A rectifier that supplies a direct-current voltage, the magnitude and polarity of which are determined by the magnitude and relative polarity of an alternating-current selsyn error voltage.

**directive gain**—In a given direction,  $4\pi$  times the ratio of the radiation intensity to the total power radiated by the antenna.

**directivity**—1. The property that causes an antenna to radiate or receive more energy in some directions than in others. 2. The value of the directive gain of an antenna in the maximum-gain direction. 3. The ability of an antenna to pick up signals from one general direction (usually from the front) and effectively reject those from other directions (usually from the back and sides). The front-to-back ratio is one measure of an antenna's directivity. 4. A tendency for some microphones to respond less strongly to sounds arriving from the sides and/or rear. Directional microphones are useful in discriminating on the basis of direction between wanted sounds (musical instruments) and unwanted sounds (audience noises). Directivity is typically graphed on a polar pattern, and is thus classed as nondirectional (omnidirectional), bidirectional (figure-8), or unidirectional (cardioid), supercardioid, or hyperdirective.

**directivity diagram of an antenna**—The graphical representation of the gain of an antenna in the different directions of space.

**directivity factor**—1. In acoustics, the directivity factor is equivalent to directivity, as applied to an antenna. 2. Of a transducer used for sound emission, the ratio of the intensity of the radiated sound at a remote point in a free field on the principal axis to the average intensity of the sound transmitted through a sphere passing through the remote point and concentric with the transducer. 3. Of a transducer used for sound reception, the ratio of the square of the electromotive force produced in response to sound waves arriving in a direction parallel to the principal axis of the transducer to the mean square of the electromotive force that would be produced if sound waves having the same frequency and mean square pressure were arriving at the transducer simultaneously from all directions with random phase. The frequency should be specified in both cases.

**directivity index**—Also called directional gain. A measure of the directional properties of a transducer. It is the ratio, in decibels, of the average intensity or response over the whole sphere surrounding the projector

or hydrophone to the intensity or response on the acoustic axis.

**directivity of a directional coupler**—Ratio of the power measured at the forward-wave sampling terminals with only a forward wave present in the transmission line to the power measured at the same terminals when the forward wave reverses direction. This ratio is usually expressed in dB and would be infinite for a perfect coupler.

**directivity of an antenna**—The ratio of the maximum field intensity to the average field intensity at a given distance, implying a maximum value.

**directivity pattern**—A plot of the response of an electroacoustic transducer as a function of direction.

**directivity signal**—A spurious signal present in the output of any coupler because its directivity is not infinite.

**direct light**—Light from a luminous object such as the sun or an incandescent lamp, as opposed to reflected light.

**direct lighting**—A system of lighting that delivers a majority of light in useful directions without being deflected from the ceiling or walls. Any lamp equipped with a glass or metal reflector arranged to reflect the light toward the object to be illuminated is classified as direct lighting.

**directly grounded**—See solidly grounded.

**directly heated cathode**—A wire, or filament, designed to emit the electrons that flow from cathode to plate. This is done by passing a current through the filament; the current heats the filament to the point at which electrons are emitted. In an indirectly heated cathode, the hot filament raises the temperature of a sleeve around the filament; the sleeve then becomes the electron emitter.

**direct material**—A semiconductor material in which electrons move directly from the conduction band to the valence band to recombine with holes. The process of recombination conserves energy and momentum.

**direct memory access**—Abbreviated DMA. 1. A technique that permits a peripheral device to enter or extract blocks of data from a microcomputer memory without involving the central processing unit. In some cases, a CPU can perform other functions while the transfer occurs. 2. A method of I/O data transfer that does not alter minicomputer instruction-execution flow. The peripheral "steals" memory or CPU cycles to transfer data. 3. A mechanism that allows an input/output device to take control of the CPU for one or more memory cycles in order to write into memory or read from memory. The order of executing the program steps (instructions) remains unchanged. 4. Direct access to a block of memory by more than one system. 5. The technique generally used to transfer blocks of data between a peripheral and random-access memory. It is called direct because the host does not handle the data during the transfer operation. 6. A method of transferring blocks of data directly between an external device and system memory without the need for CPU intervention. This method significantly increases the data transfer rate and hence system efficiency. See also cycle stealing.

**direct metal mask**—A metal mask made by etching a pattern into a sheet of metal.

**direct numerical control**—A system connecting a set of numerically controlled machines to a common memory for part program or machine program storage with provision for on-demand distribution of data to the machines. Direct numerical control systems have additional provisions for collection, display, or editing of part programs, operator instructions, or data related to the numerical control process.

**director**—1. A parasitic antenna element located in the general direction of the major lobe of radiation for the purpose of increasing the radiation in that direction. 2. Equipment in common-carrier telegraph message switching systems, used to make cross-office selection and connection from an input-line to an output-line equipment in accordance with addresses in the message. 3. A telephone switch that translates the digits dialed into the directing digits actually used to switch the call. 4. Electromechanical equipment that is used to track a moving target in azimuth and angular height and that, with the addition of other necessary information from an outside source such as a radar set or a range finder, continuously computes firing data and transmits them to the guns. 5. In a machine-tool or process control system, the part of the system that receives the command signals from a controller and converts and amplifies these signals to make them usable by the control devices in the machine or process. 6. In a liquid crystal system, a local symmetry axis around which the long-range order of the crystal is aligned. For the nematic phase, the molecular long axis is—on average—parallel to the director.

**directory**—Also called a catalog. 1. A table of contents designed to allow convenient access to specific files. 2. A file containing information concerning the other files on a mass-storage device. 3. In the logical format of a disk or disc, a branch of the information tree containing other directories (subdirectories) and/or files. 4. An index of the files on a disk. A directory can contain individual files in addition to other directories.

**direct outward dialing**—Abbreviated DOD. 1. Dialing of a call into the city system from a PAX/PABX extension without the help of an operator. Usually accomplished by first dialing the digit 9. 2. The dialing of a call from a local system into a toll network without the help of an operator.

**direct pickup**—Transmission of television images without resorting to an intermediate magnetic or photographic recording.

**direct piezoelectricity**—A name sometimes given to the piezoelectric effect in which an electric charge is developed on a crystal by the application of mechanical stress.

**direct point repeater**—A telegraph repeater in which the relay controlled by the signals received over a line sends corresponding signals directly into another line or lines without the use of any other repeating or transmitting apparatus.

**direct radiative transition**—A transition that involves photons alone. See transition, 1.

**direct radiator**—A speaker that is not horn loaded. The term usually refers to a cone-type speaker, as opposed to a compression driver/horn assembly.

**direct-radiator speaker**—A speaker in which the radiating element acts directly on the air instead of relying on any other element such as a horn.

**direct recording**—1. The production of a visible record without subsequent processing, in response to received signals. 2. Analog recording in which continuous amplitude variations are recorded linearly through the use of ac bias.

**direct-recording magnetic tape**—A method of recording using a high frequency bias in which the electrical input signal is applied to the recording head without alteration.

**direct/reflected speaker**—A form of speaker in which a small part of the total output is radiated directly forward, with the major part reflected from the wall behind the speaker.

**direct resistance-coupled amplifier**—An amplifier in which the plate of one stage is connected

**direct route — discharge lamp**

either directly or through a resistor to the control grid of the next stage, with the plate-load resistor being common to both stages. Used to amplify small changes in direct current.

**direct route**—In wire communications, the trunks that connect two switching centers, regardless of the geographical path the actual trunk facilities may follow.

**direct scanning**—A scanning technique in which the object is illuminated the entire time, and in which picture elements of the object are viewed singly by the television camera.

**direct sound wave**—A wave emitted from a source in an enclosure prior to the time the wave has undergone its first reflection from a boundary of the enclosure. Frequently a sound wave is said to be direct if it contains reflections that have occurred from surfaces within about 0.05 second after the sound was first emitted.

**direct synthesizer**—1. A frequency synthesizer producing an output frequency that is related to the reference frequency by the ratio of two integers. The primary advantage of this type of synthesizer lies in its ability to change output frequencies at a moderately fast rate (typically in the microsecond range) and in a random way. Principal applications include frequency-agile radars, secure communication links, and electronic countermeasures. 2. Derives an output from one or more fixed-frequency reference oscillators, using combinations of frequency division, multiplication, mixing, summing, and filtering.

**direct-to-disc recording**—A technique in which a live performance is recorded directly onto the master lacquer disc for manufacturing of phonograph records.

**direct voltage**—Also called dc voltage. A voltage that forces electrons to move through a circuit in the same direction and thereby produce a direct current.

**direct wave**—1. A wave that is propagated directly through space, as opposed to one that is reflected from the sky or ground. 2. A radio wave that travels from the transmitting antenna to the point of reception without reflection or refraction.

**direct Wiedemann effect**—See Wiedemann effect.

**direct-wire circuit**—A supervised protective signaling circuit usually consisting of one metallic conductor and a ground return and having signal-receiving equipment responsive to either an increase or a decrease in current.

**direct writing galvanometer recorder**—Recorder using a pen attached directly to a galvanometer movement for direct writing of signals of frequencies up to about 300 Hz.

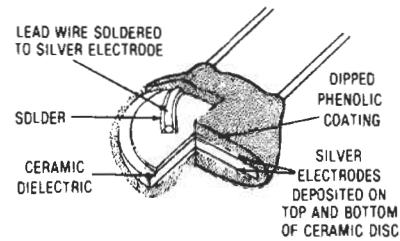
**disable**—To prevent the passage of binary signals by application of the proper signal to the disable terminal of a device.

**disassemblers**—Programs that do the opposite of compiler programs. Given a machine-code program listing, the disassembler turns it back into an assembly listing, with mnemonic representations, for troubleshooting purposes.

**disassembly**—1. Retranslation of machine language into mnemonics during debugging. 2. Translation of binary machine code into assembly-language statements.

**disc**—1. A phonograph record. 2. The blank used in a recorder. See also disk.

**disc capacitor**—A small disc-shaped capacitor with a ceramic dielectric, generally used for bypassing or for temperature compensation in tuned circuits.



*Disc (ceramic) capacitor.*

**disc files**—A type of storage medium consisting of numbers of discs that rotate; each disc has a special coating for retaining stored information.

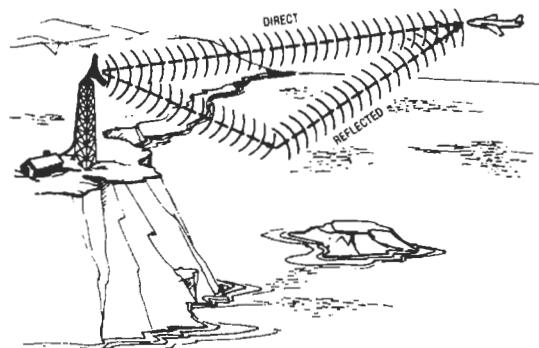
**disc generator**—A capacitive-charge type of voltage generator.

**discharge**—1. In a storage battery, the conversion of chemical energy into electrical energy. 2. The release of energy stored in a capacitor when a circuit is connected between its terminals. 3. The conversion of dielectric stress of a capacitor into an electric current.

**discharge breakdown**—Breakdown of a material as a result of degradation due to gas discharges.

**discharge key**—A device for switching a capacitor suddenly from a charging circuit to a load through which it can discharge.

**discharge lamp**—A lamp containing a low-pressure gas or vapor that ionizes and emits light when an electric discharge is passed through it. Fluorescent materials are sometimes used on the inside of the glass envelope to



*Direct waves.*

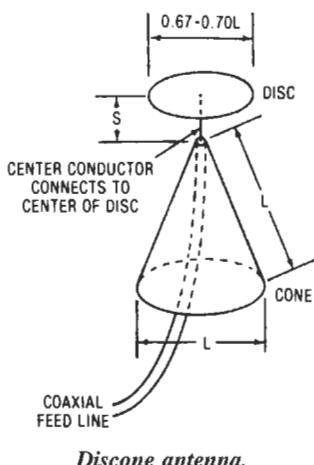
increase the illumination, as in an ordinary fluorescent lamp.

**discharge rate** — The amount of current a battery will deliver over a given period of time. A slower discharge rate generally results in more efficient use of a battery.

**discharge tube** — A tube containing a low-pressure gas that passes a current whenever sufficient voltage is applied.

**discharge voltage** — Also called clamping voltage. The maximum peak voltage measured across suppressor device terminals when subjected to peak pulse current.

**discone antenna** — A special form of biconical antenna in which the vertex angle of one cone is 180°.



Discone antenna.

**disconnect** — Also called release. 1. To break an electric circuit. 2. To remove the power from an electrical device (colloquially, "to unplug the device"). 3. To disengage the apparatus used in a connection and to restore it to its ready condition when not in use. 4. A device or group of devices that removes electrical continuity from between the conductors of a circuit and the source of supply.

**disconnecting means** — A device whereby the current-carrying conductors of a circuit can be disconnected from their source of supply.

**disconnector release** — A device that disengages the apparatus used in a telephone connection to restore it to the condition in which it exists when not in use.

**disconnect signal** — 1. A signal sent from one end of a trunk or subscriber line to indicate at the other end that the established connection should be released. 2. The on-hook signal in a telephone system by which the calling and called terminals notify the switching equipment that an established connection is no longer needed and should be released.

**disconnect switch (motor circuit switch)** — A switch intended for use in a motor branch circuit. It is rated in horse power and is capable of interrupting the maximum operating overload current of a motor of the same rating at the rated voltage.

**discontinuity** — 1. A broken connection, or the loss of a specific connection characteristic. 2. The temporary interruption or variation in current or voltage. 3. A point of abrupt change in the impedance of a circuit, where wave reflections can occur.

**discontinuous amplifier** — An amplifier that reproduces an input waveform on some type of averaging basis.

**disc pack** — A set of magnetic discs that can be removed from a disc storage as one unit.

**disc recorder** — A recording device in which the sounds are mechanically impressed onto a disc; as opposed to a tape recorder, which impresses the sound magnetically on a tape.

**discrete** — 1. An individual circuit component, complete in itself, such as a resistor, diode, capacitor, or transistor, and used as an individual and separable circuit element. 2. Pertaining to distinct elements, such as characters, or to representation by means of distinct elements. 3. A term applied to four channels when there are four electrically independent signals, as opposed to matrix. 4. A quad disc or record-playback method that keeps four signals separate, distinct, and independent from recording to playback. 5. Having an individual identity. Fabricated prior to installation and/or separately packaged, not part of an integrated circuit.

**discrete circuit** — 1. A circuit built from separate components that are individually manufactured, tested, and assembled. 2. Electronic circuit built of separate components (transistors, resistors, etc.) connected by wiring or printed-circuit etched conductors.

**discrete component** — 1. A component that has been fabricated prior to its installation (e.g., resistors, capacitors, diodes, and transistors). 2. A circuit component having an individual identity, such as a transistor, capacitor, or resistor.

**discrete device** — 1. A class of electronic components, such as power MOSFETs, bipolar power transistors, MOVs, optoelectronic devices, rectifiers, power hybrid circuits, intelligent power discretes, and transistors. Typically, these devices contain one active element, such as a transistor or diode. However, hybrids, optoelectronic devices, and intelligent discretes may contain more than one active element. In contrast, integrated circuits typically contain hundreds, thousands, or even millions of active elements in a single die. 2. An individual electrical component, such as a resistor, capacitor, or transistor, as opposed to an integrated circuit, which is equivalent to several discrete components.

**discrete element** — An electronic element, such as a resistor or transistor, fabricated in such a way that it can be measured and transported individually.

**discrete part** — A separately packaged single circuit element supplying one fundamental property as a lumped characteristic in a given application. Examples: resistor, transistor, diode.

**discrete sampling** — The lengthening of individual samples so that the sampling process does not deteriorate the intelligence frequency response of the channel.

**discrete thin-film component** — An individually packaged electronic component having one or more thin films serving as resistive, conductive, and/or insulating elements. Resistors and potentiometers having thin-film metallic resistance elements are examples.

**discretionary wiring** — The use of a selective metallization pattern in the interconnection of large numbers of basic circuits on a slice of semiconductor material to form complex arrays. The metallization pattern connects only the "good" circuits on the wafers. Discretionary wiring requires a different interconnection pattern for each wafer.

**discrimination** — 1. The difference between losses at specified frequencies, with the system or transducer terminated in specified impedances. 2. In a frequency-modulated system, the detection or demodulation of the imposed variations in the frequency of the carriers. 3. In a tuned circuit, the degree of rejection of unwanted signals.

**discrimination ratio — display**

**discrimination ratio**—The ratio of the width of the passband of a filter to the width of the stopband of the filter.

**discriminator**—1. A device in which amplitude variations are derived in response to frequency or phase variations. 2. A facsimile auxiliary device between the radio receiver and the recorder that converts an audio-frequency-shifted facsimile signal to an amplitude-modulated facsimile signal.

**discriminator transformer**—A transformer used in FM receivers to convert frequency changes directly to audio-frequency signals.

**discriminator tuning unit**—A device that tunes the discriminator to a particular subcarrier.

**disc-seal tube**—Also called lighthouse tube or megatron. An electron tube with disc-shaped electrodes arranged in closely spaced parallel layers to give a low interelectrode capacitance along with a high power output in the UHF region.

**dish**—1. A microwave antenna, usually shaped like a parabola, that reflects the radio energy leaving or entering the system. 2. A parabolic type of radio or radar antenna, roughly the shape of a soup bowl. 3. A colloquial expression for a parabolic antenna. 4. Common term for a parabolic microwave antenna.

**dish illumination**—The area of a dish as seen by the feedhorn.

**disk**—1. An electromagnetic storage medium for digital data. 2. High-capacity random-access magnetic storage medium. *See also* disc.

**disk cartridge**—The flat, round, removable disk pack, containing programs and data, that is placed into a disk drive.

**disk drive**—1. Identified floppy, removable, and nonremovable bulk storage for most minicomputer and mainframe systems, and microcomputer systems needing several megabytes of storage. 2. A disk player that rotates the disk, writes data onto it, and reads data from it as instructed by a program.

**diskette**—*See* floppy disk.

**disk operating system**—Abbreviated DOS. 1. The software that organizes how a computer reads, writes, and reacts with its disks and talks to its various peripherals (input/output devices), such as keyboards, screens, serial and parallel ports, printers, modems, etc. The most popular operating system for PCs is MS-DOS from Microsoft. 2. An operating system (set of programs) that instructs a disk-based computing system to manage resources and operate related equipment. 3. A set of programs that controls a computer. The DOS performs a variety of tasks, including managing communications between the computer and its peripherals. *See also* operating system.

**disk pack**—The vertical stacking of a series of magnetic disks in a removable self-contained unit.

**disk storage**—1. Random-access auxiliary memory device in which information is stored on constantly rotating magnetic disks. 2. The storage of data on the surface of magnetic disks. 3. A mass storage memory device employing a flat, rotating medium onto which data can be stored via magnetic recording techniques and retrieved by magnetic playback. 4. A method of high-speed bulk storage of programs and data. The medium is a rotating circular plate coated with a magnetic material, such as iron oxide. Data is written (stored) and read (retrieved) by fixed or movable read/write heads positioned over data tracks on the surface of the disk. Addressable portions can be selected for read or write operations.

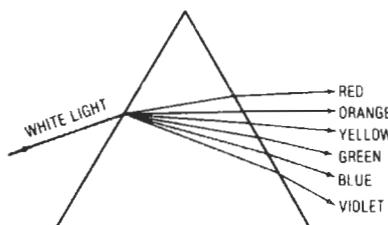
**dislocation**—In a crystal, a region in which the atoms are not arranged in the perfect crystal-lattice structure.

**dispatcher**—In a digital computer, the section that transfers the words to their proper destinations.

**dispenser**—A device that automatically distributes radar chaff from an aircraft.

**disperse**—In data processing, to distribute grouped input items among a larger number of groups in the output.

**dispersion**—1. Separation of a wave into its component frequencies. 2. Scattering of a microwave beam as it strikes an obstruction. 3. The property of an optical material that causes some wavelengths of light to be transmitted through the material at different velocities, with the velocity a function of the wavelength. (This causes each wavelength of light to have a different refractive index.) 4. In a magnetostrictive delay line, the variation of delay as a function of frequency. 5. The frequency difference that can be analyzed in one sweep by a spectrum analyzer. Dispersion can be considered as that frequency width over which sampling can be performed, and is always equal to or less than the frequency range. 6. The extent to which a speaker distributes acoustical power widely and evenly into the listening area. 7. The undesirable effect of the broadening of optical pulses caused by lengthening of rise and fall times as the pulse travels along the fiber. Sometimes referred to as pulse spreading, it results from either modal or material effects in the fiber that reduce bandwidth. Expressed in nanoseconds per kilometer. 8. A fiber-optic phenomenon that causes pulse widths of transmitted data to lengthen. Dispersion is caused by the arrival of data at the far terminal at different times due to the varying lengths of optical paths in multimode fiber, and by inherent properties in the fiber. Dispersion increases with length of conductor and is caused by the difference in ray path lengths within the fiber core.



Dispersion, 3 (by a prism).

**dispersive medium**—A medium in which the phase velocity of a wave is related to the frequency.

**displacement**—1. The vector quantity representing change of position of a particle. 2. A number that a computer must add to a base address to form an effective address.

**displacement current**—A current that exists in addition to ordinary conduction current in ac circuits. It is proportional to the rate of change of the electric field. The current is at right angles to the direction of propagation determined by the rate at which the field energy changes.

**displacement of porches**—The difference in level between the front and back porch of a television signal.

**displacement transducer**—A device that converts mechanical energy into electrical energy, usually by the movement of a rod or an armature. The amount of output voltage is determined by the amount the rod or armature is moved.

**display**—Also called readout. 1. Visual presentation of a received signal on a cathode-ray tube or video screen.

2. Row of digits across the top of a calculator, showing input or final answer. In printing-type calculators, referred to as printout. 3. The observable illustration of an image, scene, or data on a screen, such as a console or CRT screen, seen as a graph, report, or drawing. 4. The representation of data in visible form, e.g., on a cathode-ray tube, by lights or indicators on the console of a computer, or a printed report.

**display console**—A visual display used with a computer to give access to the many elements of data as an array of points. With the display console, an operator may check information in the computer and change it if required.

**display-generation time**—The time span between the output of data from the host computer and the moment at which the complete display can be viewed.

**display generator**—An electronic device that interfaces computer-graphics display information with a graphics-display device. Typically, the interface is made between a digital computer and a CRT. In general, a display generator for a raster-scan display contains four subsystems: display controller, display processor, refresh memory, and video driver.

**display highlighting**—The ability of the word processor to intensify or blink certain portions of the display screen—either the characters themselves or the screen area behind the characters—to emphasize a text segment designated for some special activity such as deleting or moving.

**display information processor**—A computer used in a combat operations center to generate situation displays.

**display loss**—*See* visibility factor.

**display modes**—Each display mode, such as vector, increment, character, point, vector continue, or short vector, specifies the manner in which points are to be displayed on the screen.

**display panel**—The substrate containing the media for creating an image, including electric connections but excluding the electronic interface.

**display primaries**—Also called receiver primaries. The red, green, and blue colors produced by a color television receiver and mixed in proper proportions to produce other colors.

**display processor**—A component of a display generator used to add intelligence. Typically, the device is a microcomputer with stored programs that perform high-level graphics functions.

**display-storage tube**—A special cathode-ray tube with a long and controllable image persistence and high luminescence.

**display unit**—A device used to provide a visual representation of data.

**display window**—The width of the portion of the frequency spectrum presented on panoramic presentation, expressed in frequency units, usually megahertz.

**disruptive discharge**—The sudden, large current through an insulating medium when electrostatic stress ruptures the medium and thus destroys its insulating ability.

**dissector**—In optical character recognition, a mechanical or electronic transducer that sequentially detects the level of light in different areas of a completely illuminated sample space.

**dissector tube**—A camera tube having a continuous photocathode on which a photoelectric emission pattern is formed. Scanning is done by moving the electron optical image of the pattern over an aperture. *See also* image dissector, 1.

**dissipation**—The undesired loss of electrical energy by conversion into heat.

**dissipation constant**—A constant of proportionality between the power dissipated and the resultant temperature rise in a thermistor at a specified temperature.

**dissipation factor**—1. Symbolized by  $D$ . Ratio between the permittivity and conductivity of a dielectric. The reciprocal of the dissipation factor ( $df$ ) is the storage factor, sometimes called the quality factor ( $Q$ ). 2. A measure of the ac loss. Dissipation factor is proportional to the power loss ( $P_L$ ) per cycle ( $f$ ) per potential gradient squared ( $E^2$ ) per unit volume ( $V$ ) as follows:

$$\text{dissipation factor} = (P_L/kE^2 fV)$$

where  $k$  is a constant. Dissipation factor is approximately equal to power factor when the loss angle is small.

**dissipation line**—A length of stainless-steel or Nichrome wire used as a noninductive impedance for termination of a rhombic transmitting antenna when power of several kilowatts must be dissipated.

**dissonance**—The formation of maxima and minima by the superposition of two sets of interference fringes from light of two different wavelengths.

**dissymmetrical network**—*See* dissymmetrical transducer.

**dissymmetrical transducer**—Also called dissymmetrical network. A transducer with unequal input and output image impedances.

**distance mark**—Also called range mark. A mark that indicates, on a cathode-ray screen, the distance from the radar set to a target.

**distance-measuring equipment**—Abbreviated DME. A radio navigational aid for determining the distance from a transponder beacon by measuring the time of transmission to and from it.

**distance protection**—The effect of a device operative within a predetermined electrical distance on the protected circuit to cause and maintain an interruption of power in a faulty circuit.

**distance relay**—1. A protective relay, the operation of which is a function of the distance between the relay and the point of fault. 2. A device that functions when the circuit admittance, impedance, or reactance increases or decreases beyond predetermined limits.

**distance resolution**—The ability of a radar to differentiate targets solely by distance measurement. Generally expressed as the minimum distance the targets can be separated and still be distinguishable.

**distortion**—1. Undesired changes in the waveform of a signal so that a spurious element is added. All distortion is undesirable. Harmonic distortion disturbs the original relationship between a tone and other tones naturally related to it. Intermodulation distortion (IMD) introduces new tones caused by mixing of two or more original tones. Phase distortion, or nonlinear phase shift, disturbs the natural timing sequence between a tone and its related overtones. Transient distortion disturbs the precise attack and decay of a musical sound. Harmonic and IMD distortion are expressed in percentages; phase distortion in degrees; transient distortion is usually judged from oscilloscope patterns. 2. Unwanted changes in the purity of sound being reproduced or in rf signals. In audio, it generally implies intermodulation and/or harmonic distortion. These are derived from phase differences and/or amplitude distortion in which the amplitude of the output does not bear the same proportion to the input at all frequencies. 3. With a signal frequency (sine wave) signal, distortion appears as harmonics (multiples) of the input frequency. The rms (effective ac point) sum of all harmonic distortion components, plus hum and noise, is known as total harmonic distortion, or THD. When a two-tone test signal is used, distortion components

appear at frequencies that are sums and differences of multiples of the input frequencies. Their magnitude is expressed as intermodulation distortion, which is more distressing to hear than THD. The lower the distortion in any form, the better. 4. Any difference in the waveshape after the signal has traversed the transmission circuit. 5. The unwanted changes in signal or signal shape that occur during transmission between two points.

**distortion factor**—*See* harmonic distortion.

**distortion factor of a wave**—The ratio of the effective value of the residue after the elimination of the fundamental to the effective value of the original wave.

**distortionless line**—A transmission line whose propagation constant is independent of frequency. (This is approached in a practical case by adjusting the line parameters, series inductance ( $I$ ), shunt capacitance ( $c$ ), series resistance ( $r$ ), and shunt conductance ( $g$ ) so that  $r/g = 1/c$ .)

**distortion meter**—1. An instrument that measures the deviation of a complex wave from a pure sine wave. 2. An instrument that measures the harmonic content of a sine wave, usually calibrated to read in percent distortion.

**distortion tolerance**—Of a telegraph receiver, the maximum signal distortion that can be tolerated without error in reception.

**distress frequency**—A frequency reserved for distress calls, by international agreement. It is 500 kHz for ships at sea and aircraft over the sea.

**distributed**—Spread out over an electrically significant length, area, or time.

**distributed amplifier**—A multistage amplifier in which the high-frequency limitation, due to the input and output capacitances of the active element, is circumvented by making these capacitances the shunt elements of lumped-parameter device lines. In this way the overall gain is the sum of the gains of the individual stages rather than the product, thus allowing amplification even when the individual gains are less than unity.

**distributed capacitance**—Also called self-capacitance. Any capacitance not concentrated within a capacitor, such as the capacitance between the turns in a coil or choke, or between adjacent conductors of a circuit.

**distributed computer network**—A collection of computers and I/O devices that can communicate with each other. *See* distributed processing.

**distributed constants**—Constants such as resistance, inductance, or capacitance that exist along the entire length or area of a circuit, instead of being concentrated within circuit components.

**distributed data processing**—Abbreviated DDP. The functional distribution of certain data-processing activities along logical organizational lines.

**distributed-emission photodiode**—A broadband photodiode for use in detecting modulated laser beams at millimeter wavelengths.

**distributed inductance**—The inductance along the entire length of a conductor, as distinguished from the inductance concentrated within a coil.

**distributed network**—1. An electrical-electronic device that for proper operation depends on physical size in comparison to a wavelength and physical configuration. 2. A network configuration in which all node pairs are connected either directly or by redundant paths through intermediate nodes.

**distributed parameter network**—A network in which the parameters of resistance, capacitance, and inductance cannot be taken as being concentrated at any one point in space. Rather, the network must be described in terms of its magnetic and electric fields and the quantities related to the distributed constants of the network.

**distributed paramp**—A paramagnetic amplifier consisting essentially of a transmission line shunted by uniformly spaced, identical varactors. The varactors are excited in sequence by the applied pumping wave to give the desired traveling-wave effect.

**distributed pole**—A motor has distributed poles when its stator or field windings are distributed in a series of slots located within the arc of the pole.

**distributed processing**—1. A multiprocessing computer technique in which each processor has a specific task or set of tasks to perform. These processors transfer commands and data via a standard communication interface. 2. Performing a data-processing task by performing the needed calculations in a distributed computer network. The efficiency of the data-processing task is improved through the simultaneous performance of operations in several interconnected processors of a distributed computer network. 3. Data-processing tasks performed simultaneously in several interconnected processors of a computer network.

**distributing amplifier**—An amplifier, either radio frequency or audio frequency, having one input and two or more isolated outputs.

**distributing cable**—*See* distribution cable.

**distributing frame**—A structure for terminating permanent wires of a central office, private branch exchange, or private exchange and for permitting the easy change of connection between them by means of cross-connecting wires.

**distributing terminal assembly**—A frame situated between each pair of selector bays to provide terminal facilities for the selector bank wiring and facilities for cross connection to trunks running to succeeding switches.

**distribution**—Also called frequency distribution. The number of occurrences of the particular values of a variable as a function of those values.

**distribution amplifier**—1. A power amplifier designed to energize a speech, music, or antenna distribution system. Its output impedance is sufficiently low that changes in the load do not appreciably affect the output voltage. 2. A device that provides several isolated outputs from one looping or bridging input, and has a sufficiently high input impedance and input-to-output isolation to prevent loading of the input source.

**distribution cable**—Also called distributing cable.

1. A cable extended from a feeder cable for the purpose of providing service to a specific area. 2. In a system, the transmission cable from the distribution amplifier to the drop cable.

**distribution center**—In an alternating-current power system, the point at which control and rotating equipment is installed.

**distribution coefficients**—Equal-powered tristimulus values of monochromatic radiations.

**distribution switchboard**—A power switchboard used for the distribution of electrical energy at the voltage common for each distribution within a building.

**distributive sort**—A sorting procedure that divides data elements into two or more distinct groups or subsets. The partition sort is an example.

**distributor**—1. *See* memory register. 2. The electronic circuitry that acts as an intermediate link between the accumulator and drum storage.

**distributorless**—A semiconductor automotive ignition system that does not utilize breaker contacts to time or trigger the system, nor does it utilize a distributor distribution of the secondary voltage.

**disturbance**—1. An irregular phenomenon that interferes with the interchange of intelligence during transmission of a signal. 2. An interruption of a quiet state. 3. Any form of interference with normal communications.

**disturbed-one output**—A “one” output of a magnetic core to which partial-read pulses have been applied since that core was last selected for writing.

**disturbed-zero output**—A “zero” output of a magnetic core to which partial-write pulses have been applied since that core was last selected for reading.

**disturbing conductor**—A conductor carrying energy that creates spurious signals in another conductor.

**dither**—1. An oscillation introduced for the purpose of overcoming the effects of friction, hysteresis, or clogging. 2. A small electrical signal deliberately injected into an electromechanical device for the purpose of overcoming static friction in the device. In a recording instrument it makes the indicator ready to jump. 3. Constant vibration about a point. 4. The technique of adding controlled amounts of noise to a signal to improve overall system loop control, or to smear quantizing error in an analog-to-digital converter application.

**dithering**—1. The application of intermittent or periodic acceleration forces sufficient to minimize the effect of static friction with a transducer, without introducing other errors. 2. The creation of additional colors or shades of gray to create special effects or to make hard edges softer.

**divergence loss**—The part of transmission loss that is caused by the spreading of sound energy.

**diverging lens**—A lens that is thinner in the center than at the edges. Such a lens causes light passing through to spread out, or diverge.

**diversity**—1. A form of transmission and/or reception using several modes, usually in space or in time, to compensate for fading or outages in any one of the modes. In the space diversity system, the same signal is sent simultaneously over several different transmission paths, which are separated enough so that independent propagation conditions can be expected. With time diversity, the same path may be used, but the signal is transmitted more than once, at different times. There are other forms of diversity, using different frequencies or different polarizations to provide the separate transmission mode. See diversity reception. 2. The practice of constructing a portion of the system or backup system by using a different technology, component, or design, such that the two portions of the total system are not vulnerable to a common-cause failure.

**diversity factor**—The ratio of the sum of the individual maximum demands of the subdivisions of a system (or part of a system) to the maximum demand of the entire system (or part of the system).

**diversity gain**—The gain in reception as a result of the use of two or more receiving antennas.

**diversity reception**—1. A method of minimizing the effects of fading during reception of a radio signal. This is done by combining and/or selecting two or more sources of received-signal energy that carry the same intelligence but differ in strength or signal-to-noise ratio in order to produce a usable signal. See frequency-diversity reception; space-diversity reception. 2. A technique for reducing the adverse effects of multipath fading by receiving the same signal on two or more diverse, or different, antenna-receiver combinations with a means of choosing the combination with the strongest signal. A two-channel system is known as dual diversity; a three-channel system, triple diversity. Diversity reception is widely and effectively used in commercial high-frequency installations.

**diverter pole generator**—A compound-wound direct-current generator with the series winding of the diverter pole opposing the flux generated by the shunt-wound main pole; provides a close voltage regulation.

**divide-by-N counter**—A group of counter stages that can be programmed to divide an input frequency by any number up to  $N$ .

**divide-by-16 counter**—A logic device in which four flip-flops count from 0 through 15 and then recycle to 0. All 16 states of the combination of four flip-flops are used. Sometimes referred to as a hexadecimal counter.

**divide-by-10 counter**—See decade counter.

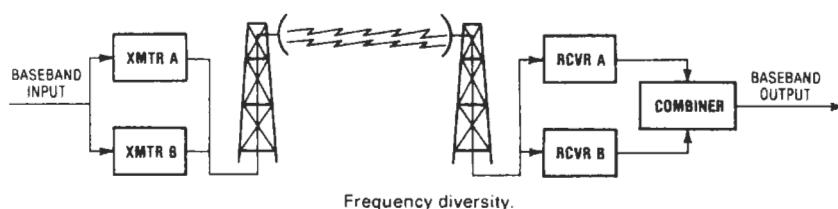
**divide-carrier modulation**—The process by which two signals are added so that they can modulate two carriers of the same frequency but  $90^\circ$  out of phase. The resultant signal will have the same frequency as the carriers, but its amplitude and phase will vary in step with the variations in amplitude of the two modulating signals.

**divide check**—In a computer, an indicator that shows that an invalid division has occurred or has been attempted.

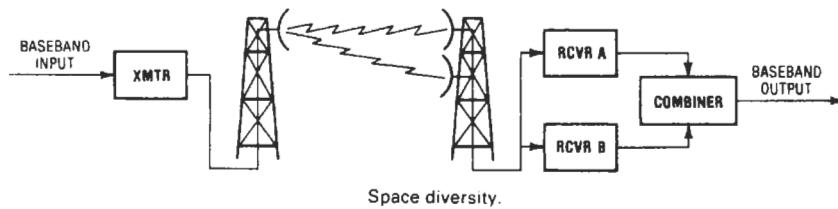
**divider**—See counter, 4.

**dividing network**—Also called speaker dividing network and crossover network. A frequency-selective network that divides the audio-frequency spectrum into two or more parts to be fed to separate devices such as amplifiers or speakers.

**D layer**—The lowest ionospheric layer, located between about 35 to 55 miles (56 to 88 km) above the earth. Its intensity is proportional to the height of the sun and is greatest at noon. Waves below approximately 3 MHz are absorbed by the D layer when it is present.



Frequency diversity.



Space diversity.

High-angle radiation may penetrate the D layer and be reflected by the E layer.

**DMA**—Abbreviation for direct memory access. A method in which a device in a computer other than the main processor can access main memory directly. It must first obtain control of the bus from the processor or other DMA devices. Then it can read and write to memory directly. This is a very fast method of transferring large amounts of data from a peripheral to main memory. Using the main processor to handle the data transfer requires more software overhead and reduces system throughput.

**DMI**—Abbreviation for dual-mode ignition. An adaptation of the Duraspark (Ford Motor) electronic ignition system that allows its use on smaller four-cylinder engines like the 2.3-liter size.

**DMM**—Abbreviation for digital multimeter.

**DMOS**—Abbreviation for double-diffused metal-oxide FET semiconductor. A process in which n and p atoms are diffused through the same mask opening to give precisely sized narrow channels. Used on discrete field-effect transistors (not MOS ICs) for ultrahigh gains and frequency performance. A very fast MOSFET fabricated with an extra diffusion step.

**DNC**—Abbreviation for direct numerical control.

**DNL**—See dynamic noise limiter.

**DOC files**—Document files. The default file extension for Microsoft Word. Most files with this extension are Microsoft Word files, but there are many that are plain text.

**documentation**—An orderly collection of recorded hardware and software data such as tables, listings, diagrams, etc.

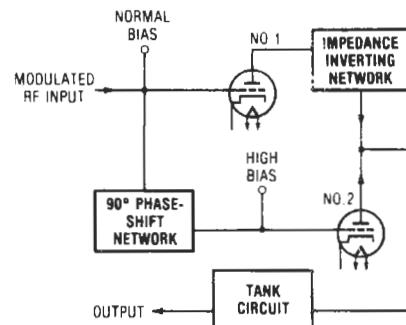
**document reader**—A general term referring to OCR or OMR equipment that reads a limited amount of information (one to five lines). Generally operates from a predetermined format and is therefore more restricted in the location of information to be read. The forms involved are generally tab card size or slightly smaller or larger.

**doghouse**—A small enclosure located near the base of a transmitting-antenna tower and used to house antenna tuning equipment.

**Doherty amplifier**—A radio-frequency linear power amplifier divided into two sections, the inputs and outputs of which are connected by quarter-wave (90°) networks. As long as the input-signal voltage is less than half the maximum amplitude, section No. 2 is inoperative and section No. 1 delivers all the power to the load. The load presents twice the optimum impedance required for maximum output. At one-half the maximum input, section No. 1 is operating at peak efficiency but is beginning to saturate. Above this level, section No. 2 comes into operation and decreases the impedance presented to section No. 1. As a result, section No. 2 delivers more and more power to the load until, at maximum signal input, both sections are operating at peak efficiency and each section is delivering one-half the total output power.

**Dolby**—1. A technique that increases the signal-to-noise ratio of a recording medium by raising the volume of quiet passages prior to recording, and lowering them to their original levels during playback. The lowering process automatically reduces any noise that was introduced as a result of the recording or playback processes. 2. Noise-reduction circuit that boosts the recorded signal at the tape hiss frequencies for low levels and reduces the boost progressively as the signal becomes large enough to mask the noise. (The Dolby system has the important advantage that it is standardized and any Dolby tape can be replayed accurately on any other Dolby machine.) 3. Name of a noise-reduction system available as a special circuit on some stereo cassette tape decks. 4. A proprietary electronic device or circuit that reduces the amount

## DMA — domain



**Doherty amplifier.**

of noise (principally tape hiss) introduced during the recording process by boosting—in carefully controlled amounts—the strength of weak high-frequency signals before they are recorded. During playback the signals (and the noise) are cut back by an exactly equivalent amount. The original dynamics are restored, but the noise is reduced by 10 dB.

**Dolby A**—The original form of the Dolby noise-reduction device, intended for professional use. It has four independently controlled noise-reduction channels, to increase signal-to-noise ratio at low, middle, high and very high frequencies.

**Dolby B**—1. A simplified version of the original Dolby A, intended primarily for use by nonprofessional recordists. Dolby B functions identically to Dolby A, but has only one controlled frequency band, which is effective primarily on tape hiss. 2. A noise-reduction system widely used in cassette recorders, as well as in some open-reel and cartridge machines and in FM broadcasting. The high-frequency portions of signals being recorded are compressed, with the degree of compression being greater as signal level decreases. An opposite expansion process takes place in playback, restoring the original frequency response, but with a reduction in high-frequency hiss. 3. A complementary noise-reduction system designed to reduce tape (and FM) hiss. A Dolby B circuit boosts low-level high-frequency signals during recording and reduces them, along with the tape's added noise, in a complementary fashion during playback. Noise can be reduced up to 10 db above 5 kHz with the Dolby B system. It is now in virtually universal use in cassette decks.

**Dolby B & C noise reduction (cassette deck)**—Two systems of noise/hiss reduction invented by Ray Dolby. They work by boosting high frequencies during recording (also called encoding) and attenuating them during playback (also called decoding). Dolby B noise reduction boosts the level of the high-frequency range during recording and tapers the high frequencies during playback, reducing tape hiss by 8 to 10 dB. Dolby C noise reduction uses the same principle as Dolby B, with the addition of a second stage in which the frequencies affected are lower by about one octave. This results in a 15 to 18 dB reduction in tape hiss over an extended frequency range.

**Dolby digital**—The multi-channel audio encoding formed for DVD.

**dolly**—A wheeled platform or frame on which the tripod or frame supporting a television camera or other apparatus is mounted to give it wider mobility.

**domain**—1. In magnetic theory, that region of a magnetic material in which the spontaneous magnetization is all in one direction. In conventional magnetic-tape

coatings, this corresponds to one oxide particle. 2. A region within a ferromagnetic substance where the atomic magnets of many atoms tend to orient themselves parallel to each other; the north poles pointing one way act spontaneously. The domains may be treated as small bar magnets of microscopic dimension. 3. In the Internet and other networks, an extension in a host name that identifies the type of host. The seven domains established by the InterNIC are .arpa (ARPANET), .com (company/commercial), .edu (educational institutions), .gov (government), .mil (military), .net (Internet access providers), and .org (organization). Outside the United States, the domain name is a two-letter country code (for example, .fr for France and .ca for Canada).

**domain name** — The unique name that identifies an Internet site. Domain names always have two or more parts, separated by dots. The part on the left is the most specific, and the part on the right is the most general. A given machine may have more than one domain name, but a given domain name points to only one machine. Usually, all of the machines on a given network will have the same thing as the right-hand portion of their domain names.

**domains** — *See* particles.

**domestic induction heater** — A home cooking utensil that is heated by induced currents within it. The unit contains a primary inductor, with the utensil itself acting as the secondary.

**dominant mode** — Also called fundamental mode or principal mode. In waveguide transmission, the mode with the lowest cutoff frequency. Designations for this mode are TE<sub>0,1</sub> and TE<sub>1,1</sub> for rectangular and circular waveguides, respectively.

**dominant wave** — The guided wave that has the lowest cutoff frequency. It is the only wave that will carry energy when the excitation frequency is between the lowest and the next higher cutoff.

**dominant wavelength** — 1. Of a color sample, the wavelength of light that matches it in chromaticity when mixed with white light. 2. The wavelength that is a quantitative measure of the apparent color of light as perceived by the human eye.

**dominant wavelength of a color** — The predominant wavelength of light in a color.

**donor** — Also called donor impurity. 1. An impurity atom that tends to give up an electron and thereby affects the electrical conductivity of a crystal. Used to produce n-type semiconductors. 2. A chemical that adds electrons to crystal lattices. 3. An impurity from column V of the periodic table, which adds a mobile electron to the conduction band of silicon, thereby making it more n-type. Commonly used donors are arsenic and phosphorous (compare with *acceptor*).

**donor impurity** — An element or compound whose atoms or molecules have more valence electrons than those of the intrinsic semiconductor material into which they are introduced in small quantities as an impurity or dopant. Because the donor impurity possesses more valence electrons, the material doped with a donor impurity is an n-type semiconductor. *See* donor.

**donor-type semiconductor** — An n-type semiconductor.

**donut** — *See* land, 2.

**door cord** — A short, insulated cable with an attaching block and terminals at each end used to conduct current to a device, such as foil, mounted on the movable portion of a door or window.

**doorknob tube** — A vacuum tube so called because of its shape designed for UHF transmitter circuits. It has a low electron-transit time and low interelectrode

capacitance because of the close spacing and small size, respectively, of its electrodes.

**door trip switch** — A mechanical switch mounted so that movement of a door will operate the switch.

**dopant** — 1. An impurity added to a semiconductor to improve its electrical conductivity; any material added to a substance to produce desired properties in the substance. 2. Selected impurity introduced into semiconductor substrates in controlled amounts, the atoms of which form negative (n-type) and positive (p-type) conductive regions. Phosphorus, arsenic, and antimony are n-type dopants for silicon; boron, aluminum, gallium, and indium are p-type dopants for silicon.

**dope** — To add impurities (called dopants) to a substance, usually a solid, in a controlled manner to cause the substance to have certain desired properties. For example, the number of electrical carriers in silicon can be increased by doping it with small amounts of other semimetallic elements. Ruby is aluminum oxide doped with chromium oxide.

**doped junction** — A semiconductor junction produced by the addition of an impurity to the melt during crystal growth.

**doped region** — A layer of an integrated circuit in which impurities have been introduced.

**doped solder** — Solder to which an element not normally found in solder has been intentionally added.

**doping** — The addition of controlled amounts of impurities to a semiconductor to achieve a desired characteristic, such as to produce an n-type or p-type material, accomplished through thermal diffusion or ion implantation. Common doping agents for germanium and silicon include aluminum, antimony, arsenic, gallium, and indium.

**doping agent** — An impurity element added to semiconductor materials used in crystal diodes and transistors. Common doping agents for germanium and silicon include aluminum, antimony, arsenic, gallium, and indium.

**doping compensation** — The addition of donor impurities to a p-type semiconductor or of acceptor impurities to an n-type semiconductor.

**Doppler cabinet** — A speaker cabinet in which either the speaker or a baffle board is rotated or moved to change the length of the sound path cyclically and thereby produce a vibrato effect mechanically.

**Doppler effect** — 1. The observed change of frequency of a wave caused by a time rate of change of the effective distance traveled by the wave between the source and the point of observation. As the distance between a source of constant vibration and an observer diminishes or increases, the received frequencies are greater or less. 2. The apparent change in the frequency of radio wave reaching an observer, due either to motion of the source toward or away from the observer, to motion of the observer, or both. 3. The apparent change in frequency of sound or radio waves when reflected from or originating from a moving object. Utilized in some types of motion sensors. 4. The radiation emitted from a source that moves away from an observer appears to be of lower frequency than the radiation emitted from a stationary source. The radiation emitted from a source moving toward the observer appears to be of a higher frequency than that from a stationary source.

**Doppler principle** — The theory established by Doppler in 1842 that states that the rate of change in distance between a receiver and a radiation source determines the change in frequencies.

**Doppler radar** — A radar unit that measures the velocity of a moving object by the shift in carrier

**Doppler ranging — dot-matrix display**

frequency of the returned signal. The shift is proportionate to the velocity of the object as it approaches or recedes.

**Doppler ranging**—Abbreviated as doran. A cw trajectory-measuring system that utilizes the Doppler shift to measure the distance between a transmitter, missile, transponder, and several receiving stations. From these measurements, trajectory data is computed. In contrast to a similar system, doran circumvents the necessity of continuously recording the Doppler signal by performing the distance measurements with four different frequencies simultaneously.

**Doppler shift**—1. The change in frequency of a wave reaching an observer or a system, caused by a change in distance or range between the source and the observer or the system during the interval of reception. It is due to the Doppler effect. 2. The change in frequency with which energy reaches a receiver when the source of radiation or a reflector of the radiation and the receiver are in motion relative to each other. The Doppler shift is used in many tracking systems. 3. The magnitude, expressed in cycles per second, of the alteration in the wave frequency observed as a result of the Doppler effect.

**Doppler signal**—The signal, traveling from transmitter to receiver, that has an altered frequency due to the Doppler effect.

**Doppler velocity and position**—1. Having to do with a beacon tracking system in which pulses are sent from a tracking station to a receiver in the object to be tracked, and returned to the station on a different frequency. 2. Having to do with a Doppler trajectory-measuring system for determining target position relative to transmitting and receiving stations on the ground.

**doran**—See Doppler ranging.

**DOS**—Abbreviation for disk operating system.

**dosage meter**—See dosimeter; intensitometer.

**dose**—A measure of energy actually absorbed in tissue as a result of ionizing radiation.

**dosimeter**—Also called intensitometer or dosage meter. 1. An instrument that measures the amount of exposure to nuclear or X-ray radiation utilizing the ability of such radiation to produce ionization of a gas. 2. Quartz fiber electrometer that is charged by a battery and discharges when exposed to radiation. Can be direct reading or indirect reading. Measures the total radiation dose received, in rem, and is carried by a person who works with radiation.

**DOS prompt**—The letter informing DOS system users what drive they're in, followed by the greater-than symbol (C>), which indicates that the system is ready to receive a command.

**dot**—1. See button, 2. 2. Also called bubble. A symbol placed at the input of a logic symbol to indicate that the active signal input is negative. The absence of a dot indicates a positive active signal.

**dot AND**—See wired AND.

**dot-bar generator**—An instrument that generates a specified output pattern of dots and bars. Used for measuring scan linearity and geometric distortion of TV cameras, video monitors, and TV receivers. Also used for converging cathode-ray tubes as recommended by color monitor and receiver manufacturers.

**dot cycle**—One cycle of a periodic alternation between two signaling conditions, each condition having unit duration. Thus, two-condition signaling consists of a dot, or marking element, followed by a spacing element. In teletypewriter applications, one dot cycle consists of a mark and a space. The speed of telegraph transmission sometimes is stated in terms of dot cycles per second, or dot speed (half the speed of transmission expressed in bauds).

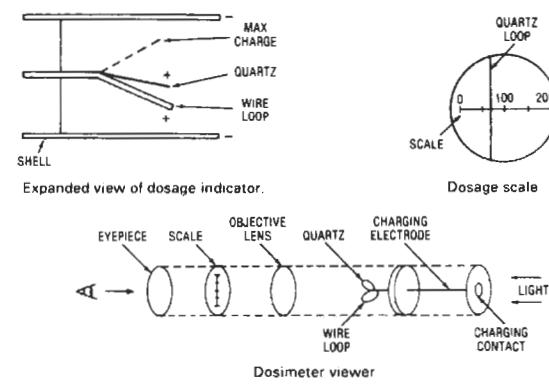
**dot encapsulation**—A packaging process in which cylindrical components are inserted into a perforated wafer to form a solid block with interconnecting conductors on both surfaces joining the components.

**dot generator**—An instrument used in servicing color television receivers. It produces a pattern of white dots so that convergence adjustments can be made on the picture tube.

**dot matrix**—1. A pattern of dots in a fixed area used for formulation of characters. A method of display character generation in which each character is formed by a grid or matrix pattern of  $5 \times 7$  to  $7 \times 9$  dots, combinations of which form characters on a video or hard-copy medium. For very high quality,  $11 \times 13$  patterns or greater are required. 2. The printing of characters by a matrix pattern of ink dots. 3. A technique for representing characters by composing them out of selected dots from within a rectangular matrix of dots.

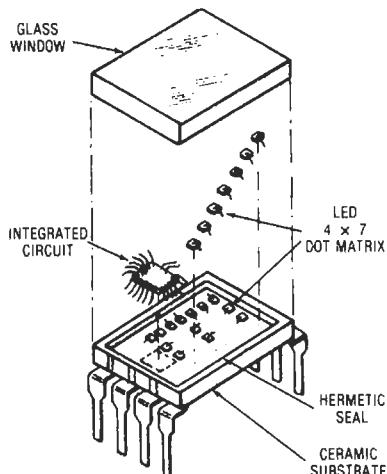
**dot-matrix character**—1. A printed character formed of dots so close together that it gives the impression of having been printed by uninterrupted strokes. The dots are formed by wire ends, jets of ink, electrical charge, or laser beams. 2. A character composed from a rectangular matrix of dots.

**dot-matrix display**—1. A display format consisting of small light-emitting elements arranged as a matrix. Various elements are energized to depict a character. A typical matrix is  $5 \times 7$ . 2. A display composed of dots in close, rectangular array, capable of being individually illuminated to produce alphanumeric characters and graphic displays.



**Dosimeter.**

A B C D E F G H I J K L M N O  
 P Q R S T U V W X Y Z 1 2 3 4  
 5 6 7 8 9 0 + - [ ] = . / = ? \*

Dot-matrix characters and numerals ( $5 \times 7$  matrix).

Dot-matrix LED display with on-board IC.

**dot-matrix printer**—A printer that forms letters by striking the paper with small pins or other means of making a mark (such as a small jet of ink), forming each letter with a pattern of dots. More marks per letter result in a denser image. Some dot-matrix printers squeeze the dots so closely together that they look almost like letter-quality print, which is made by machines that form letters with a single impact, as do traditional typewriters. When dot-matrix printers produce letters that are close to the quality of traditional electric typewriters, the result is often called correspondence-quality or letter-quality print. 2. See also wireprinter.

**dot pattern**—Small dots of light produced on the screen of a color picture tube by the signal from a dot generator. If overall beam convergence has been obtained, the three color-dot patterns will merge into one white-dot pattern.

**dot pitch**—1. A measure of picture quality or resolution in RGB color monitors. 2. The shortest distance between two phosphor dots of the same color on the screen. The smaller the dot pitch, the better the resolution of the monitor. High-resolution monitors usually have a dot pitch of 0.28 mm. 3. For printers, the number of dots per linear inch; for example, a desktop laser printer prints at least 300 dpi. The larger the number, the higher the resolution. 4. A measure of picture quality or resolution in RGB color monitors, which is more commonly known as pixel resolution. Dot pitch is the distance between screen dots (pixels) measured in millimeters. The shorter the distance, the better the resolution. It is specified in pixels/mm.

**dot sequential**—Pertaining to the association of the primary colors in sequence with successive picture elements of a color television system. Examples: dot-sequential pickup, dot-sequential display, dot-sequential system, dot-sequential transmission.

**double-amplitude-modulation multiplier**—A multiplier in which a carrier is amplitude modulated by one variable, and the modulated signal is again amplitude modulated by a second variable. The product of the two variables is obtained by applying the resulting double-modulated signal to a balanced demodulator.

**double armature**—An armature having two windings and commutators but only one core.

**double-base diode**—See unijunction transistor.

**double-base junction transistor**—Also called tetrode junction transistor. Essentially a junction triode transistor with two base connections on opposite sides of the central region of the transistor.

**double-beam cathode-ray tube**—A cathode-ray tube having two electron beams capable of producing on the screen two independent traces that may overlap. The beams may be produced by splitting the beam of one gun or by using two guns.

**double-bounce calibration**—A method of calibration used to determine the zero set error by using round-trip echoes. The correct range is the difference between the first and second echoes.

**double-break contacts**—A set of contacts in which one contact is normally closed and makes simultaneous connection with two other contacts.

**double-break switch**—A switch that opens the connected circuit at two points.

**double bridge**—See Kelvin bridge.

**double-button carbon microphone**—Also called differential microphone. A microphone with two carbon resistance elements or buttons, one on each side of a central diaphragm. They are connected in parallel to the current source in order to give twice the resistance change obtainable with a single button.

**double-channel duplex**—A method for simultaneous communication between two stations over two rf channels, one in each direction.

**double-channel simplex**—A method for nonsimultaneous communication between two stations over two rf channels, one in each direction.

**double-checkerboard pattern**—See worst-case noise pattern.

**double-clocking**—Incorrect setting of a flip-flop due to bounce in input signal.

**double-conversion receiver**—A receiver using a superheterodyne circuit in which the incoming signal frequency is converted twice, first to a high IF and then to a lower one.

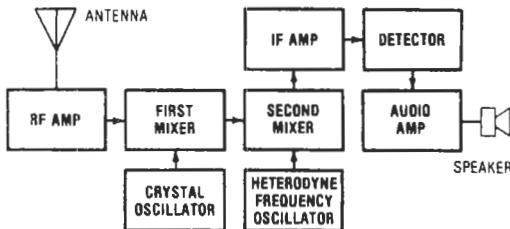
**double-current generator**—A machine that supplies both direct and alternating current from the same armature winding.

**double density**—A type of diskette that allows twice as much data to be stored as single density.

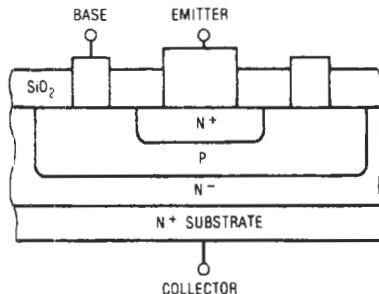
**double-diffused epitaxial mesa transistor**—See epitaxial-growth mesa transistor.

**double-diffused metal-oxide FET semiconductor**—See DMOS.

**double-diffused transistor**—Also called double-emitter-and-base transistor. A transistor in which two pn junctions are formed in the semiconductor wafer by

**double diode — double-pole switch**

*Double-conversion superheterodyne receiver block diagram.*



*Double-diffused epitaxial planar bipolar npn transistor.*

gaseous diffusion of both p-type and n-type impurities. An intrinsic region can also be formed.

**double diode**—Also called duodiode. A vacuum tube or semiconductor having two diodes in the same envelope.

**double-diode limiter**—A type of limiter used to remove all the positive signals from a combination of positive and negative pulses or to remove all the negative signals from such a combination of positive and negative pulses.

**double-doped transistor**—A transistor formed by growing a crystal and successively adding p- and n-type impurities to the melt while the crystal is being grown.

**double-doublet antenna**—An antenna composed of two half-wave doublet antennas criss-crossed at their centers; one is made shorter than the other to give broader frequency coverage.

**double drop**—An alarm-signaling method often used in central-station alarm systems, in which the line is first opened to produce a break alarm and then shorted to produce a cross alarm.

**double-emitter follower**—See Darlington amplifier.

**double frequency-shift keying**—A multiplex system in which two telegraph signals are combined and transmitted simultaneously by frequency shifting among four radio frequencies.

**double-grip terminal**—A solderless terminal with an extended flared barrel that permits a crimp to be made over the insulation of a wire as well as over the stripped portion.

**double image**—A television picture consisting of two overlapping images due to reception of the signal over two paths that differ in length so signals arrive at slightly different times.

**double insulation**—The insulation system resulting from a combination of functional and supplementary insulation.

**double-junction photosensitive semiconductor**—A semiconductor in which the current flow is controlled by light energy. It consists of three layers of a semiconductor material, with electrodes connected to the ends of each.

**double-length number**—Also called double-precision number. An electronic computer number having twice the normal number of digits.

**double local oscillator**—An oscillator mixing system that generates two rf signals accurately spaced a few hundred hertz apart and mixes these signals to give the difference frequency that is used as the reference. This equipment is used in an interferometer system to obtain a detectable signal containing the phase information of an antenna pair, and the reference signal to allow removal of the phase data for use.

**double-make contacts**—A set of contacts in which one contact is normally open and makes simultaneous connection with two other independent contacts when closed.

**double moding**—Changing from one frequency to another abruptly and at irregular intervals.

**double modulation**—1. The process of modulation in which a carrier wave of one frequency is first modulated by a signal wave, and the resultant wave is then made to modulate a second carrier wave of another frequency. 2. A two-step modulation scheme in which an intelligence wave modulates a subcarrier, and then the modulated subcarrier is used to modulate a higher-frequency carrier.

**double operand**—An instruction type containing two address fields: source operand address field and destination operand address field.

**double orthomode coupler**—A dish-mounted device that allows reception of both vertically and horizontally polarized signals.

**double photoresist**—A technique for eliminating pinholes in the photoresist coating during fabrication of microelectronic integrated circuits. The method may consist of two separate applications and exposures of photoresist emulsions of the same or different types.

**double-play tape**—Tape having half the thickness, and hence double the running time (for a given reel size) of standard 1.5-mil tape.

**double pole**—A term applied to a contact arrangement to denote that it includes two separate contact forms (i.e., two single-pole contact assemblies).

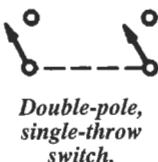
**double-pole, double-throw switch**—Abbreviated dpdt. A switch that has six terminals and is used to connect one pair of terminals to either of the other two pairs.



*Double-pole,  
double-throw  
switch.*

**double-pole, single-throw switch**—Abbreviated dpst. A switch that has four terminals and is used to connect or disconnect two pairs of terminals simultaneously.

**double-pole switch**—A switch that operates simultaneously in two separate electric circuits or in both lines of a single circuit.



**double precision**—1. Having to do with the use of two computer words to represent one number. 2. The technique of allocating twice the data storage space for representing numeric information in order to achieve twice the accuracy.

**double-precision arithmetic**—The use of two computer words to represent a single number. This is done where it is necessary to obtain a greater accuracy than a single word of computer storage will provide. It effectively doubles the data word size.

**double-precision number**—*See* double-length number.

**double-pulsing station**—A loran station that receives two pairs of pulses and emits pulses at two pulse rates.

**double pumping**—A technique of pumping a laser for a relatively long time to store energy in subthreshold-level excited states, followed immediately by a very brief second pumping in which the threshold condition is exceeded in some region. This triggers laser oscillation throughout the entire active region and produces peak output powers several times larger than normally seen.

**double rail**—*See* dual rail.

**double-rail logic**—Pertaining to self-timing asynchronous circuits in which each logic variable is represented by two electrical lines that in combination can assume three meaningful states: zero, one, and undecided.

**double screen**—A three-layer screen consisting of a two-layer screen with the additional second long-persistence coating having a different color and different persistence from the first.

**double-shield enclosure**—A shielded enclosure or room whose inner wall is partially isolated electrically from the outer wall.

**double sideband**—Amplitude-modulated intelligence that is transmitted at frequencies both above and below the carrier frequency by the audio-frequency value of the intelligence.

**double-sideband transmitter**—A transmitter that transmits not only the carrier frequency, but also the two sidebands resulting from modulation of the carrier.

**double-sided board**—A printed board with a conductive pattern on both sides.

**double-spot tuning**—Superheterodyne reception of a given station at two different local-oscillator frequencies. The local oscillator is adjusted either above or below the incoming signal frequency by the intermediate-frequency value.

**double-stream amplifier**—A microwave traveling-wave amplifier in which amplification occurs through interaction of two electron beams having different average velocities.

**double-stub tuner**—An impedance-matching device consisting of two stubs, usually fixed three-eighths of a wavelength apart, in parallel with the main transmission lines.

**double superheterodyne reception**—Also called triple detection. The method of reception in which two frequency converters are employed before final detection.

**double-surface transistor**—A point-contact transistor, the emitter and collector whiskers of which are in contact with opposite sides of the base.

**doublet**—The output voltage waveform of a delay line under linear operating conditions when the input to the line is a current step function.

**doublet antenna**—An antenna consisting of two elevated conductors substantially in the same straight line and of substantially equal length, with the power delivered at the center.

**double tape mark**—A delimiter, consisting of two consecutive tape marks, that is used to indicate the end of a volume or of a file set.

**double throw**—A term applied to a contact arrangement to denote that each contact form included is a break-make.

**double-throw circuit breaker**—A circuit breaker by means of which a change in the circuit connections can be obtained by closing either of two sets of contacts.

**double-throw switch**—A switch that alternately completes a circuit at either of its two extreme positions. It is both normally open and normally closed.

**double-track recorder**—*See* dual-track recorder.

**double trigger**—A trigger signal consisting of two pulses spaced by a fixed amount for coding.

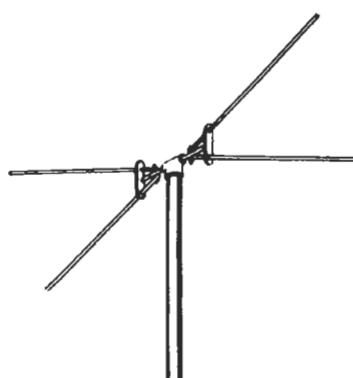
**double triode**—*See* duotriode.

**double-tuned amplifier**—An amplifier in which each stage utilizes coupled circuits having two frequencies of resonance for the purpose of obtaining wider bands than are possible with single tuning.

**double-tuned circuit**—A circuit in which two circuit elements are available for tuning.

**double-tuned detector**—A type of FM discriminator in which the limiter output transformer has two secondary windings, one tuned a certain amount above the center frequency and the other tuned an equal amount below the center frequency.

**double-V antenna**—Also called fan antenna. A modified single dipole that has a higher input impedance and broader bandwidth than an ordinary dipole.



*Double-V antenna.*

**double-winding synchronous generator**—A synchronous generator that has two similar windings in phase with one another, mounted on the same magnetic structure but not connected electrically, designed to supply power to two independent external circuits.

**doubling**—The generation of large amounts of second-harmonic distortion by nonlinear motion of a loudspeaker cone.

**doubly balanced modulator — drawing**

**doubly balanced modulator**—A modulator circuit in which two class A amplifiers are supplied with modulating and carrier signals of equal amplitudes and opposite polarities. Carrier suppression takes place because the two amplifiers share a common plate circuit and only the sidebands appear at the output.

**downconversion**—The process of converting microwave signals down into a frequency range in which signal processing components are less expensive. Typically, this is a VHF frequency of 70 MHz.

**downconverter**—1. A type of converter whose input is a radio frequency and whose output is an intermediate frequency. 2. A microwave system (consisting of local oscillators, mixers, and bandpass filters) that accomplishes downconversion. 3. The front end of the satellite TV receiver. 3. The part of a satellite receiving system that converts the downlink signals to a 70-MHz intermediate frequency that is used by the receiver. Although it is sometimes part of the receiver, it is more often externally mounted directly at the LNA so that inexpensive coaxial cable can bring the signal to the receiver.

**down lead**—Also called a lead-in wire. The wire that connects an antenna to a transmitter, receiver, or downconverter.

**downlink**—1. A satellite-to-earth microwave channel and related components, such as the earth station receiving equipment. The satellite contains a downlink transmitter; downlink components in the earth station are involved with the reception and processing of satellite-transmitted signals. 2. The communication path from a TV satellite to its ground (earth) stations.

**download**—1. The process of sending communications instructions, operating software or data from a central computer to individual terminals, including personal computers. To electronically copy a file from one computer to another computer. 2. To receive a file from a remote computer. 3. To transfer information stored in a remote computer system to the user's system. The reverse process is an upload.

**downloading**—1. The electronic transfer of information from one computer to another, generally from a larger computer to a smaller one, such as a microcomputer. 2. Transferring information from a host computer to another computer. 3. To transfer data stored in one computer to a storage device in another computer. 4. The process of sending configuration parameters, operating software, or related data from a central source to remote stations. 4. Direct transfer of code from a host system (MDS) into a target system or a PROM programmer.

**downstream**—Outlet side of an instrument.

**downtime**—1. Any period of time during which a system or device cannot be used as a result of a failure or routine maintenance, but not because of a lack of work or the absence of an operator. 2. The period during which computer or network resources are unavailable to users because of a system or component failure.

**downward compatibility**—Software that can run on older and/or less powerful versions of a computer it was designed to run on.

**downward modulation**—Modulation in which the instantaneous amplitude of the modulated wave is never greater than that of the unmodulated carrier.

**dpdt**—Abbreviation for double-pole, double-throw.

**dpi (dots per inch)**—A measurement of resolution, usually used with printers and scanners.

**DPM**—*See* digital panel meter.

**dpst**—Abbreviation for double-pole, single-throw.

**draft mode**—A low-quality printing mode available on some printers.

**drag**—Selecting and moving an on-screen icon via a mouse.

**drag angle**—A stylus cutting angle of less than 90° to the surface of the record. So called because the stylus drags over the surface instead of digging in. It is the opposite of dig-in angle.

**drag cup**—A nonmagnetic metal rotated in a magnetic field to generate a torque or voltage proportional to its speed.

**drag-cup motor**—A small, high-speed, two-phase, alternating-current electric motor having a two-pole, two-phase stator. The rotating element consists only of an extremely light metal cup attached to a shaft rotating on ball bearings. Reversal is accomplished by reversing the connections to one phase. Used in applications requiring quick starting, stopping, and reversal characteristics.

**dragging**—An interactive technique for repositioning an image on a display screen.

**drag magnet**—*See* retarding magnet.

**drag soldering**—A form of mass soldering in which a printed circuit board is mounted on a conveyor and contacts the surface of a static pool of molten solder at a slight angle when entering and exiting the solder bath. The board remains in contact with solder for a defined length (the dragging length) of time, travelling horizontally across the solder surface.

**drain**—1. The current taken from a voltage source. 2. The working-current terminal (at one end of the channel in a FET) that is the drain for holes or free electrons from the channel. Corresponds to a collector of a bipolar transistor. 3. Terminal that receives carriers from the MOS channel. 4. One of the three regions that form a field-effect transistor. Majority carries that originate at the source and traverse the channel are collected at the drain to complete the current path. The flow between source and drain is controlled by the voltage applied to the gate.

**drainage equipment**—Equipment used to protect connected circuits from transients produced by the operation of protection equipment.

**drain conductor**—A conductor in continuous contact with a shield for ground termination.

**drain cutoff current**—The current into the drain terminal of a depletion-type transistor with a specified reverse gate-to-source voltage applied to bias the device to the off state.

**drain terminal**—The terminal electrically connected to the region into which majority carriers flow from the channel.

**drain wire**—1. An uninsulated solid or stranded tinned copper wire that is placed directly under a shield. It touches the shield throughout the cable, and therefore may be used in terminating the shield to ground. It is completely necessary on spiral shielded cables because it eliminates the possibility of induction in a spiral shield. 2. An uninsulated wire, usually placed directly beneath and in electrical contact with a shield. It is used for making shield connections through terminal strips and to ground.

**DRAM**—Abbreviation for dynamic random-access memory (pronounced "dee-ram"). 1. The least expensive and most popular type of semiconductor read/write memory chip, in which the presence or absence of a capacitive charge represents the state of a binary storage element (0 or 1). The charge must be periodically refreshed. 2. Memory that requires periodic refreshing because of charge leaking from capacitors in the cell circuit. 3. Main memory system of large computers, minicomputers, and even some large microcomputers.

**drawing**—In the manufacture of wire, pulling the metal through a die or series of dies for reduction of diameter to a specified size.

**D-region** — The region of the ionosphere up to about 90 kilometers above the earth's surface. It is below the E-region.

**dress** — 1. The exact placement of leads and components in a circuit to minimize or eliminate undesirable feedback and other troubles. 2. To arrange wire connections, cable ends, or cables so that they present a neat and orderly appearance.

**dressed contact** — A contact that has a locking spring member permanently attached.

**drift** — 1. Movement of carriers in a semiconductor as voltage is applied. 2. A change in either absolute level or slope of an input-output characteristic. 3. See flutter, 1. 4. See degradation, 1. 5. An undesired change in one of the output parameters of a power supply (voltage, current, frequency, etc.) over a period of time. The change is unrelated to all other variables, such as load, line, and environment. Drift is measured over a period of time by keeping all variables (such as line, load, and environment) constant. Specifications usually apply only after a warm-up period. 6. The angular displacement of an aircraft by the wind, generally expressed in degrees. 7. In a dc amplifier, the change in output with constant input, usually measured in terms of the dc input signal required to restore normal output; may be called out as microvolts or millivolts per hour. 8. A change in output attributable to any cause. 9. A change in the properties of an electrical circuit, as a result of aging or temperature changes.

**drift current** — 1. The flow of carriers in a semiconductor due to an electric field. In the same electric field, holes and electrons will flow in opposite directions due to their opposite charge. 2. The relatively small directional bias that becomes superimposed on the random motion of carriers in an excited crystal lattice under the influence of an applied electric field (drift field).

**drifting** — An instability in a preset voltage, frequency, or other electronic circuit parameter.

**drift mobility** — The average drift velocity of carriers in a semiconductor per unit electric field. In general, the mobilities of electrons and holes are not the same.

**drift space** — 1. In an electron tube, a region substantially free of alternating fields from external sources, in which relative repositioning of the electrons depends on their velocity distributions and the space-charge forces. 2. The distance between the buncher and catcher in a velocity-modulated vacuum tube.

**drift speed** — Average speed at which electrons or ions progress through a medium.

**drift transistor** — A type of transistor manufactured with a variable-conductivity base region. Such a base sets up an electric field that speeds up the carriers, thus reducing the transit time and improving high-frequency operation. *See also* diffused-alloy transistor.

**drift velocity** — Net velocity of charged particles in the direction of the applied field.

**drip loop** — A loop formed in a transmission line at a point where it enters a building. Condensation of moisture and water that may form on the line will drip off at the loop and thus will not enter the building.

**drip-proof motor** — A motor in which the ventilating openings are such that foreign matter falling on the motor at any angle not exceeding 15° from the vertical cannot enter the motor either directly or indirectly.

**driptight enclosure** — An enclosure that is intended to prevent accidental contact with the enclosed apparatus and, in addition, is so constructed as to exclude falling moisture or dirt.

**drive** — 1. A unit used in mass storage applications to hold and operate the medium (e.g., disk or tape) being used to store data or programs. 2. Also called excitation.

The signal applied to the input of a power amplifier. *See* excitation, 2.

**drive belt** — A belt used to transmit power from a motor to a driven device.

**drive circuit** — A circuit, usually a printed circuit card or an encapsulated module, that converts an input pulse to the appropriate winding excitation sequence to produce one step of the motor shaft.

**drive control** — *See* horizontal drive control.

**driven element** — 1. An antenna element connected directly to the transmission line. 2. An element of an antenna, such as of a Yagi antenna, that is energized directly from the antenna feed line.

**driven sweep** — A sweep signal triggered by an incoming signal only.

**drive pattern** — In a facsimile system, an undesired pattern of density variations that result from periodic errors in the position of the recording spot.

**drive pin** — In disc recording, a pin similar to the center pin but located at one side of it and used to prevent a disc record from slipping on the turntable.

**drive pulse** — A pulsed magnetomotive force applied to a magnetic cell from one or more sources.

**driver** — 1. An electronic circuit that supplies input to another electric circuit. 2. A stage of amplification that precedes the power output stage. 3. In a radar transmitter, a circuit that produces a pulse to be delivered to the control grid of the modulator tube. 4. An element coupled to the output stage of a circuit to increase the power- or current-handling capability or fanout of the stage; for example, a clock driver is used to supply the current necessary for a clock line. 5. A device in a logic family controlled with normal logic levels whose output has the capability of sinking or sourcing high current. The output may control a lamp, relay, or a very large fanout of other logic devices. Also a device driving a higher-output device or transistor by supplying power, voltage, or current to it. 6. Any individual speaker within an audio system, such as the woofer, tweeter, etc. 7. A transistor output circuit that has an emitter-follower configuration. 8. A dc driver output module that contains driver output circuits. Each load must be connected between the output and ground as specified in the module data sheet. 9. Amplifier circuit used to reshape signals on a bus when more than one TTL load is present. 10. The low-power oscillator-modulator-amplifier unit that supplies the excitation to a power amplifier. *See also* exciter. 11. A program or routine that controls either external devices or other programs. 12. Typically, an electronic function used to provide amplification to drive high current loads. Term often used to denote bus drivers that rapidly charge and discharge capacitance. Also used to denote the ability to control power, such as when driving a solenoid or other high-current device.

**driver element** — An antenna array element that receives power directly from the transmitter.

**driver gate** — An analog switch, usually including two parts: the switch gate and a driver that controls the switch.

**driver stage** — The amplifier stage preceding the power-output stage.

**driving-point admittance** — The complex ratio of the alternating voltage for an electron tube, network, or other transducer.

**driving-point impedance** — 1. At any pair of terminals in a network, the driving-point impedance is the ratio of an applied potential difference to the resultant current at these terminals, all terminals being terminated in any specified manner. 2. The input impedance of a transmission line or of an antenna.

**driving power**—The power supplied to the grid circuit of a tube where the grid swings positive and draws current for part of each cycle of the input signal.

**driving-range potential**—The voltage difference between the potential of the electrochemically more active anode and the less active protected metal or cathode. One example of driving potential is the electromotive force in a cathodic protection system that causes current between the protected structure (cathode) and the anode. The driving potential decreases as the electrodes become polarized.

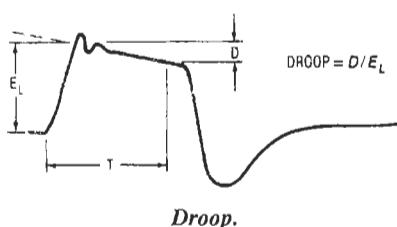
**driving signal**—Television signals that time the scanning at the pickup point. Two kinds of driving signals are usually available from a central sync generator, one composed of pulses at the line frequency and the other of pulses at the field frequency.

**driving spring**—The spring driving the wipers of a stepping relay.

**DRO memory**—Destructive readout memory. A memory in which the contents of a storage location are destroyed in being read. Information must be rewritten after reading, if it is to be returned. An example of a DRO memory is the common computer core memory.

**drone cone**—An undriven speaker cone mounted in a bass-reflex enclosure.

**droop**—The decrease in mean pulse amplitude, expressed as a percentage of the 100-percent amplitude, at a specified time following the initial attainment of 100-percent amplitude.



**drop**—1. To develop a specified difference of potential between a pair of terminals as the result of a flow of current. 2. See voltage drop.

**drop bar**—A protective device used to ground a high-voltage capacitor when opening a door.

**drop bracket transposition**—Reversal of the relative positions of two parallel wire conductors while depressing one, so that the crossover is in a vertical plane.

**drop cable**—In a cable TV system, the transmission cable from the distribution cable to a dwelling.

**drop channel**—A type of operation in which one or more channels of a multichannel system are terminated (dropped) at some intermediate point between the end terminals of the system.

**drop-down menu**—A type of computer menu that drops from the menu bar when requested and remains open without further action until the user closes it or chooses an item from the menu. Same as pull-down menu.

**drop-in**—The reading of a spurious signal of amplitude greater than a predetermined percentage of the nominal signal amplitude.

**drop indicator**—An indicator for signaling, consisting of a hinged flap normally held up by a catch. The catch is released by an electromagnet, allowing the flap to drop when a signal is received.

**drop-in mike**—A surreptitious listening device that transmits phone conversations only, by rf, to a radio receiver. So called because it is "dropped in," replacing

the standard carbon microphone in the ordinary telephone handset.

**dropout**—1. A momentary loss of volume or treble response due to a brief separation of the tape from the surface of the record or play head. A very slight separation causes a treble dropout; more severe loss of head-to-tape contact causes the whole signal to drop out. Dropouts can be caused by buckled or crinkled tape, lumps or pits in the magnetic coating, or detached clumps of oxide passing across the head surface. 2. Short pause in tape replay due to bad tape coating. 3. Momentary loss of signal in a transmission channel. 4. Momentary signal losses due to imperfections in the surface of recording tape or phonograph record.

**dropout compensator**—Circuitry that senses a signal loss produced by dropout and substitutes missing information with signal from the preceding line; if one line drops out of a picture, it is filled in with the preceding line, resulting in no dropout on the screen.

**dropout error**—An error, such as loss of a recorded bit, that occurs in recorded magnetic tape because of foreign particles on or in the magnetic coating or because of defects in the backing.

**dropouts**—Also called keys. Special images inserted at certain points in the array on a photomask used in the production of monolithic circuits.

**dropout value**—The maximum value of current, voltage, or power that will deenergize a previously energized relay. *See also* hold current; pickup value (voltage, current, or power).

**dropout voltage**—The input-output voltage differential at which a regulator circuit ceases to regulate against further reductions in input voltage.

**dropping resistor**—1. A resistor used to decrease a given voltage by an amount equal to the potential drop across the resistor. 2. A resistor placed in series between a voltage source and a load to reduce the voltage supplied to the load.

**drop rate**—The rate of discharge or decay rate of the sample-and-hold capacitor of a sample-and-hold device. The rate is a function of switch leakage current and the current required by other circuit elements connected to the capacitor. It is expressed as millivolts per second.

**drop relay**—A relay activated by incoming ringing current to call the attention of an operator to the subscriber's line.

**drop repeater**—A microwave repeater station equipped for local termination of one or more circuits.

**dropsonde**—A parachute-carried radiosonde dropped from a high-flying aircraft to measure weather conditions and report them to the aircraft. It is used over water or other areas where ground stations cannot be maintained.

**drop wire**—A wire suitable for extending an open wire or cable pair from a pole or cable terminal to a building.

**dross**—Oxide and other contaminants that form on the surface of molten solder.

**drum**—1. A random-access auxiliary memory device in which information is stored on a revolving drum that is coated with a magnetic material. 2. Rotating magnetic memory that uses the surface of a cylinder.

**drum controller**—1. A device in which electrical contacts are made on the surface of a rotating cylinder or sector. 2. A device in which contacts are made by the operation of a rotating cam.

**drum memory**—A rotating cylinder or disk coated with magnetic material so that information can be stored in the form of magnetic spots.

**drum parity**—A parity error that occurs during the transfer of information to or from drums.

**drum plotter** — Plotter that draws an image on paper or film mounted on a drum.

**drum printer** — A type of printer that employs a rotating cylinder. A complete set of characters is embossed on the circumference of the drum for each print position. A set of hammers is used to strike the drum (through the paper and ribbon) and print the proper character each time the drum rotates. (No longer used.)

**drum programmer** — An electromechanical device that provides stored program logic for control of a sequential operation such as batch processing or machine cycling. It ranks between relay and solid-state systems in the cost/complexity scale.

**drum recorder** — A facsimile recorder in which the record sheet is mounted on a rotating cylinder. (No longer used.)

**drum sequencer** — Mechanical programming device that can be used to operate switches or valves.

**drum speed** — The number of revolutions per minute made by the transmitting or receiving drum of a facsimile transmitter or recorder.

**drum storage** — A storage device in which information is recorded magnetically on a rotating cylinder; a type of addressable storage associated with some computers.

**drum switch** — A switch in which the electrical contacts are made on pins, segments, or surfaces on the periphery of a rotating cylinder.

**drum transmitter** — A facsimile transmitter in which the copy is mounted on a rotating cylinder. (No longer used.)

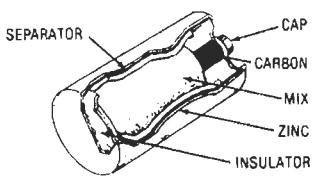
**drum-type controller** — 1. A multicircuit timing device, with or without a motor, using a cylindrical carriage into which pins are inserted to program events. 2. A multicircuit timing device intended to be driven from an external rotary power source.

**drunkometer** — A device measuring the degree of alcoholic intoxication by analyzing the subject's breath.

**dry** — 1. A condition in which the electrolyte in a cell is immobilized. The electrolyte may be either in the form of a gel or paste or absorbed in the separator material. 2. Said of circuits or contacts that do not carry direct current.

**dry battery** — Two or more dry cells arranged in series, parallel, or series-parallel within a single housing to provide desired voltage and current values.

**dry cell** — 1. A voltage-generating cell having an immobilized electrolyte. The commonest form has a positive electrode of carbon and a negative electrode of zinc in an electrolyte of sal ammoniac paste. 2. A source of energy produced by the reaction of an acid or alkaline paste on dissimilar metals or on a metal and a carbon electrode. Normal open-circuit voltage is 1.5 volts. The paste is sealed in a container in normal use, and the cell cannot be recharged.



Dry cell.

**dry-charged battery** — A battery with the plates charged but lacking electrolyte. When ready to be placed in service, the electrolyte is added.

**dry circuit** — 1. A circuit in which current and voltage are so low that there is no arcing to roughen the contacts. As a result, an insulating film can develop that prevents an electrical closing of the circuit when contacts are brought together, if the proper means are not employed to prevent the initial formation of the film. 2. A circuit in which the open-circuit voltage is 0.03 V or less and the current 200 mA or less. (The voltage is most important because at such a low level it is not able to break through most oxides, sulfides, or other films that can build up on contacting surfaces.) 3. A telephone circuit over which voice signals are transmitted and which carries no direct circuit.

**dry-circuit contact** — A contact that carries current but neither makes nor breaks while its load circuit is energized. Sometimes erroneously used if referring to low level.

**dry contacts** — Contacts through which there is no direct current.

**dry-disc rectifier** — A rectifier consisting of discs of metal and other materials in contact under pressure. Examples are the copper-oxide and the selenium rectifier.

**dry dross** — Nonmetallic components normally found on still solder pots and drag machines. A dry dross may be mixed in with flux, oil, or any other organic material. The term *dry* refers basically to the absence of any metallic solder.

**dry-electrolytic capacitor** — An electrolytic capacitor with a paste rather than liquid electrolyte. By eliminating the danger of leakage, the paste electrolyte permits the capacitor to be used in any position.

**dry flashover voltage** — The voltage at which the air surrounding a clean, dry insulator or shell completely breaks down between electrodes.

**dry-reed contact** — An encapsulated switch containing two metal wires that serve as the contact points for a relay.

**dry-reed relay** — A relay that consists of one or more capsules containing contact mechanisms that are generally surrounded by an electromagnetic coil for actuation. The capsule consists of a glass tube with a flattened ferromagnetic reed sealed in each end. These reeds, which are separated by an air gap, extend into the tube so as to overlap. When placed in a magnetic field, they are brought together and close a circuit.

**dry shelf life** — The length of time that a cell can stand without electrolyte before it deteriorates to a point at which a specified output cannot be obtained.

**dry-type forced-air-cooled transformer (class AFA)** — A transformer that is not immersed in oil and that derives its cooling by the forced circulation of air.

**dry-type self-cooled/forced-air-cooled transformer (class AA/FA)** — A transformer that is not immersed in oil and that has a self-cooled rating with cooling obtained by the forced circulation of air.

**dry-type self-cooled transformer (class AA)** — A transformer that is cooled by the natural circulation of air and that is not immersed in oil.

**dry-type transformer** — A transformer that is cooled by the circulation of air and that is not immersed in oil.

**dsc** — Abbreviation for double silk-covered.

**D-scope** — A radar display similar to a C-scope except that the blips extend vertically to give a rough estimate of the distance.

**"D" service** — FAA service pertaining to radio broadcast of meteorological information, advisory messages, and notices to airmen.

**DSP — dual-tone multifrequency signaling**

**DSP** — Abbreviation for digital signal processor. A specialized chip and/or system that is dedicated to processing real-time signals. Typically used for modems, audio, imaging, and video applications.

**DSU** — *See* data service unit.

**DT-cut crystal** — A crystal cut to vibrate below 500 kHz.

**DTE** — *See* data termination equipment.

**DTL** — Abbreviation for diode-transistor logic.

**DTMF** — Abbreviation for dual-tone multifrequency (signaling).

**DTP** — Abbreviation for desktop publishing.

**DTV** — Abbreviation for digital television.

**D-type flip-flop** — A flip-flop that, on the occurrence of the leading edge of a clock pulse, propagates to the 1 output whatever information is at its D (data) conditioning input prior to the clock pulse.

**dual** — Either of a pair of systems, circuits, etc., that are described by equations of the same form in which the same functional relationships hold provided that the dependent and independent dynamic variables are interchanged between these equations.

**dual-beam oscilloscope** — An oscilloscope in which the cathode-ray tube produces two separate electron beams that may be individually or jointly controlled.

**dual capacitor** — Two capacitors within a single housing.

**dual capstan** — *See* closed loop drive.

**dual-channel amplifier** — An amplifier that has two channels independent of each other, but similar in design, construction, and output.

**dual coaxial cable** — Two individually insulated conductors laid parallel or twisted and placed within an overall shield and sheath.

**dual cone** — Speaker unit containing a main cone for bass and middle frequencies and a smaller, stiffer inner cone for treble frequencies, sometimes called a full-range speaker unit.

**dual-diversity receiver** — 1. A radio receiver that receives signals from two different receiving antennas and uses whichever signal is the stronger at each instant to offset fading. In one arrangement, two identical radio-frequency systems, each with its own antenna, feed a common audio-frequency channel. In another arrangement, a single receiver is changed over from one antenna to the other by electronic switching at a rate fast enough to prevent loss of intelligibility. 2. The operation of combining two identical signals received over diverse paths to obtain an improvement of up to 3 dB in signal-to-noise ratio.

**dual-emitter transistor** — A passivated pnp silicon planar epitaxial transistor with two emitters; used as a low-level chopper.

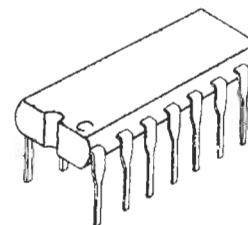
**dual feedhorn** — A feedhorn that can simultaneously receive both horizontally and vertically polarized signals.

**dual-frequency induction heater** — A type of induction heater in which work coils operating at two different frequencies induce energy, either simultaneously or successively, to material within the heater.

**dual-groove record** — *See* Cook system.

**dual in-line package** — Abbreviated DIP. 1. A type of housing for integrated circuits. The standard form is a molded plastic container about  $\frac{3}{4}$  inch long and  $\frac{1}{3}$  inch wide ( $1.9 \times 0.8$  cm), with two rows of pins spaced 0.1 inch (2.5 cm) between centers. This package is more popular than the flat pack or TO-type can for industrial use because it is relatively inexpensive and is easily dip-soldered into printed circuit boards. 2. Carrier in which a semiconductor integrated circuit or other components, such as transistors, diodes, capacitors, inductors, resistors,

or film hybrid circuits, are assembled and sealed. Package consists of a plastic or ceramic body with two rows of seven or more vertical leads that are inserted into a circuit board and secured by soldering. 3. The most common type of integrated-circuit package, which can be either plastic (DIP-plastic) or ceramic (CERDIP). Circuit leads or pins extend symmetrically outward and downward from opposite sides of the rectangular package body. "DIP, side-brazed" is a dual in-line package with leads brazed externally, on the sides of the package.



*Dual in-line package.*

**dual meter** — A meter constructed so that two aspects of a circuit may be read simultaneously.

**dual-mode ignition** — *See* DMI.

**dual-mode phone** — A phone that operates on both analog and digital networks.

**dual modulation** — The use of two different types of modulation, each conveying separate intelligence, to modulate a common carrier or subcarrier wave.

**dual operation** — A logic operation whose result is the negation of the result of an original operation when applied to the negation of its operands; for example, the OR operation is the dual of the AND operation. A dual operation is represented by writing 0 for 1 and 1 for 0 in the tabulated values of P, Q, and R for the original operation.

**dual pickup** — *See* turnover pickup.

**dual rail** — Also called double rail. Pertaining to a method of transferring data in which the data and the complement of the data are available on different input or output lines or wires.

**dual slope converter** — An integrating analog-to-digital converter in which the unknown signal is converted to a proportional time interval that is then measured digitally.

**dual-tone multifrequency** — Abbreviated DTMF.

1. A signaling method in which are employed set pairs of specific frequencies used by subscribers and PBX attendants, if their switchboard positions are so equipped, to indicate telephone address digits, precedence ranks, and end of signaling. 2. A portion of the touch-tone telephone dialing system developed by AT&T that combines two of a set of standard frequencies. The result of the combination is a third or beat frequency (signal) that is the desired or useable signal. DTMF signaling transports precisely defined and matched tone pair signals over sharply tuned amplitude-guarded channels to achieve highly error-immune operation.

**dual-tone multifrequency signaling** — Abbreviated DTMF signaling. Sending numerical address information from a telephone by sending, simultaneously, a combination of two tones out of a group of eight. The eight frequencies are 697, 770, 852, 941, 1209, 1336, 1477, and 1633 Hz.

		HIGH-GROUP TONES			
		1209 Hz	1336 Hz	1477 Hz	1633 Hz
LOW-GROUP TONES	697 Hz	1	2	3	A
	770 Hz	4	5	6	B
	852 Hz	7	8	9	C
	941 Hz	*	0	#	D

← TWO-OUT-OF-SEVEN CODE →  
← TWO-OUT-OF-EIGHT CODE →

**Dual-tone multifrequencies.**

**dual trace**—A mode of operation in which a single beam in a cathode-ray tube is shared by two signal channels. *See also* alternate mode; chopped mode.

**dual-track recorder**—Normally a monophonic recorder in which the recording head covers slightly less than half the width of a standard quarter-inch tape, making it possible to record one track on the tape in one direction and, after turning the reels over, a second track in the opposite direction. Known also as half-track or two-track recorder.

**dual-use line**—A communications link that normally is used for more than one mode of transmission (e.g., for voice and data).

**dub**—Also called rerecording. 1. A copy of a recording. 2. To make a copy of a recording by recording on one machine what another machine is playing.

**dubbing**—1. In radio broadcasting, the addition of sound to a prerecorded tape or disc. 2. Copying of already recorded material. In tape recording, playing a tape or disc on one machine while recording it on another. The copy is called a dub.

**duct**—1. An overhead or underground protective tube or pipe used for carrying electrical conductors. 2. In microwave transmission, atmospheric conditions may cause radio waves to follow a narrower path than usual. The narrower path is called a duct. The presence of ducting sometimes causes unusual transmission because the transmission waves do not follow the intended path.

**ducting**—The trapping of an electromagnetic wave, in a waveguide action, between two layers of the earth's atmosphere, or between a layer of the atmosphere and the earth's surface.

**DUF**—Abbreviation for diffusion under the epitaxial film. A method for providing a low-resistance path between the active region of an IC transistor and the contact electrode at the surface. A region of high conductance is formed by selective diffusion in the required location prior to deposition of the epitaxial layer.

**dumb terminal**—1. Conversational slave to a host computer in a communication network. 2. An inexpensive means of interactive computer control that is good for on-line fixed-program applications. All software is in the host computer mainframe. A dumb terminal contains no user programming or memory for data manipulation. 3. The minimum equipment necessary to communicate with a computer. It consists of a monitor and a keyboard and will do little more than send and receive data. 4. A display terminal with no processing capabilities other than that associated with screen formatting. For processing, the terminal is entirely dependent on the main computer with which it communicates.

**dummy**—1. A device that can be substituted for another, but which has no operating features. 2. A telegraphy network used to simulate a customer's loop for adjustment of a telegraph repeater. The dummy side of the repeater is the side toward the customer. 3. In a computer, an artificial address, instruction, or other unit of information inserted solely for the purpose of fulfilling such prescribed conditions as word length or block length

without affecting operations. 4. A simulating circuit that has no features.

**dummy antenna**—*See* artificial antenna.

**dummying**—The process of removing metallic impurities from plating solution with a large-area dummy cathode.

**dummy instruction**—An artificial instruction or address inserted in a list of instructions to a computer solely to fulfill prescribed conditions (such as word length or block length) without affecting the operation.

**dummy load**—*See* artificial load.

**dummy variable**—In a computer program, a symbol inserted at definition time, which will later be replaced by the actual variable.

**dump**—Also called power dump. 1. To withdraw all power from a computer, either accidentally or intentionally. 2. To transfer all or part of the contents of one section of a digital-computer memory into another section. 3. To transfer information from a register word to a memory position. 4. To transfer all of the information contained in a record into another storage medium. For example, a disc record could be dumped onto tape. 5. Copying contents of memory from one place to another. Same as memory dump.

**dump check**—Checking a computer by adding all digits as they are dumped (transferred) to verify the sum to make sure no errors exist as the digits are retransferred.

**dump circuit**—One form of transient suppression circuit, a self-biased snubber. The dump circuit is virtually inactive until the voltage across it exceeds the recent (slow) average value.

**dumping resistor**—A resistor whose function is to discharge a capacitor or network for safety purposes.

**Dunmore cell**—*See* lithium chloride sensor.

**duodecal socket**—A vacuum-tube socket having 12 pins. Used for cathode-ray tubes.

**duodecimal**—1. Pertaining to a characteristic or property involving a selection, choice, or condition in which there are 12 possibilities. 2. Pertaining to the numbering system with a radix of 12.

**duodiode**—Also called dual diode. A vacuum tube or semiconductor having two diodes within the same envelope.

**duodiode-pentode**—An electron tube containing two diodes and a pentode in the same envelope.

**duodiode-triode**—An electron tube containing two diodes and a triode in the same envelope.

**duolateral coil**—*See* honeycomb coil.

**duopole**—An all-pass action with two poles and two zeros.

**duotriode**—Also called double triode. An electron tube containing two triodes in the same envelope.

**duplex**—1. The method of operation of a communication circuit in which each end can simultaneously transmit and receive. (Ordinary telephones are duplex. When used on a radio circuit, duplex operation requires two frequencies.) 2. Two-in-one, as two conductors with a common overall insulation or two telegraph transmission channels over one wire. 3. Two conductors twisted together, usually with no outer covering. This term has a double meaning; it is possible to have parallel wires and jacketed parallel wires, and still refer to them as duplex. 4. Two-way data transmission. *Full duplex* describes two data paths that allow simultaneous data transmission in both directions. *Half duplex* describes one data path that allows data transmission in either of two directions, but only one direction at a time.

**duplex artificial line**—A balancing network simulating the impedance of the real line and distant terminal apparatus; it is employed in a duplex circuit for the

purpose of making the receiving device unresponsive to outgoing signal currents.

**duplex cable**—A cable composed of two insulated stranded conductors twisted together. They may or may not have a common insulating covering.

**duplex channel**—A communication channel providing simultaneous transmission in both directions.

**duplexer**—1. A radar device that, by using the transmitted pulse, automatically switches the antenna from receive to transmit at the proper time. 2. Highly selectable, tunable filters that allow a transmitter and receiver to use one common antenna.

**duplexing assembly (radar)**—See transmit-receive switch.

**duplex operation**—Simultaneous operation of transmitting and receiving apparatus at two locations.

**duplex system**—A system with two distinct and separate sets of facilities, each of which is capable of assuming the system function while the other assumes a standby status. Usually both sets are identical in nature.

**duplex tube**—A combination of two vacuum tubes on one envelope.

**duplicate**—To copy in such a way that the result has the same physical form as the source. For example, to make a new punched card that has the same pattern of holes as an original punched card.

**duplication check**—A computer check in which the same operation or program is checked twice to make sure the same result is obtained both times.

**Duraspark**—Conventional (Ford Motor) electronic ignition for use with high-voltage, high-energy spark timing control.

**duration control**—A control for adjusting the time duration of reduced gain in a sensitivity time control circuit.

**duress alarm device**—A device that produces either a silent alarm or local alarm under a condition of personnel stress such as holdup, fire, illness, or other panic or emergency. The device is normally manually operated and may be fixed or portable.

**duress alarm system**—An alarm system that employs a duress alarm device.

**during cycle**—The interval while a timer is operating for its preset time period.

**dust core**—A pulverized iron core consisting of extremely fine iron particles mixed with a binding material for use in radio-frequency coils.

**dust cover**—A device specifically designed to cover the mating end of a connector so as to provide mechanical and/or environmental protection.

**DUT**—Abbreviation for device under test.

**duty cycle**—1. Ratio of working time to total time for intermittently operated devices. 2. The ratio of on-time to off-time in a periodic on-off cycle. 3. The ratio of operating time to total elapsed time of a device that operates intermittently, expressed as a percentage. 4. In percent,  $100(t_o/T)$ , where  $T$  is the period between pulses and  $t_o$  is the pulse width.

**duty cyclometer**—A test meter that gives a direct reading of duty cycle.

**duty factor**—1. In a carrier composed of regularly recurring pulses, the product of their duration and repetition frequency. 2. Ratio of average to peak power. 3. Same as duty cycle except it is expressed as a decimal rather than a percentage. Usually calculated by multiplying pulses per second times pulse width.

**duty ratio**—In a pulsed system, such as radar, the ratio of average to peak power.

**DVD**—Abbreviation for the digital versatile disc and digital video disk. A high capacity optical storage medium

## duplex cable — dynamic cell

with improved capacity and bandwidth over the CD for prerecorded multimedia program material with applications in video playback and PC areas.

**dv/dt**—The rate of change of voltage with respect to time. Proportional to current in a capacitor.

**Dvorak keyboard**—A keyboard arrangement designed by August Dvorak for increased speed and comfort. It reduces the rate of errors by placing the most frequently used letters in the center of the keyboard for use by the strongest fingers.

**DX**—1. Abbreviation for distance. 2. Reception of distant stations. 3. Distant and/or difficult to hear radio stations.

**DXer**—One who listens to distant or hard-to-hear stations as a hobby.

**DX hound**—An amateur who specializes in making distant contacts.

**DXing**—The hobby of listening to distant or otherwise hard-to-hear stations.

**dyadic Boolean operator**—A Boolean operator that has two operands. The dyadic Boolean operators are AND, exclusive OR, NAND, NOR, and OR.

**dyadic operation**—An operation on two operands.

**dye laser**—A laser using a dye solution as its active medium. Its output is a short pulse of broad spectral content, and its achievable gain is high. Dye lasers function at room temperature. Synchronous pumping can be used to produce a continuous train of tunable picosecond pulses for sustained periods.

**dynamic**—1. Of, concerning, or dependent on conditions or parameters that change, particularly as functions of time. 2. A speaker drive principle using the interaction between the magnetic field surrounding a voice coil carrying a signal current and a fixed magnetic field to move the coil and the cone to which it is attached. 3. A headphone driver using a voice coil in a magnetic field driving a paper or plastic diaphragm, as in a speaker.

**dynamic acceleration**—Acceleration in a constantly changing magnitude and direction, either simple or complex motion, usually called vibration. Also measured in gravity units.

**dynamically balanced arm**—A type of tonearm whose masses are balanced about its pivot, with tracking force applied by a spring. This type of arm does not require that the turntable be level for proper tracking.

**dynamic analogies**—The similarities in form between the differential equations that describe electrical, acoustical, and mechanical systems that allow acoustical and mechanical systems to be reduced to equivalent electrical networks, which are conceptually simpler than the original systems.

**dynamic analysis**—Execution of an instrumented program to collect information on its behavior and correctness.

**dynamic behavior**—The way a system or individual unit functions with respect to time.

**dynamic braking**—1. A system of braking of an electric drive in which the motor is used as a generator, and the kinetic energy of the motor and driven machinery is employed as the actuating means of exerting a retarding force. 2. A type of motor braking caused by current being applied to the windings after the power is shut off. This is accomplished either by self-excitation (dc motors) or by separate excitation (ac motors).

**dynamic burn-in**—High-temperature test with devices subject to actual or simulated operating conditions.

**dynamic cell**—A memory cell that stores data as charge (or absence of charge) on a capacitor. A typical cell isolates the capacitor from the data line (bit line) with a transistor switch. Thus, when no read or write operation is desired, there is essentially no power required

to maintain data. However, normal leakage requires that the charge be periodically restored by a process called refresh. Characteristics of a dynamic cell are very low data retention power, fewer transistors per bit (a one-transistor cell is common), and, usually, less area and lower cost per bit than for static cells.

**dynamic characteristics** — Relationship between the instantaneous plate voltage and plate current of a vacuum tube as the voltage applied to the grid is varied.

**dynamic check** — A check used to ascertain the correct performance of some or all components of equipment or a system under dynamic or operating conditions.

**dynamic contact resistance** — 1. In a relay, a change in contact electrical resistance due to a variation in contact pressure on mechanically closed contacts. For example, during wiping motion of sliding contacts during make or prior to break. Also when contact members no longer actually open, as in contact bounce, but members are still vibrating and varying the contact pressure and hence its resistance. 2. A varying contact resistance on contacts mechanically closed.

**dynamic convergence** — 1. The condition in which the three beams of a color picture tube come together at the aperture mask as they are deflected both vertically and horizontally. 2. A composite horizontal and vertical voltage used to ensure correct convergence of the three beams of a tricolor picture tube over the entire surface of the phosphor-dot faceplate. *See also* horizontal dynamic convergence; vertical dynamic convergence.

**dynamic crosstalk** — A condition (in an amplifier utilizing a single power supply) in which the demands made on one channel will effectively modulate the output of the other channel because the power supply feeding both is pumping up and down. To completely eliminate dynamic crosstalk may require separate and well-shielded power supplies for each channel.

**dynamic decay** — In a storage tube, decay caused by an action such as that of ion charging.

**dynamic demonstrator** — A three-dimensional schematic diagram in which the components of the radio, television receiver, etc., are mounted directly on the diagram.

**dynamic deviation** — The difference between the ideal output value and the actual output value of a device or circuit when the reference input is changing at a specified constant rate and all other transients have expired.

**dynamic dump** — A dump performed while a program is being executed.

**dynamic electrode potential** — The electrode potential measured when current is passing between the electrode and the electrolyte.

**dynamic equilibrium of an electromagnetic system** — 1. The tendency of any electromagnetic system to change its configuration so that the flux of magnetic induction will be maximum. 2. The tendency of any two current-carrying circuits to maintain the flux of magnetic induction linking the two at maximum.

**dynamic error** — An error in a time-varying signal resulting from inadequate dynamic response of a transducer.

**dynamic focus** — The application of an ac voltage to the focus electrode of a color picture tube to compensate for the defocusing caused by the flatness of the screen.

**dynamic headroom** — The ability of an amplifier to produce more than its rated power for very short periods of time. An amplifier rated at 100 watts per channel with 3 dB of dynamic headroom can briefly produce 200 watts per channel.

**dynamic magnetic field** — A field whose intensity is changing and whose lines of force are expanding or

contracting. Such change can be periodic or random. Unlike the static field, the dynamic field can transfer energy from one point to another without relative motion between the points.

**dynamic memory** — 1. A type of semiconductor memory in which the presence or absence of an electrical or capacitive charge represents the two states of a binary storage element. Without refresh, the data represented by the electrical charge would be lost. 2. An MOS RAM memory using dynamic circuits. Each bit is stored as a charge on a single MOS transistor. This results in very high-density storage (only one transistor per bit). The charge leaks; therefore, a typical dynamic memory must be refreshed every 2 ms by rewriting its entire contents. In practice, this does not slow down the system, but requires additional memory refresh logic. (Dynamic chips are inexpensive and generally preferred to static ones for sizes over 16 K.)

**dynamic memory allocation** — Allocation of a limited main memory to successive programs in function of an allocation strategy based on priority, availability, or size.

**dynamic microphone** — *See* moving-coil microphone.

**dynamic MOS array** — A circuit made up of MOS devices that requires a clock signal. The circuit must be tested at its rated (operating) speed. Known as clock-rate testing.

**dynamic mutual-conductance tube tester** — *See* transconductance tube tester.

**dynamic noise limiter** — Abbreviated DNL. A compatible circuit designed primarily for use with tape recorders. It improves the effective signal-to-noise ratio during replay by selective filtering at low signal levels.

**dynamic noise suppressor** — An audio filter whose bandpass is adjusted automatically to the signal level. At low signal levels, filtering is highest; at high signal levels, all filter action is removed.

**dynamic output impedance** — *See* output impedance, 2.

**dynamic pickup** — A phonograph pickup whose electrical output is the result of the motion of a conductor in a magnetic field.

**dynamic plate impedance** — The internal resistance to the flow of alternating current between the cathode and plate of a tube.

**dynamic plate resistance** — *See* ac plate resistance.

**dynamic power** — *See* music power.

**dynamic printout** — In a computer, a printout of data that occurs as one sequential operation during the machine run.

**dynamic problem check** — A dynamic check used to ascertain that the solution determined by an analog computer satisfies the given system of equations.

**dynamic programming** — 1. A procedure used in operations research for optimization of a multistage problem solution in which a number of decisions are available at each stage of the process. 2. A method of sequential decision making in which the result of the decision in each stage affords the best possible answer to exploit the expected range of likely (yet unpredictable) outcomes in the following decision-making stages.

**dynamic RAM** — *See* DRAM.

**dynamic range** — 1. The difference, in decibels, between the overload level and the minimum acceptable signal level in a system or transducer. 2. The span of volume between the loudest and softest sounds, either in an original signal (original dynamic range) or within the span of a recorder's capability (recorded dynamic

range). Dynamic range is expressed in decibels. *See* signal-to-noise ratio. 3. The range of signal amplitudes, from the loudest to the quietest, that can be reproduced effectively by an equipment. Limited by the intrinsic noise of the amplifier and the ambient background noise level of the listening environment and by the power capacity of the amplifier and speaker system. 4. The ratio between the maximum recorded level (usually that which results in 3-percent playback distortion) and the playback noises from a tape recorded with no signal input. Expressed in decibels. 5. The difference between the maximum acceptable signal level and the minimum acceptable signal level. 6. The ratio of the largest to the smallest values of range, often expressed in decibels. 7. The ratio of the maximum output signal to the smallest output signal that can be processed in a system, usually expressed logarithmically in dB. (Dynamic range can be specified in terms of harmonic distortion, signal-to-noise ratio, spurious-free dynamic range, or other ac input-based performance criteria.)

**dynamic register** — A memory in which the storage takes the form of capacitively charged circuit elements and therefore must be continually refreshed, or recharged, at regular intervals.

**dynamic regulator** — A transmission regulator in which the adjusting mechanism is in self-equilibrium at only one or a few settings and requires control power to maintain it at any other setting.

**dynamic relocation** — The ability to move computer programs or data from auxiliary memory to any convenient location in the memory. Normally the addresses of programs and data are fixed when the program is compiled.

**dynamic reproducer** — *See* moving-coil pickup.

**dynamic resistance** — Incremental resistance measured over a relatively small portion of the operating characteristic of a device.

**dynamic router** — A router that automatically broadcasts routing information throughout the Internet at regular intervals. Other dynamic routers use this information to update their routing tables in case any changes have been made to the network.

**dynamic run** — Also called dynamic test. 1. The test performed on an instrument to obtain the overall behavior and to establish or corroborate specifications such as frequency response, natural frequency of the device, etc. 2. Test based on a time-interval measurement as, for example, the rise time or fall time of a pulse. 3. A test of one or more of the signal properties or characteristics of equipment that is energized or in a nonquiescent state.

**dynamic sequential control** — A method of operation in which a digital computer can alter instructions or their sequence as the computation proceeds.

**dynamic shift register** — A shift register in which information is stored by means of temporary charge storage techniques. The major disadvantage of this method is that loss of the information occurs if the clock repetition rate is reduced below a minimum value.

**dynamic skew** — Short-term misalignment of the read head of a tape player as referenced to a master skew tape. It results from variations in tape-path geometry and tape-path alignment and slitting and "snaking" tolerances of magnetic tape.

**dynamic speaker** — *See* moving-coil speaker.

**dynamic storage** — 1. A data-storage device in which the data is permitted to move or vary with time in such a way that the specified data is not always immediately available for recovery. Magnetic drums and disks are permanent dynamic storage; acoustic delay line is a volatile dynamic storage. 2. Information storage using temporary charge storage techniques. It requires a clock

repetition rate high enough to prevent loss of information.

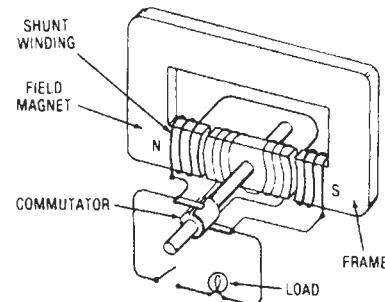
**dynamic storage allocation** — A storage-allocation technique in which program and data locations are determined by criteria applied at the moment of need.

**dynamic subroutine** — In digital-computer programming, a subroutine that involves parameters (such as decimal point position) from which a properly coded subroutine is derived. The computer itself adjusts or generates the subroutine according to the parametric values chosen.

**dynamic test** — *See* dynamic run.

**dynamic transfer-characteristic curve** — A curve showing the variation in output current as the input current changes.

**dynamo** — 1. Normally called a generator. A machine that converts mechanical energy into electrical energy by electromagnetic induction. 2. In precise terminology, a generator of direct current—as opposed to an alternator, which generates alternating current.



Dynamo.

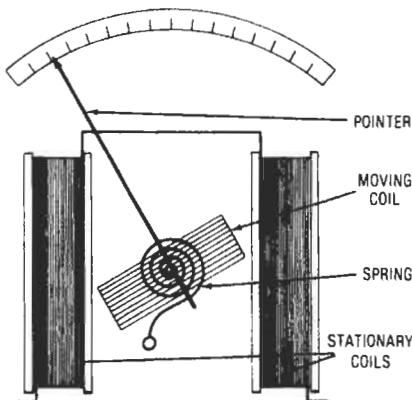
**dynamoelectric** — Pertaining to the relationship between mechanical force and electrical energy or vice versa.

**dynamometer** — 1. An instrument in which the force between a fixed and a moving coil provides a measure of current, voltage, or power. 2. Equipment designed to measure the power output of a rotating machine by determining the friction absorbed by a hand brake opposing the rotation.

**dynamotor** — Also called a rotary converter or synchronous inverter. 1. A rotating device for changing a dc voltage to another value. It is a combination electric motor and dc generator with two or more armature windings and a common set of field poles. One armature winding receives the direct current and rotates (thus operating as a motor), while the others generate the required voltage (and thus operate as a dynamo or generator). 2. A rotary electrical machine used to convert direct current to alternating current. The machine has a single field structure and a single rotating armature having two windings, one equipped with a dc commutator and the other with ac slip rings.

**dynaquad** — A germanium pnpn semiconductor switching device that is base controlled and has three terminals. Its operation is similar to that of a flip-flop circuit or latching relay.

**dynatron** — Also called negatron. A type of vacuum tube in which secondary emission of electrons from the plate causes the plate current to decrease as the plate voltage increases, with the result that the device exhibits a negative-resistance characteristic. Used in oscillator circuits. *See* tetrode.

*Dynamometer, I.*

**dynatron oscillator**—A negative-resistance oscillator with negative resistance derived between the plate and cathode of a screen-grid tube operating such that secondary electrons produced at the plate are attracted to the higher-potential screen grid.

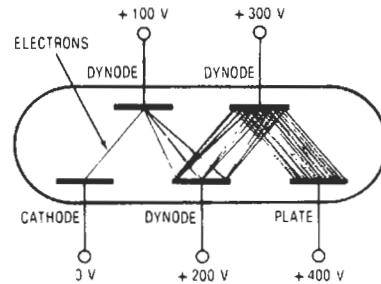
**dyne**—The fundamental unit of force in the cgs system that, if applied to a mass of 1 gram, would give it an acceleration of 1 cm/s<sup>2</sup>.

**dyne per square centimeter**—Also called microbar. The unit of sound pressure. One dyne per square

centimeter was originally called a bar in acoustics, but the full expression is used in this field now because the bar is defined differently in other applications.

**dynistor**—A nonlinear semiconductor having the characteristics of a small current flow as voltage is applied. As the applied voltage is increased, a point is reached at which the current flow suddenly increases radically and will continue at this rate even though the applied voltage is reduced.

**dynode**—1. An electrode having the primary function of supplying secondary electron emission in an electron tube. 2. The auxiliary electrode that, when functioning within a photomultiplier tube and when bombarded by photoelectrons, gives rise to secondary emission and amplification.

*Dynode.*

# E

**E**—1. Symbol for voltage or emitter. 2. Abbreviation for illumination.

**E and M leads**—In a signaling system, the output and input leads, respectively.

**E- and M-lead signaling**—Communications between a trunk circuit and a separate signaling unit by way of two leads: an M lead over which battery or ground signals are transmitted to the signaling equipment, and an E lead over which open or ground signals are received from the signaling unit.

**early failure**—A failure that occurs during the initial life phase and is generally caused by initial production, assembly, test, installation, or commissioning errors.

**early-failure period**—Also called debugging period, burn-in period, or infant-mortality period. The period of equipment life, starting immediately after final assembly, during which equipment failures initially occur at a higher than normal rate due to the presence of defective parts and abnormal operating procedures.

**early-warning radar**—A radar that usually scans the sky in all directions in order to detect approaching enemy planes and/or missiles at distances far enough away that interceptor planes can be in the air to meet their approach before they are near their target.

**EAROM**—Abbreviation for electrically alterable ROM. 1. A read-only memory (ROM) that can be erased and reprogrammed any number of times. 2. Device that resembles an EPROM except that electric current rather than ultraviolet light does the erasing. This is an expensive type of PROM because it requires complete read/write control logic. Use is restricted mainly to applications such as machine controllers in which operators must change programs regularly. 3. Similar to the EPROM, the EAROM can be erased by a sort of reversed programming with a high voltage. The EAROM is thus like a RAM that will not lose its data if power is removed.

**earphone**—Also called receiver. 1. An electroacoustic transducer intended to be placed in or over the ear. 2. An electroacoustic device that transforms electric waves into sound waves. It is intended to be closely coupled, acoustically, to the ear.

**earth**—Term used in Great Britain for ground.

**earth conductivity**—The conductance between opposite faces of a unit cube (usually cubic meter) of a given earth material (loam, clay, sand, rock, etc.). The volume conductivity of this earth sample is the reciprocal of its volume (not to be confused with surface) resistivity.

**earth current**—Also called ground current. 1. Current in the ground as a result of natural causes and affecting the magnetic field of the earth, sometimes causing magnetic storms. 2. Return, fault, leakage, or stray current passing from electrical equipment through the earth.

**earthered**—A British term meaning grounded.

**earth ground**—1. A connection from an electrical circuit or equipment to the earth through a water pipe or a metal rod driven into the earth. This connection reduces shock hazards from faulty equipment. Water pipes may no longer be reliable grounds because of the use of transite pipe, neoprene gaskets, and other nonconducting links. Any ground rods driven under the interior of a large building may gradually become ineffective because the building may drive the local water table down so far that the rod is essentially surrounded by dry soil. 2. An actual connection into the surface of the earth by way of a metal or chemical rod or a wire connected to such a conductor.

**earth inductor**—See generating magnetometer.

**earth-layer propagation**—1. Propagation of electromagnetic waves through layers in the atmosphere of the earth. 2. Propagation of electromagnetic waves through layers below the surface of the earth.

**earth oblateness**—The slight departure from a perfect spherical shape of the earth and the form of its gravity field.

**earth permittivity**—The ratio of a capacitor's capacitance using our earth sample as a dielectric to that with air as a dielectric. Permittivity has also variously been termed dielectric constant, specific inductive capacity, and capacititivity.

**earth station**—The term used to describe the combination of antenna, low-noise amplifier (LNA), down-converter, and receiver electronics; used to receive a signal transmitted by a satellite. Earth station antennas vary in size from the 2-foot to 12-foot (65 centimeters to 3.7 meters) diameter size used for TV reception to those as large as 100 feet (30 meters) in diameter sometimes used for international communications. The typical antenna used for INTELSAT communication today is 13 to 18 meters or 40 to 60 feet in diameter.

**EAS**—Abbreviation for extensive area service.

**EAX**—Abbreviation for electronic automatic exchange.

**EBCDIC**—Abbreviation for extended binary coded decimal interchange code. A coding scheme wherein letters, numbers, and special symbols are represented as unique eight-bit values, allowing for standardization between data communications devices; popularized by IBM. The code can accommodate 256 characters.

**E-bend**—See E-plane bend.

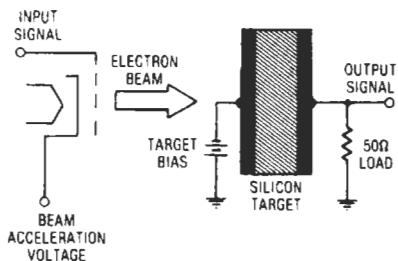
**ebconductivity**—Conductivity induced as the result of electron bombardment.

**ebmd**—Abbreviation for electron-beam mode discharge.

**EBS amplifier**—Abbreviation for electron-bombarded semiconductor amplifier.

**ec**—Abbreviation for enamel covered.

**eccentric circle**—See eccentric groove.

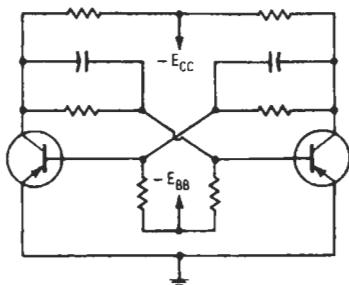


EBS amplifier.

**eccentric groove** — Also called eccentric circle. An off-center locked groove for actuating the trip mechanism of an automatic record changer at the end of a recording.

**eccentricity** — In disc recording, the displacement of the center of the recording-groove spiral with respect to the record center hole.

**Eccles-Jordan circuit** — A flip-flop consisting of a two-stage, resistance-coupled amplifier. Its output is coupled back to its input, two separate conditions of stability being achieved by alternately biasing the two stages beyond cutoff.



Eccles-Jordan multivibrator.

**ECCM** — Abbreviation for electronic counter-countermeasures.

**ECG** — See electrocardiogram.

**echelon** — One of a series of levels of accuracy of calibration, the highest of which is represented by an accepted national standard. There may be auxiliary levels between two successive echelons.

**echo** — 1. In radar, that portion of the energy reflected to the receiver from a target. 2. A wave that has been reflected or otherwise returned with sufficient magnitude and delay to be distinguishable from the directly transmitted wave. 3. In facsimile, a multiple reproduction on the record sheet caused by the arrival of the same original facsimile signal at different times over transmission paths of different lengths. 4. In a radio system, an electronic condition that causes a signal such as a voice signal to be reflected from some point or points in the circuit back to the point of origination of the signal. 5. A delayed repetition (sometimes several rapid repetitions) of the original sound or signal. 6. In tape recording, refers to a provision for picking up some of the sound from a play head while recording, and feeding it back to the record head to produce a rapidly periodic repetition of each sound. Correct echo-volume adjustment causes a decay of the repeated sounds to simulate acoustical reverberation. 7. A special

recording effect, in which a portion of the recorded program is taken from the playback head, a short interval after being recorded, and mixed with the incoming program. Principally used at tape speeds greater than 3 1/4 ips (9.5 cm/s), where the delayed signal is not heard as a separate sound. 8. An instantaneous repetition of the sound heard in playing some tapes or other recordings. This is caused by print through. 9. A portion of the transmitted signal returned from a distant point to the transmitted source with sufficient time delay to be received as interference. 10. A signal that has been reflected at one or more points during transmission with sufficient magnitude and time difference as to be detected as a signal distinct from that of the primary signal. Echoes can either lead or lag the primary signal and appear as reflections or ghosts. 11. Displaying information sent or received on a terminal, to visually detect transmission errors. Remote echo comes from the host computer. Local echo comes from the sender's transmission. 12. The distortion created when a signal is reflected back to the originating station.

**echo area** — Equivalent echoing area of a radar target (i.e., the relative amount of radar energy the target will reflect).

**echo attenuation** — In a four-wire (or two-wire) circuit equipped with repeater or multiplex equipment in which the two directions of transmission can be separated from each other, the attenuation of the echo currents (which return to the input of the circuit under consideration) is determined by the ratio of the transmitted power to the echo power received.

**echo box** — Also called phantom target. A device for checking the overall performance of a radar system. It comprises a resonant cavity that receives a portion of the pulse energy from the transmitter and retransmits it to the receiver as a slowly decaying transient. The time required for this transient response to decay below the minimum detectable level on the radar indicator is known as the ring time and is indicative of the overall performance of the radar set.

**echo cancellation** — 1. A circuit that uses digital signal processing technology in a full-duplex communications node to remove echoes of the transmitted signal from the received signal. 2. The technique used in modems to filter out unwanted signals.

**echo canceller** — An electronic circuit that attenuates or eliminates the echo effect on satellite telephony links. Echo cancellers are largely replacing obsolete echo suppressors.

**echocardiogram** — Ultrasound image of the structure and motions of the heart.

**echocardiography** — A sonarlike noninvasive method of diagnosing cardiac malfunctions. A pulsed ultrasound beam is directed through the chest wall and echoes reflected from differing tissue interfaces (e.g., soft tissue and blood; tissue and bone, etc.) are detected by the barium titanate transducer that originated the pulse. Echoes are recorded against a linear time base to provide a hard-copy record of cardiac structure movement in a given time span, generally defined by the ECG.

**echo chamber** — A reverberant room or enclosure used for adding hollow effects or actual echoes to radio or television programs.

**echo check** — A method of checking the accuracy of transmission of data in which the received data is returned to the sending end for comparison with the original data.

**echo checking** — A method of checking in which transmitted information is reflected back to the transmitting point and compared with what was sent.

**echo distortion** — 1. A modulation-related impairment created when one or more delayed echo signals introduce a phase-sensitive delay ripple across the FM

portion of a system. The amplitude of this distortion is a complex function involving the relative magnitude and delay time of the echo signal with respect to the main signal, the level of baseband loading present, and the relative position of the channel in the baseband. 2. A telephone-line impairment caused by electrical reflections at distant points where line impedances are dissimilar.

**echoencephaloscope**—An ultrasonic instrument for use in brain studies. A transducer that generates a series of ultrasonic pulses and detects the returning echoes is placed against the patient's head. Each pulse is displayed together with its associated echoes on a cathode-ray tube.

**echo intensifier**—A device, located at the target, that is used to increase the amplitude of the reflected energy to an abnormal level.

**echo matching**—Rotating an antenna to a position in which the pulse indications of an echo-splitting radar are equal.

**echo splitting**—In certain radar equipment, the echo return is split and appears as a double indication on the screen of the radar indicator. This splitting is accomplished by special electronic circuits associated with the antenna lobe switching mechanism. When the two echo indications are of equal height, the target bearing is read from a calibrated scale.

**echo suppression**—1. A control used to disable a responder for a short interval of time so that reception of echoes of the interrogator pulse from nearby targets is prevented. 2. A circuit used to eliminate reflected waves.

**echo suppressor**—1. A voice-operated device that is connected to a two-way telephone circuit to attenuate echo currents in one direction caused by telephone currents in the other direction. 2. In navigation, a circuit that desensitizes the equipment for a fixed period after the reception of one pulse, for the purpose of rejecting delayed pulses arriving from indirect reflection.

**echo talker**—A portion of the transmitted signal returned from a distant point to the transmitting source with sufficient time delay to be received as interference.

**ECL**—Abbreviation for emitter-coupled logic. 1. A type of unsaturated logic performed by emitter-coupled transistors. Higher speeds may be achieved with ECL than are obtainable with standard logic circuits. 2. An IC logic family characterized by its very high speed of operation, low circuit density per chip, and very high power dissipation when compared with other IC logic families. Used mainly in large, very high-speed digital computers and sold mainly on a custom-designed basis. 3. A type of current-mode logic in which the circuits are coupled with one another through emitter followers at the input or output of the logic circuit. 4. A bipolar digital IC family that uses a more complex design than TTL to speed up IC operations. Emitter-coupled logic is costly, power hungry, and difficult to use, but it is four times faster than TTL. 5. A family of nonsaturated logic devices that operate at very high speed. ECL logic dissipates relatively large amounts of power, requires a bias supply, and is characterized by low component density.

**ECL bipolar memories**—Very high-speed cache, writable control stores, and processing sections of large computers.

**ECM**—Abbreviation for electronic countermeasures.

**ECO**—Abbreviation for electron-coupled oscillator.

**E-core**—The laminated configuration resembling the capital letter E in some transformers and inductive transducers.

**ECU**—Abbreviation for electronic control unit. 1. Electronic ignition system (Chrysler Corp.) that replaced the breaker-point ignition system. Provides spark

## echoencephaloscope — edge effect

timing to the high-energy coil and spark plugs. 2. A high-energy ignition system using a Hall effect semiconductor pickup in the distributor instead of the conventional reluctance pickup.

**EDC**—Abbreviation for error detection code. 32 bits in each sector that are used to detect errors in the sector data of a CD.

**EDCT**—Abbreviation for electrochemical diffused-collector transistor. A pnp transistor in which all the mass of p material is etched off and replaced with metal, which acts as a heat sink. It is suitable for high-current, high-speed core driver and computer-memory applications.

**eddy current clutch**—A device that permits connection between a motor and a load by electrical (magnetic) means—no physical contact is involved. This method is also used for speed control by clutch slippage.

**eddy-current heating**—Synonym for induction heating.

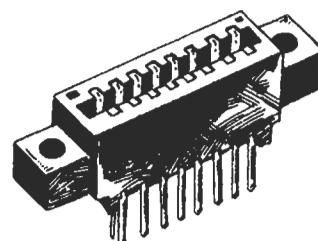
**eddy-current loss**—The core loss that results when a varying induction produces electromotive forces that cause a current to circulate within a magnetic material.

**eddy currents**—Also called Foucault currents. 1. Those currents induced in the body of a conducting mass by a variation in magnetic flux. 2. Circulating currents induced in conducting materials by varying magnetic fields. Usually undesirable because they represent loss of energy and cause heating. 3. Induced currents through an iron core in a transformer. They cause a waste of power.

**edge-board connector**—Also called card-edge connector. A connector that mates with printed wiring leads running to the edge of a printed circuit board.

**edge-board contact**—A series of contacts printed on or near any edge of a printed board and intended for mating with an edge connector.

**edge connector**—1. A one-piece receptacle, containing female contacts, designed to receive the edge of a printed circuit board and interconnect on which the male contacts are etched or printed. The connector may contain either a single or double row of female contacts. Both thermoplastic and thermosetting insulating materials are used. 2. A connector designed to mate with printed circuit boards. May be equipped with a polarizing pin or a key to ensure correct polarity. 3. A row of etched lines on the edge of a printed circuit board that is inserted into a motherboard or an expansion slot of a computer.



Edge connector.

**edge effect**—1. See following blacks; following whites; leading blacks; leading whites. 2. Nonuniformity of electric fields between two parallel plates caused by an outward bulging of electric flux lines at the edges of the plates. 3. The bulging out of the lines of the electric field at the edges of two parallel electrodes, created by a potential difference between the electrodes.

**edge-triggered flip-flop**—A type of flip-flop in which some minimum clock-signal rate of change is one necessary condition for an output change to occur.

**edging**—Undesired coloring around the edges of different-colored objects in a color television picture.

**EDI**—Abbreviation for electronic data interchange. A format in which business data is represented using national or international standards.

**Edison base**—Standard screw-thread base used for ordinary electric lamps.

**Edison distribution system**—A three-wire direct-current distribution system, usually 120 to 240 volts, for combined light and power service from a single set of mains.

**Edison effect**—Also called Richardson effect. The phenomenon wherein electrons emitted from a heated element within a vacuum tube will flow to a second element that is connected to a positive potential.

**Edison storage cell**—A storage cell having negative plates of iron oxide and positive plates of nickel oxide immersed in an alkaline solution. An open-circuit voltage of 1.2 volts per cell is produced.

**E-display**—In a radar, a rectangular display in which targets appear as blips with distance indicated by the horizontal coordinate and elevation by the vertical coordinate.

**edit**—1. To arrange or rearrange output information from a digital computer before it is printed out. Editing may involve deleting undesired information, selecting desired information, inserting invariant symbols, such as page numbers and typewriter characters, and applying standard processes such as zero suppression. 2. To deliberately modify the user program in a memory.

**editing**—1. The rearrangement of recorded material to provide a change of content or form, or for replacement of imperfect material. Usually accomplished by cutting and splicing the tape. 2. Revising text with a word processor to create an updated document.

**editor**—1. A program allowing such text editing functions as addition of a line or character, insertion, or deletion to permit altering of a program. Input data can be anything from programs or reports to raw instrument data. 2. Program that permits data or instructions to be manipulated and displayed. Most common use is in the preparation of new programs. 3. Program that takes the source program, written by the programmer in assembly or high-level language and entered through a keyboard or paper tape, and transfers it to a file in the computer's auxiliary memory, such as magnetic disk or tape. The editor also acts on special commands from the user to add, delete, or replace portions of the source program in the auxiliary memory. Editors can vary significantly in the ease with which they permit a user to make changes in the program. For example, some editors can operate only on entire lines in a program, whereas others can add, delete, or replace arbitrary character strings in the program. However, the less-sophisticated editors are usually easier to learn to use. 4. An interactive software subsystem that allows users to modify test programs directly on an automatic system. 5. A program that permits a user to create new files in symbolic form or to modify existing files. 6. A program that permits a series of mnemonic instructions comprising a user program to be displayed, analyzed, corrected, and otherwise modified quickly and easily on a CRT screen or other terminal device.

**EDP**—Abbreviation for electronic data processing.

**EDP center**—See electronic data-processing center.

**EDPM**—Abbreviation for electronic data-processing machine.

**EEC**—Abbreviation for electronic engine control. Precision control of engine spark timing and exhaust gas

recirculation for emissions control and good fuel mileage (Ford Motor). Uses a microprocessor chip.

**EEC IV**—The fourth progressive version of the electronic engine control (Ford Motor) using the latest technology of microprocessor chips to control engine spark timing, EGR, and feedback carburetor fuel management.

**EED**—Abbreviation for electroexplosive device. An electroexplosive device for use with an air cushion that automatically inflates to protect the driver when an automobile equipped with such a cushion is involved in a collision.

**EEG**—See electroencephalograph and electroencephalogram.

**EEG electrode**—Electrode that attaches to scalp for detecting brain waves.

**EEPROM or E<sup>2</sup>PROM**—Abbreviation for electrically erasable programmable read-only memory. 1. A field-programmable read-only memory in which cells may be erased electrically and each cell may be reprogrammed electrically. The number of times the E<sup>2</sup>PROM can be reprogrammed (write/erase cycles) ranges from 10 times to  $10^6$  times. 2. Similar to PROM, but with the capability of selective erasure of information through special electrical stimulus. Information stored in EEPROM chips is retained when the power is turned off (compare with PROM). See also electronically programmable read-only memory.

**effective acoustic center**—Also called apparent source. The point from which the spherically divergent sound waves from an acoustic generator appear to diverge.

**effective actuation time**—The sum of the initial actuation time and the contact chatter intervals of a relay following such actuation.

**effective address**—The address that is actually used in carrying out a computer instruction.

**effective ampere**—That alternating current which, when flowing through a standard resistance, produces heat at the same average rate as 1 ampere of direct current flowing in the same resistance.

**effective antenna length**—The length that, when multiplied by the maximum current, will give the same product as the length and uniform current of an elementary electric dipole at the same location, and the same ratio field intensity in the direction of maximum radiation.

**effective aperture delay**—In a sample-and-hold circuit, the time difference between the hold command and the time at which the input signal is at the held voltage.

**effective area**—The effective area of an antenna in any specified direction is equal to the square of the wavelength multiplied by the power gain (or directive gain) in that direction, divided by  $4\pi$ .

**effective bandwidth**—For a bandpass filter, the width of an assumed rectangular bandpass filter having the same transfer ratio at a reference frequency and passing the same mean-square value of a hypothetical current and voltage having even distribution of energy over all frequencies.

**effective capacitance**—The total capacitance existing between any two given points of an electric circuit.

**effective conductivity**—The conductance between the opposite parallel faces of a portion of a material having unit length and unit cross section.

**effective confusion area**—Amount of chaff whose radar cross-sectional area equals the radar cross-sectional area of a particular aircraft at a particular frequency.

**effective current**—That value of alternating current that will give the same heating effect as the corresponding

value of direct current. For sine-wave alternating currents, the effective value is 0.707 times the peak value.

**effective cutoff**—See effective cutoff frequency.

**effective cutoff frequency**—Also called effective cutoff. The frequency at which the insertion loss of an electric structure between specified terminating impedances exceeds the loss at some reference point in the transmission band.

**effective facsimile band**—A frequency band equal in width to the difference between zero frequency and the maximum keying frequency of a facsimile signal.

**effective field intensity**—Root-mean-square value of the inverse distance fields 1 mile from the transmitting antenna in all directions horizontally.

**effective height**—1. The height of the antenna center of radiation above the effective ground level. 2. In loaded or nonloaded low-frequency vertical antennas, a height equal to the moment of the current distribution in the vertical section divided by the input current.

**effective irradiance to trigger**—The minimum effective irradiance required to switch a light-activated silicon-controlled rectifier from the off state to the on state.

**effective isotropically radiated power**—See EIRP.

**effectively grounded**—Grounded through a ground connection of sufficiently low impedance (inherent and/or intentionally added) so that fault grounds that may occur cannot build up voltages that are dangerous to connected equipment.

**effectiveness**—The capability of the system or device to perform its function.

**effective parallel resistance**—The resistance considered to be in parallel with a pure dielectric.

**effective percentage modulation**—For a single sinusoidal input component, the ratio between the peak value of the fundamental component of the envelope and the direct-current component in the modulated conditions, expressed as a percentage.

**effective radiated power**—1. The product of the radio-frequency power, expressed in watts, delivered to an antenna and the relative gain of the antenna over that of a half-wave dipole antenna. 2. The product of the antenna power (transmitter power less transmission-line loss) times either the antenna power gain or the antenna field gain squared. Where circular or elliptical polarization is employed, the term *effective radiated power* is applied separately to the horizontal and vertical components of radiation. For allocation purposes, the effective radiated power authorized is the horizontally polarized component of radiation only. If specified for a particular direction, it is the antenna power gain in that direction only.

**effective radius of the earth**—A value used in place of the geometrical radius to correct the atmospheric refraction when the index of refraction in the atmosphere changes linearly with height. Under conditions of standard refraction, the effective radius is one and one-third the geometrical radius.

**effective resistance**—1. The average rate of dissipation of electric energy during a cycle divided by the square of the effective current. 2. The equivalent pure dc resistance that, when substituted for the winding of a motor being checked, will draw the same power. It is also equivalent to the impedance of a circuit having a capacitor connected in parallel with the winding and the capacitor adjusted to unity power factor for the circuit.

**effective series resistance**—A resistance considered to be in series with an assumed pure capacitance inductance.

**effective sound pressure**—The root-mean-square value of the instantaneous sound pressure at one point

## effective cutoff — E-H tuner

over a complete cycle. The unit is the dyne per square centimeter.

**effective speed**—The speed (less than rated) that can be sustained over a significant period of time and that reflects slowing effects of control codes, timing codes, error detection, retransmission, tabbing, hand keying, etc.

**effective speed of transmission**—Also called average rate of transmission. The average rate over some specified time interval at which information is processed by a transmission facility. Usually expressed as average characters or average bits per unit time.

**effective thermal resistance**—Of a semiconductor device, the effective temperature rise per unit power dissipation of a designated junction above the temperature of a stated external reference point under conditions of thermal equilibrium.

**effective value**—Also called the rms (root-mean-square) value. The value of alternating current that will produce the same amount of heat in a resistance as the corresponding value of direct current. For a sine wave, the effective value is 0.707 times the peak value.

**effective wavelength**—The wavelength corresponding to the effective propagation velocity and the observed frequency.

**efficiency**—1. Ratio of the useful output of a physical quantity that may be stored, transferred, or transformed by a device to the total input of the device. 2. Ratio of the output power to the input power of a power supply, usually expressed as a percentage of the input power measured at nominal line and load conditions. That part of the input not appearing in the output is converted into heat, which must be conducted away from the power supply circuitry. Efficiency is determined to a great extent by the method of regulation and is expressed as a percentage. In the absence of statements to the contrary, it is assumed to be taken at nominal input and output levels and full load conditions. 3. The percentage of the electrical input power to a speaker that is converted to acoustic energy. Varies from a small fraction of 1 percent to as much as 10 percent or more, depending on the design of the speaker. Higher efficiency means that less electrical amplifier power is required for a given listening volume, but it is not directly related to sound quality.

**efficiency of a source of light**—The ratio of the total luminous flux to the total power consumed. In the case of an electric lamp, it is expressed in lumens per watt.

**efficiency of rectification**—Ratio of direct-current power output to alternating-current power input of a rectifier.

**E-field sensor**—A passive sensor that detects changes in the earth's ambient electric field caused by the movement of an intruder. See also H-field sensor.

**EFTS**—Abbreviation for electronic funds transfer system. A payments system in which the processing and communications necessary to effect economic exchange and the processing and communications necessary for the production and distribution of services incidental or related to economic exchanges are dependent wholly or in large part on the use of electronics.

**EGLA**—Abbreviation for enhanced graphics adapter. A color graphics system for IBM PCs and compatibles that supports 16 colors. Provides higher resolution than CGA, lower than VGA.

**EHF**—Abbreviation for extremely high frequency.

**E-H tee**—A waveguide junction composed of a combination of E- and H-plane tee junctions that intersect and the main guide at a common point.

**E-H tuner**—An E-H tee having two arms terminated in adjustable plungers. It is used for impedance transformation.

**EIA** — See Electronic Industries Association.

**EIA interface** — 1. A set of signal properties (time duration, voltage, and current) specified by the Electronic Industries Association for business machine/data set connections. 2. A standardized set of signal characteristics for connection of terminals to modem units.

**EIA RS-232-C standard** — A set of specifications used throughout the data communications industry to define the interconnection of data terminal equipment (DTE) and data communication equipment (DCE) for the exchange of serial binary data. This standard defines electrical signal characteristics, mechanical interface characteristics, and circuits.

**EIC** — Abbreviation for electronic instrument cluster (Chrysler Corp.). Digital instrument display for speed, miles, fuel level, fuel consumption clock, etc.

**eight-bit chip** — A CPU chip that processes data eight bits at a time.

**eight-bit color** — The color range possible with an eight-bit-graphics system. In such a system, each pixel can display one of 256 colors at any given time.

**eight-level code** — A code in which eight impulses are utilized for describing a character. Start and stop elements may be added for asynchronous transmission. The term is often used to refer to the U.S. ASCII code.

**eight-track** — Most commonly, a cartridge tape system having eight narrow tracks on  $\frac{1}{4}$ -inch (6.35-mm) tape wound in a continuous loop around a single hub.

**eight-track tape-recording format** — Either of two professional tape recording formats (half-track or quarter-track) in which eight independent channels can be recorded in the same direction.

**E-indicator** — A rectangular radar display in which the horizontal coordinate of a target blip represents range and the vertical coordinate represents elevation.

**einstein** — A unit of energy equal to the amount of energy absorbed by one molecule of material undergoing a photochemical reaction, as determined by the Stark-Einstein law.

**Einthoven string galvanometer** — A moving-coil type of galvanometer in which the coil is a single wire suspended between the poles of a powerful electromagnet.

**E-I pick-off** — An assembly of transformer-like laminations, the output coils of which develop a voltage proportional to the displacement of a magnetic element from the neutral position for limited rotary as well as angular travel.

**EIRP** — Abbreviation for effective (or equivalent) isotropically radiated power. 1. A measure of the signal strength that a satellite transmits toward the earth below. The EIRP is highest at the center of the beam and decreases at angles away from the boresight. 2. The gain of an antenna in a given direction, multiplied by the net power accepted by the antenna from the transmitter.

**EKG** — Abbreviation for electrocardiograph.

**elastance** — 1. Symbolized by  $S$ . In a capacitor, the ratio of potential difference between its electrodes to the charge in the capacitor. It is the reciprocal of capacitance. The unit of measure is the daraf.

$$S(\text{daraf}) = V/Q$$

2. A measure of the difficulty of placing an electric charge in a capacitor.

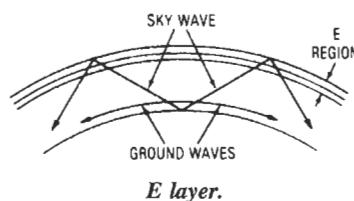
**elasticity** — The resistance of an electrostatic field. It is the reciprocal of permittivity.

**elastic wave** — A pure acoustic wave; a moving lattice distortion without a magnetic component.

**elastomer** — 1. A material that has the ability to recover from extreme deformation, in the order of hundreds of percent. It may be thermosetting or thermoplastic.

2. A material that at room temperature stretches under low stress to at least twice its length and snaps back to the original length on release of stress.

**E layer** — 1. One of the regular ionospheric layers, with an average height of about 100 kilometers or 60 to 70 miles. This layer occurs during daylight hours, and its ionization is dependent on the sun's angle. The principal layer corresponds roughly to what was formerly called the Kennelly-Heaviside layer. 2. The lowest layer of the ionosphere that supports long-distance radio communication.



*E layer.*

**elbow** — In a waveguide, a bend with a relatively short radius and an angle normally of  $90^\circ$  but sometimes, for acute angles, down to  $15^\circ$ .

**el casel** — A tape system that uses a cassette similar in plan to the compact cassette, but holding  $\frac{1}{4}$ -inch (6.35-mm) tape running at  $3\frac{3}{4}$  inches per second (9.5 cm/s); the tape is looped out of the cassette to reach the heads and capstan during recording and playback. In other cassette systems, the heads contact the tape through windows in the cassette shell.

**electra** — A specific radionavigational aid that provides a number (usually 24) of equasignal zones. Electra is similar to sonne except that in sonne the equasignal zones as a group are periodically rotated in bearing.

**electret** — 1. A permanently polarized piece of dielectric material produced by heating the material and placing it in a strong electric field during cooling. Some barium titanate ceramics can be polarized in this way, and so can carnauba waxes. The electric field of an electret corresponds somewhat to the magnetic field of a permanent magnet. 2. A special plastic piezoelectric element, polarized during manufacture to become the equivalent of a permanently charged capacitor. Generates an amplitude-responsive output voltage, like a ceramic element, but requires less energy from the stylus system. By loading with an appropriate resistance, its output can be converted to the equivalent of a magnetic cartridge's velocity-responding output characteristic.

**electric** — Containing, producing, arising from, actuated by, or carrying electricity, or designed to carry electricity and capable of so doing. Examples: electric eel, energy, motor, vehicle, wave.

**electrical** — Related to, pertaining to, or associated with electricity but not having its properties or characteristics. Examples: electrical engineer, handbook, insulator, rating, school, unit.

**electrical angle** — A quantity that specifies a particular instant in a cycle of alternating current. One cycle is considered to be  $360^\circ$ , so a half cycle is  $180^\circ$  and a quarter cycle is  $90^\circ$ . If one voltage reaches its peak value a quarter cycle after another, the phase difference, or electrical angle between the voltages, is  $90^\circ$ .

**electrical bail** — A switch action in which, upon actuation of one station, the switch changes the contact position, electrically locks the switch in that position, and releases any station previously actuated.

**electrical bias**—An electrically produced force tending to move the armature of a relay toward a given position.

**electrical boresight**—The tracking axis as determined by an electrical indication, such as the null direction of a conical scanning or monopulse antenna system or the beam maximum direction of a highly directive antenna.

**electrical bridging**—The formation of a conductive path between conductors.

**electrical center**—1. The point approximately midway between the ends of an inductor or resistor. This point divides the inductor or resistor into two equal electrical values (e.g., voltage, resistance, inductance, or number of turns). 2. The center established by the electromagnetic field distribution within a test coil. A constant-intensity signal, irrespective of the circumferential position of a discontinuity, is indicative of electrical centering. The electrical center may be different from the physical center of the test coil.

**electrical charge**—The excess on (or in) a body of one kind (polarity) of electricity over the other kind. A plus sign indicates that positive electricity predominates, and a minus sign indicates that negative electricity predominates. Symbol:  $Q$  or  $q$ .

**electrical conductivity**—1. The reciprocal of the resistance in ohms measured between opposite faces of a centimeter cube of an aqueous solution at a specified temperature. 2. The property of a fluid or solid that permits the passage of an electrical current as a result of an impressed emf. It is measured by the quantity of electricity transferred across unit area per unit potential gradient per unit time. In sampling and analysis, changes in this property are utilized to measure the presence of certain ions and compounds such as sulfur dioxide.

**electrical coupling**—Coupling discrete elements with either electrical conductors or reactances.

**electrical degree**—One 360th part of a cycle of alternating current.

**electrical discharge machining**—Machining in which metal is removed by a controlled electrical spark in a dielectric.

**electrical distance**—The distance between two points, expressed as the length of time an electromagnetic wave in free space takes to travel between them.

**electrical element**—The concept in uncombined form of any of the individual building blocks from which electronic circuits are synthesized. Examples of basic electrical elements are insulation, conductance, resistance, capacitance, and inductance.

**electrical erosion**—The loss of contact material due to action of an electrical discharge.

**electrical forming**—The application of electric energy to a semiconductor device in order to permanently modify the electrical characteristics.

**electrical gearing**—A term used to describe the action of a system in which the output shaft rotates at a different speed from the input shaft, the ratio being established by electrical means.

**electrical generator**—A machine that converts mechanical energy into electrical energy.

**electrical glass insulation**—Insulating materials made from glass fibers of varying diameters, lengths, compositions, etc., including yarns, rovings, slivers, cords, and sheets or mats, bounded or treated only as necessary to their manufacture.

**electrical ground**—The zero voltage reference for the power supply in an electronic device, usually connected to the equipment chassis. May also be connected to the power mains or earth ground.

**electrical-impedance cephalography**—A method of evaluating blood circulation in the brain by measuring changes in the impedance between two surface electrodes attached to the head. This impedance decreases when the blood volume in the brain increases. The technique is also known as rheoencephalography.

**electrical inertia**—Inductance that opposes any change in current through an inductor.

**electrical initiation**—Any source of electrical power used to start a function or sequence.

**electrical interlocks**—Switches mounted on contactors or other devices and operated by rods or levers. These interlocks open or close depending on the open or closed position of the contact or device with which they are associated, and are used to govern succeeding operations of the same or allied devices.

**electrical length**—Length expressed in wavelengths, radians, or degrees. Distance in wavelengths  $\times 2\pi =$  radians; distance in wavelengths  $\times 360 =$  degrees.

**electrical load**—A device (e.g., a speaker) comprising resistive and/or reactive components into which an amplifier, generator, etc., delivers power.

**electrically alterable read-only memory**—Abbreviated EAROM. An electrically erasable programmable read-only memory built using metal-nitride-oxide-semiconductor (MNOS) technology. The term electrically alterable read-only memory (EAROM) is being replaced by electrically erasable programmable read-only memory (EEPROM or E<sup>2</sup>PROM). However, the MNOS technology devices should always be referred to as EAROMs.

**electrically connected**—Joined through a conducting path or a capacitor, as distinguished from being joined merely through electromagnetic induction.

**electrically erasable programmable read-only memory**—Abbreviated EEPROM or E<sup>2</sup>PROM.

**electrically operated rheostat**—A rheostat used to vary the resistance of a circuit in response to some means of electrical control.

**electrically operated valve**—A solenoid- or motor-operated valve used in vacuum, air, gas, oil, water, or similar lines.

**electrically variable inductor**—An inductor in which the inductance can be controlled by a current or a voltage. It is usually made in the form of a saturable reactor with two windings. One is called the signal, or tuned winding, corresponding to the ac or load winding of a power-handling saturable reactor; the other is the control winding and corresponds to the dc winding of the saturable reactor.

**electrical noise**—Unwanted electrical energy other than crosstalk in a transmission system.

**electrical overstress**—The operation of an electronic device beyond its normal range of voltage, current, and power when abnormal electric signals are presented to it.

**electrical radian**— $57.296^\circ$ , or  $1/2\pi$  (or  $1/6.28$ ) of a cycle of alternating current or voltage.

**electrical ratings**—The combinations of voltage and current under which a device or component will operate satisfactorily in specified circuits under standard atmospheric conditions.

**electrical reset**—A term applied to a relay to indicate that it is capable of being electrically reset after an operation.

**electrical resistivity**—The resistance of a material to passage of an electric current through it. Expressed as ohms (units of resistance) per mil foot or as microohms (millionths of an ohm) per centimeter cubed ( $\text{cm}^3$ ) at a specified temperature.

**electrical resolver**—Special type of synchro having a single winding on the stator and two windings whose axes are 90° apart on the rotor.

**electrical scanning**—Scanning accomplished through variation of the electrical phases or amplitudes at the primary radiating element of an antenna system.

**electrical service entrance**—A combination of intake wires and equipment including the service entrance wires, electric meter, main switch or circuit breaker, and main distribution or service panel through which the supply of power enters the home.

**electrical sheet**—Iron or steel sheets from which laminations for electric motors are punched.

**electrical shielding**—Copper screen, a wire braid, or any conducting material that surrounds a circuit or cable conductors to exclude electrostatic or radio-frequency noises.

**electrical switch**—A device that makes, breaks, or changes the connections in an electric circuit.

**electrical system**—The organized arrangement of all electrical and electromechanical components and devices in a way that will properly control the particular machine tool or industrial equipment.

**electrical twinning**—*See* twinning.

**electrical zero**—A standard synchro position at which electrical outputs have defined amplitudes and time phase.

**electric arc**—A discharge of energy through a gas.

**electric bell**—An audible signaling device consisting of one or more gongs and an electromagnetically actuated striking mechanism.

**electric brazing**—A brazing (alloying) process in which the heat is furnished by an electric current.

**electric breakdown voltage**—*See* dielectric breakdown voltage.

**electric breeze or wind**—The emission of electrons from a sharp point of a conductor that carries a high negative potential.

**electric charge**—1. Electric energy stored on the surface of an object. 2. A property of electrons and protons. Similarly charged particles repel one another. Particles having opposite charges attract one another. 3. Electric energy that is stored as stress on the surface of a dielectric.

**electric chronograph**—A highly accurate apparatus for measuring and recording time intervals.

**electric circuit**—A continuous path consisting of wires and/or circuit elements over or through which an electric current can flow. If the path is broken at any point, current can no longer flow and there is no circuit.

**electric coil**—Successive turns of insulated wire that create a magnetic field when an electric current is passed through them. It may also consist of a number of separately insulated sections that lie side by side around the same magnetic circuit.

**electric contact**—A separable junction between two conductors that is designed to make, carry, or break (in any sequence or singly) an electric circuit.

**electric controller**—A device that governs the amount of electric power delivered to an apparatus.

**electric current**—Electricity in motion. In the atoms of metallic substances, there are a number of free electrons, or negatively charged particles that wander in the spaces between the atoms of the metal. The electron movement is normally without any definite direction and cannot be detected. The connection of an electric battery produces an electric field in the metal and causes the free electrons to move or drift in one direction; it is this electron drift that constitutes an electric current. Electrons, being of negative polarity, are attracted to the positive

terminal of the battery, and so the actual direction of flow of electricity is from negative to positive, that is, opposite to the conventional direction usually adopted.

**electric delay line**—A delay line using properties of lumped or distributed capacitive and inductive elements. Can be used as a storage medium by recirculating the information-carrying signal.

**electric dipole**—Also called a doublet. A simple antenna comprising a pair of oppositely charged conductors capable of radiating an electromagnetic wave in response to the movement of an electric charge from one conductor to the other.

**electric-discharge lamp**—1. A sealed glass enclosure containing a metallic vapor or an inert gas through which electricity is passed to produce a bright glow. 2. A lamp in which light (or radiant energy) is produced by the passage of an electric current through a vapor or a gas. Electric discharge lamps may be named after the filling gas or vapor that is responsible for the major portion of the radiation, e.g., mercury lamps, sodium lamps, neon lamps, and argon lamps.

**electric displacement**—*See* electric-flux density.

**electric-displacement density**—*See* electric-flux density.

**electric eye**—1. The layman's term for a photoelectric cell. 2. The cathode-ray, tuning-indicator tube used in some radio receivers.

**electric field**—1. The region about a charged body. Its intensity at any point is the force that would be exerted on a unit positive charge at that point. 2. A condition detectable in the vicinity of an electrically charged body such that forces act on other electric charges in proportion to their magnitudes. 3. Field of force that exists in the space around electrically charged particles. Lines of force are imagined to originate at the protons or positively charged particles and to terminate on electrons or negatively charged particles.

**electric-field intensity**—A measure of the force exerted at a point by a unit charge at that point.

**electric-field strength**—The magnitude of the electric field in an electromagnetic wave. Usually stated in volts per meter. *See also* dielectric strength.

**electric-field vector**—At a point in an electric field, the force on a stationary positive charge per unit charge. May be measured in either newtons per coulomb or volts per meter. This term is sometimes called the electric-field intensity, but such use of the word *intensity* is deprecated in favor of *field strength*, since *intensity* denotes power in optics and radiation.

**electric-filament lamp**—A glass bulb either evacuated or filled with an inert gas and having a resistance element electrically heated to, and maintained at, the temperature necessary to produce incandescence.

**electric filter**—1. Device for rejecting or passing a specific band of signal frequencies. 2. *See* electric-wave filter.

**electric-flux density**—Also called electric-displacement density or electric displacement. At a point, the vector equal in magnitude to the maximum charge per unit area that would appear on one face of a thin metal plate introduced in the electric field at that point. The vector is normal to the plate from the negative to the positive face.

**electric force**—Electric field intensity measured in dynes.

**electric furnace**—A furnace in which electric arcs provide the source of heat.

**electric generator**—A machine that transforms mechanical power into electrical power.

**electric governor-controlled series-wound motor**—A series-wound motor having an electric speed

governor connected in series with the motor circuit. The governor is usually built into the motor.

**electric-heat soldering**—Soldering by heating the joint with an electric current.

**electric hygrometer**—An instrument for indicating humidity by electric means. Its operation depends on the relationship between the electric conductance and moisture content of a film of hygroscopic material.

**electric hysteresis**—Internal friction in a dielectric field (e.g., the paper or mica dielectric of a capacitor in an ac circuit). The resultant heat generated can eventually break down the dielectric and cause the capacitor to fail.

**electrician**—A person engaged in designing, making, or repairing electric instruments or machinery. Also, one who sets up an electrical installation.

**electric image**—The electrical counterpart of an object; i.e., the fictitious distribution of the same amount of electricity that is actually distributed on a nearby object.

**electricity**—1. The property of certain particles to possess a force field that is neither gravitational nor nuclear. The type of force field associated with electrons is defined as negative and that associated with protons and positrons as positive. The fundamental unit is the charge of an electron:  $1.60203 \times 10^{-19}$  coulomb. Electricity can be further classified as static electricity or dynamic electricity. Static electricity in its strictest sense refers to charges at rest, as opposed to dynamic electricity, or charge in motion. Static electricity is sometimes used as a synonym for triboelectricity or frictional electricity. 2. A basic property of all matter, which consists of negative and positive charges (electrons and protons) that attract each other. 3. The potential energy of electrons at rest. 4. The kinetic energy of electrons in motion. 5. A manifestation of free electrons that can be generated by induction, friction, or chemical action. It is recognized by its magnetic, chemical, and radiant effects.

**electric lamp**—Any lamp whose emission of radiant energy is dependent on the passage of an electrical current through the emissive medium.

**electric light**—Light produced by an electric lamp.

**electric lines of force**—In an electric field, curves whose tangents at any point give the direction of the fields at that point.

**electric meter**—A device that measures and registers the amount of electricity consumed over a certain period of time.

**electric mirror**—*See* dynode.

**electric moment**—For two charges of equal magnitude but opposite polarities, a vector equal in magnitude to the product of the magnitude of either charge by the distance between the centers of the two charges. The direction of the vector is from the negative to the positive charge.

**electric motor**—A device that converts electrical energy into rotating mechanical energy.

**electric network**—A combination of any number of electric elements, having either lumped or distributed impedances, or both.

**electric oscillations**—The back-and-forth flow of electric charges whenever a circuit containing inductance and capacitance is electrically disturbed.

**electric potential**—A measure of the work required to bring a unit positive charge from an infinite distance or from one point to another (the difference of potential between two points).

**electric precipitation**—The collecting of dust or other fine particles floating in the air. This is done by inducing a charge in the particles, which are then attracted to highly oppositely charged collector plates.

## electric-heat soldering — electric-wave filter

**electric probe**—A rod inserted into an electric field during a test to detect dc, audio, or rf energy.

**electric reset**—A qualifying term indicating that the contacts of a relay must be reset electrically to their original positions following an operation.

**electric robot**—Programmable machine that is powered by servomotors or stepping motors.

**electric service panel**—The main cabinet where electricity is brought into a building, then distributed to branch circuits. The panel usually contains the main circuit breaker for shutting down the entire system, and circuit breakers or fuses for shutting down each independent circuit.

**electric shield**—A housing, usually aluminum or copper, placed around a circuit to provide a low-resistance path to ground for high-frequency radiations and thereby prevent interaction between circuits.

**electric strain gage**—A device that detects the change in shape of a structural member under load and causes a corresponding change in the flow of current through the device.

**electric strength**—The maximum electric charge a dielectric material can withstand without rupturing. *See also* dielectric strength; insulating strength. The value obtained for the electric strength will depend on the thickness of the material and on the method and conditions of test.

**electric stroboscope**—An instrument for observing or for measuring the speed of rotating or vibrating objects by electrically producing periodic changes in the intensity of light used to illuminate the object.

**electric tachometer**—A tachometer (rpm indicator) that utilizes voltage or electrical impulses.

**electric telemeter**—A system consisting of a meter that measures a quantity, a transmitter that sends the information to a distant station, and a receiver that indicates or records the quantity measured.

**electric transcription**—In broadcasting, a disc recording of a message or a complete program.

**electric transducer**—A device actuated by electric waves from one system and supplying power, also in the form of electric waves, to a second system.

**electric tuning**—A system by which a radio receiver is tuned to a station by pushing a button (instead of, say, turning a knob).

**electric vector**—1. A component of the electromagnetic field associated with electromagnetic radiation. The component is of the nature of an electric field. The electric vector is supposed to coexist with, but act at right angles to, the magnetic vector. 2. The electric field associated with an electromagnetic wave and thus with a light wave. The electric vector specifies the direction and amplitude of this electric field.

**electric watch**—A timepiece in which a battery replaces the mainspring as the prime energy source of the watch, and in which an electromagnet impels the balance wheel through a mechanical switching-contact arrangement.

**electric wave**—Another term for the electromagnetic wave produced by the back-and-forth movement of electric charges in a conductor.

**electric-wave filter**—Also called electric filter.

1. A device that separates electric waves of different frequencies. 2. A frequency-selective device, usually passive, made up of resistance, capacitance, and inductance elements having signal transmission characteristics that are a function of frequency. Basically, filters are used to pass desired signals and reject unwanted or interfering signals. Bandpass filters are used when the desired signals encompass a frequency band that does not contain any unwanted signals.

**electrification** — 1. The process of establishing an excess of positive or negative charges in a material. 2. The process of applying a voltage to a component or device.

**electrification time** — The time during which a steady direct potential is applied to electrical insulating materials or before the current is measured.

**electroacoustic** — Pertaining to a device (e.g., a speaker or a microphone) that involves both electric current and sound-frequency pressures.

**electroacoustic device** — One that employs phonon propagation or vibrations of a material's crystal lattice structure as the basic energy transport mechanism. Electrical energy is converted into acoustic energy by the material's piezoelectric properties.

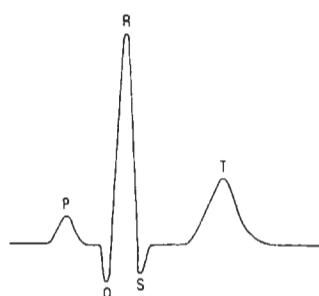
**electroacoustic transducer** — A device that receives excitations from an electric system and delivers an output to an acoustic system, or vice versa. A speaker is an example of the first, and a microphone is an example of the second.

**electroanalysis** — The process of determining the quantity of an element or compound in an electrolyte solution by depositing the element or compound on an electrode by electrolysis.

**electrobiology** — The science concerned with electrical phenomena of living creatures.

**electrobioscopy** — The application of a voltage to produce muscular contractions.

**electrocardiogram** — Abbreviated EKG or ECG.  
1. Essentially an electromyogram of the heart muscle. All muscular activity in the body is characterized by the discharge of polarized cells, the aggregate current from which causes a voltage drop that can be measured on the skin. A changing emf will appear between electrodes connected to the arms, legs, and chest, which rises and falls with heart action such that the period of the resulting waveform is the time between heartbeats. Various positive and negative peaks within one cycle of this waveform have been lettered P, Q, R, S, and T, a notation that aids in subsequent analysis and diagnosis.  
2. A hardcopy record of heart action potentials obtained by measuring instantaneous potential differences at the surface of the body. In general, the recording describes the depolarization of myocardial muscle cell masses, providing a graphic, but indirect, view of the heart's competence.  
3. Graphic tracing of the electric current that is produced by the rhythmic contraction of the heart muscle. Visually, a periodic wave pattern is produced. Changes in the wave pattern may appear in the course of various heart diseases; the tracing is obtained by applying electrodes on the skin of the chest and limbs.



*Electrocardiogram for one heartbeat.*

**electrocardiograph** — A medical instrument for detecting irregularities in the action of a human heart. It

measures the changes in voltage occurring in the human body with each heartbeat. Abbreviated EKG or ECG.

**electrocardiography** — Recording and interpretation of the electrical activity of the heart. The voltage generated by the heart is picked up by surface electrodes on the limbs and chest, amplified, and applied to a strip-chart recorder.

**electrocardiophonograph** — An instrument that records heart sounds.

**electrochemical cell** — An electrochemical system consisting of an anode and a cathode in metallic contact and immersed in an electrolyte. The anode and cathode may be different metals or dissimilar areas on the same metal surface.

**electrochemical deterioration** — A process in which autocatalytic electrochemical reactions produce an increase in conductivity and in turn ultimate thermal failure.

**electrochemical device** — A device that operates on both electrical and chemical principles, e.g., a lead-acid storage battery.

**electrochemical diffused-collector transistor** — See EDCT.

**electrochemical equivalent** — The weight of an element, compound, radical, or ion involved in a specified electrochemical reaction during passage of a specified quantity of electricity such as a coulomb.

**electrochemical junction transistor** — A junction transistor produced by etching an n-type germanium wafer on opposite sides with jets of a salt solution such as indium chloride.

**electrochemical potential** — Also called electrochemical tension. The partial derivative of the total electrochemical free energy of the system with respect to the number of moles of the constituent except that it includes the electrical as well as the chemical contributions to the free energy.

**electrochemical recording** — A recording made by passing a signal-controlled current through a sensitized sheet of paper. The paper reacts to the current and thereby produces a visual record.

**electrochemical tension** — See electrochemical potential.

**electrochemical transducer** — A device that uses a chemical change to measure the input parameter, and the output of which is a varying electrical signal proportional to the measurand.

**electrochemical valve** — Electric valve consisting of a metal in contact with a solution or compound, across the boundary of which current flows more readily in one direction than in the other direction and in which the valve action is accompanied by chemical changes.

**electrochemistry** — 1. That branch of science concerned with reciprocal transformations of chemical and electrical energy. This includes electrolysis, electroplating, the charge and discharge of batteries, etc. 2. The study of the reversible conversion of chemical energy into electrical energy. Electroplating is an electrochemical process.

**electrochromic display** — A passive solid-state display that is made from a material whose light-absorption properties are changed by an externally applied electric field. Ordinarily electrochromic materials do not absorb light in the visible range of the spectrum, so they are completely transparent. When a moderate electric field is applied, the material develops an absorption band in the visible spectrum and takes on a color that remains even after the electric field is removed and lasts from minutes to months. The color change can be reversed and the display returned to its original state when the polarity of the applied electric field is simply reversed.

**electrocoagulation**—The process of solidifying tissue by means of a high-frequency electrical current.

**electrocution**—Killing by means of an electric current.

**electrode**—1. In an electronic tube, the conducting element that does one or more of the following: emits or collects electrons or ions, or controls their movement by means of an electric field on it. 2. In semiconductors, the element that does one or more of the following: emits or collects electrons or holes, or controls their movements by means of an electric field on it. 3. In electroplating, the metal being plated. 4. A conductor by means of which a current passes into or out of a fluid or an organic material, such as human skin; often one terminal of a lead. 5. A metallic conductor such as in an electrolytic cell, in which conduction by electrons is changed to conduction by ions or other charged particles. 6. A conductor, not necessarily metal, through which a current enters or leaves an electrolytic cell, arc, furnace, vacuum tube, gaseous discharge tube, or any conductor of the nonmetallic class. 7. That part of a semiconductor device providing the electrical contact between the specified region of the device and the lead to its terminal. 8. In a spark plug, the center rod passing through the insulator forms one electrode. The rod welded to the shell forms another. They are referred to as the center and side electrodes. 9. A conducting element at whose surface electricity passes into another conducting medium.

**electrode admittance**—The alternating component of the electrode current divided by that of the electrode voltage (all other electrode voltages maintained constant).

**electrode capacitance**—The capacitance between one electrode and all the other electrodes connected together.

**electrode characteristic**—The relationship, usually shown by a graph, between the electrode voltage and current, all other electrode voltages being maintained constant.

**electrode conductance**—The quotient of the in-phase component of the electrode alternating current divided by the electrode alternating voltage, all other electrode voltages being maintained constant. This is a variational and not a total conductance.

**electrode current**—Current passing into or out of an electrode.

**electrode dark current**—Also called dark current.

1. In phototubes, the component of electrode current that flows in the absence of ionizing radiation and optical photons. 2. The current that flows in a photodetector when there is no incident radiation on the detector.

**electrode dissipation**—The power that an electrode dissipates as heat when bombarded by electrons and/or ions and radiation from nearby electrodes.

**electrode drop**—The voltage drop produced in an electrode by its resistance.

**electrode impedance**—The reciprocal of electrode admittance.

**electrode inverse current**—Current through a tube electrode in the direction opposite to that for which the tube was designed.

**electrodeless discharge**—A luminous discharge produced by means of a high-frequency electric field in a gas-filled glass tube that has no internal electrodes.

**electrodeless discharge tube**—Abbreviated EDT. A device consisting of an airtight quartz tube that holds the material to be analyzed. When a high-frequency electrostatic field, generated by microwaves, is applied to the tube, it emits energy of a wavelength identical with that of the contained material.

**electrodeposition**—Also called electrolytic deposition. *See also* electroplating.

**electrocoagulation**—**electroencephalograph**

**electrode potential**—1. The instantaneous voltage on an electrode. Its value is usually given with respect to the cathode of a vacuum tube. 2. The difference in potential between an electrode and the immediately adjacent electrolyte referred to some standard electrode potential as zero. 3. The potential in volts that an electrode has when immersed in an electrolyte, compared to the zero potential of a hydrogen electrode. The potential depends on the material of which the electrode is made.

**electrode reactance**—The imaginary component of electrode impedance.

**electrode resistance**—The reciprocal of electrode conductance. It is the effective parallel resistance, not the real component of electrode impedance.

**electrodermography**—The recording of the electrical resistance of the skin, which is a sensitive indicator of the activity of the autonomic nervous system.

**electrode voltage**—The voltage between an electrode and the cathode or a specified point of a filamentary cathode. The terms *grid voltage*, *anode voltage*, *plate voltage*, etc., designate the voltage between these electrodes and the cathode. Unless otherwise stated, electrode voltages are measured at the available terminals.

**electrodialytic process**—A process for producing fresh water by using a combination of electric current and two types of chemically treated membranes.

**electrodynamics**—Pertaining to electric current, electricity in motion, and the actions and effects of magnetism and induction.

**electrodynamic braking**—A method of stopping a tape-deck motor gently by the application of a predetermined voltage to the motors.

**electrodynamic instrument**—An instrument that depends for its operation on the reaction between the current in one or more moving coils and the current in one or more fixed coils.

**electrodynamic machine**—Electric generator or motor in which the output load current is produced by magnetomotive currents generated in a rotating armature.

**electrodynamics**—1. The science dealing with the various phenomena of electricity in motion, including interactions of currents with each other, with their associated magnetic fields, and with other magnetic fields. 2. The study of the generation of electromagnetic power by radiation from high-energy beams.

**electrodynamic speaker**—A speaker consisting of an electromagnet called the field coil, through which a direct current flows.

**electrodynamometer**—1. An instrument for detecting or measuring an electric current by determining the mechanical reactions between two parts of the same circuit. 2. A meter movement consisting of a rotatable (moving) wire coil suspended between two fixed (field) wire coils. The three coils can be connected in various configurations, so that rotation of the moving coil is proportional to applied ac or dc voltage or current, to power, power factor, etc.

**electroencephalogram**—1. A waveform obtained by plotting brain voltages (available between two points on the scalp) against time. An electroencephalogram is not necessarily a periodic function, although it can be particularly if the patient is unconscious. These voltages are of extremely low level and require recording apparatus that displays excellent noise rejection. 2. The tracing of brain waves made by an electroencephalograph.

**electroencephalograph**—Abbreviated EEG. An instrument for measuring and recording the rhythmically varying potentials produced by the brain by the use of electrodes applied to the scalp.

**electroencephalography**—1. Recording and interpretation of the electrical activity of the brain. Voltage (typically 50 microvolts) picked up by electrodes on the scalp is amplified and applied to a strip-chart recorder. 2. Recording of electric currents developed in the brain by means of electrodes applied to the scalp, to the surface of the brain, or placed within the substance of the brain.

**electroencephaloscope**—An instrument for detecting brain potentials at many different sections of the brain and displaying them on a cathode-ray tube.

**electroexplosive device**—See EED.

**electrofluid dynamics generator**—Abbreviated EFD. A generator in which the only moving parts are wind-driven charged particles. Their movement from electrode to electrode is analogous to the spinning of an armature. Ideally suited for use at sea or at the seaside, bladeless windmills could be used anywhere there is a source of moisture. Principal advantages of the concept include efficiency and low cost.

**electroforming**—Also called electrodeposition and electroplating. 1. Making a metal object by using electrolysis to deposit a metal on an electrode. 2. Creating a pn junction by passing a current through point contacts on a semiconductor. 3. The production or reproduction of articles by electrodeposition on a mandrel or mold that is subsequently separated from the deposit. 4. The process of depositing a substance on an electrode by electrolysis, as in electroplating, electroforming, electrofining, or electrotinning.

**electroforming process**—An electrochemical process of metal fabrication using an electrolyte, an anode to supply the metal, and a control of the electrical current and of the deposition of metal on the matrix of a reflector.

**electrogalvanizing**—Electrodeposition of zinc coatings.

**electrogastrogram**—The graphic record that results from synchronous recording of the electrical and mechanical activity of the stomach.

**electrograph**—1. A plot, graph, or tracing made by means of the action of an electric current on sensitized paper or other material, or by means of an electrically controlled stylus or pen. 2. Equipment for facsimile transmission.

**electrographic process**—See dielectric process.

**electrographic recording**—Also called electrostrophotography. The producing of a visible record by using a gaseous discharge between two or more electrodes to form electrostatically charged patterns on an insulator. *See also* electrostatic electrography.

**electrokinesis**—The branch of physics concerned with electricity in motion.

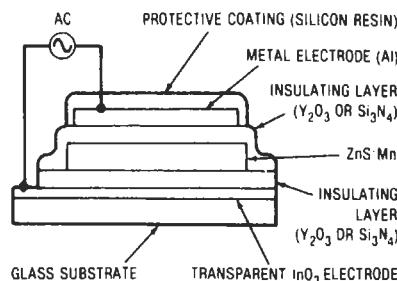
**electroless deposition**—The deposition of conductive material from an autocatalytic plating solution without application of electrical current.

**electroless plating**—1. A method of metal deposition by means of a chemical reducing agent present in the processing solution. The process is further characterized by the catalytic nature of the surface, which enables the metal to be plated to any thickness. 2. A chemical process by which certain metals can be plated without electrical current. Tin may be plated onto copper in this manner. 3. The controlled autocatalytic reduction of a metal ion on certain catalytic surfaces.

**electroluminescence**—1. Luminescence resulting from a high-frequency discharge through a gas or from application of an alternating current to a layer of phosphor. 2. Direct conversion of electrical energy into light energy in a liquid or solid; for example, photoemission as a result of electron-hole recombination in a pn junction. This is the mechanism employed by the injection laser. The standard abbreviation for the effect is written

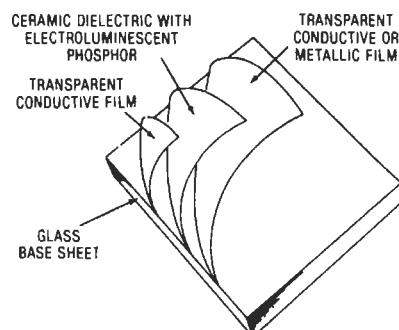
EL. (This process is not to be confused with the ordinary tungsten filament bulb, where there is an intermediate stage of heat, making the process thermoluminescent.) 3. Light produced in a phosphor that is in an alternating electric field. Consists of a phosphor a few mils thick placed between two metal films, one of which is transparent. Alternating current is applied to the plates through a current-limiting resistor.

**electroluminescent display**—1. A display, designated EL, whose segments or elements consist of transparent conductive electrodes separated by a dielectric containing a luminescent phosphor. Application of ac voltage to opposing electrodes causes the dielectric between them to glow with a characteristic blue-green light. 2. The utilization of the light produced when electrical energy is directly converted into light within devices used for visual readout displays or as complex logic-circuit elements. The display devices may be flat, giving a wide viewing angle without parallax, and may have low power needs. Can yield blue, green, yellow, and white colors.



Electroluminescent display.

**electroluminescent lamp**—A lamp in the shape of a panel that is decorative as well as illuminative. It consists primarily of a capacitor having a ceramic dielectric with electroluminescent phosphor. The amount of illumination is determined by the voltage across the layer and by the frequency applied to it.



Electroluminescent lamp.

**electroluminescent-photoconductive image intensifier**—A panel, made up of electroluminescent and photoconductive (EL-PC) layers, used as either a positive or negative image intensifier, depending on amplitude and phase of its two power supply voltages. The

photoconductive layer receives the image and converts it to electrical signals; subsequently, the electroluminescent layer converts the signals to visible, brighter light.

**electrolysis** — 1. The process of changing the chemical composition of a material (called the electrolyte) by sending an electric current through it. 2. The decay of an underground structure by chemical action due to stray electrical currents. 3. Production of chemical changes of the electrolyte by the passage of current through an electrochemical cell. 4. Conduction of an electric current through a chemical compound in its natural state, solution or as a molten, to decompose the compound.

**electrolyte** — 1. A substance in which the conduction of electricity is accompanied by chemical action. 2. The paste that forms the conducting medium between the electrodes of a dry cell, storage cell, or electrolytic capacitor. 3. A substance that, when dissolved in a suitable liquid (often water), dissociates into ions, thus rendering the liquid electrically conducting. 4. The current-conducting substance (liquid or solid) between two capacitor electrodes, at least one of which is covered by a dielectric film. 5. A conducting medium in which current is accompanied by movement of matter. Most often an aqueous solution of acids, bases, or salts, but includes many other media, such as fused salts, ionized gases, some solids, etc. 6. A substance that is capable of forming a conducting liquid medium when dissolved or melted.

**electrolyte conductivity** — Also called specific conductance. A measure of the ability of a solution to carry an electric current. Defined as the reciprocal of the resistance in ohms of a 1-cm cube of the liquid at a specified temperature. The units of specific conductance are the reciprocal ohm-cm (or siemens/cm) and one millionth of this. High-quality condensed steam and distilled or demineralized water have specific conductances at room temperatures as low as or lower than 1 microsiemens/cm.

**electrolyte recording** — A form of facsimile recording in which ionization causes a chemically moistened paper to undergo a change.

**electrolytic** — 1. Pertaining to or made by electrolysis; deposited by electrolysis; pertaining to or containing an electrolyte. 2. Said of an electrical device that contains an electrolyte.

**electrolytic capacitor** — 1. A capacitor consisting of two conducting electrodes, with the anode having a metal oxide film formed on it. The film acts as the dielectric or insulating medium. The capacitor is operable in the presence of an electrolyte, usually an acid or salt. Generally used for filtering, bypassing, coupling, or

decoupling. 2. A capacitor in which the dielectric is a film of oxide electrolytically deposited on a plate or slug of aluminum or tantalum. The thinness of the film permits a high capacitance-to-volume ratio. The oxide acts as a dielectric in one direction only. The device is, therefore, polarized. (A nonpolarized electrolytic capacitor is, in effect, two polarized types in series with their like terminals connected together.) 3. A fixed capacitor, having a relatively high capacitance-to-volume ratio due to a very thin electrically formed, nonconducting chemical dielectric (oxide) film. 4. A capacitor in which the electrolytically formed oxide layer on the surface of the anode serves as a dielectric, with a solid or nonsolid electrolyte forming the cathode, thus giving the capacitor polar properties.

**electrolytic capacitor paper** — Very pure, porous paper, 17 to 100 micrometers thick, used to separate the metallic electrodes in electrolytic capacitors.

**electrolytic cell** — 1. In a battery, the container, two electrodes, and the electrolyte. 2. A unit apparatus in which electrochemical reactions are produced by applying electrical energy, or which supplies electrical energy as a result of chemical reactions and which includes two or more electrodes and one or more electrolytes contained in a suitable vessel.

**electrolytic cleaning** — A process of removing soil, scale, or corrosion products from a metal surface by subjecting it as an electrode to an electric current in an electrolytic bath.

**electrolytic conduction** — The flow of current between electrodes immersed in an electrolyte. It is caused by the movement of ions from one electrode to the other when a voltage is applied between them.

**electrolytic corrosion** — Corrosion by means of electrochemical erosion. See corrosion.

**electrolytic deposition** — See electrodeposition.

**electrolytic development** — The method of developing a photographic image by means of an applied electric field. The systems used include electrolysis and photoconductive systems.

**electrolytic dissociation** — The breaking up of molecules into ions in a solution.

**electrolytic interrupter** — A device that is tilted to change the current through it.

**electrolytic iron** — Iron obtained by an electrolytic process. The iron possesses good magnetic qualities and is exceptionally free of impurities.

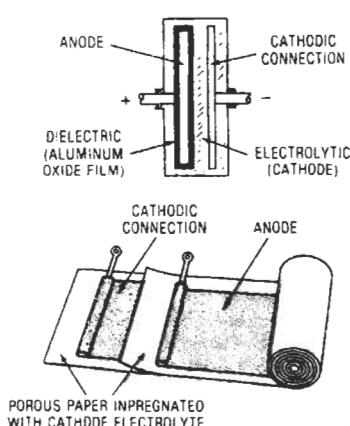
**electrolytic plating** — A method of metal deposition employing the work or cathode, the anode, the electrolyte, a solution containing dissolved salts of the metal to be plated, and a source of direct current. The anode metal is dissolved by chemical and electrical means; subsequently, cations are deposited onto the cathode. Electric current is the reducing agent. Copper, nickel, chromium, zinc, brass, cadmium, tin, gold, and silver are the metals most commonly electroplated.

**electrolytic potential** — The difference in potential between an electrode and the immediately adjacent electrolyte, expressed in terms of some standard electrode difference.

**electrolytic rectifier** — A rectifier consisting of metal electrodes in an electrolyte, in which rectification of alternating current is accompanied by electrolytic action. A polarization film formed on one of the electrodes permits current in one direction but not in the other.

**electrolytic refining** — The refining or purifying of metals by electrolysis.

**electrolytic shutter** — A high-speed shutter, similar to a Kerr cell, that uses the birefringence produced in a liquid during the passage of an electric current through it to change the liquid's optical transmission characteristics.

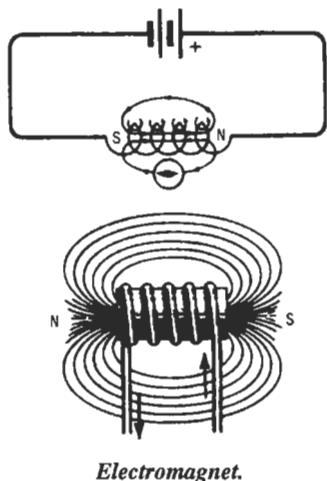


Electrolytic capacitor.

**electrolytic switch**—A switch having two electrodes projecting into a chamber containing a precisely measured quantity of a conductive electrolyte, leaving an air bubble of predetermined width. When the switch is tilted from true horizontal, the bubble shifts position and changes the amount of electrolyte in contact with the electrodes, thereby changing the amount of current passed by the switch. Used as a leveling switch in gyro systems.

**electrolyzer**—An electrolytic cell that produces alkalies, metals, chlorine, or other allied products.

**electromagnet**—1. A temporary magnet consisting of a solenoid with an iron core. A magnetic field exists only while current flows through the solenoid. 2. A magnet, consisting of a solenoid with an iron core, that has a magnetic field existing only during the time of current flow through the coil. 3. A coil of wire, usually wound on an iron core, that produces a strong magnetic field when current is sent through the coil. 4. A magnet created by inserting a suitable metal core within or near a magnetizing field that is usually formed by passing electric current through a coil of insulated wire. 5. A soft iron core that becomes a magnet temporarily when current flows through a coil of wire that surrounds it.



**electromagnetic**—1. Having both magnetic and electric properties. 2. Pertaining to the mutually perpendicular electric and magnetic fields associated with the movement of electrons through conductors, as in an electromagnet. 3. Pertaining to the combined electric and magnetic fields associated with radiation or with movements of charged particles. 4. Pertaining to or caused by the combined electric and magnetic fields that are always associated with an electric current. 5. Pertaining to the relationship between currents and magnetic fields.

**electromagnetic amplifying lens**—A system made up of a large number of waveguides symmetrically arranged with respect to an excitation medium so that they are excited with equal amplitude and phase in order to provide an effective gain in energy.

**electromagnetic bonding**—Method for joining thermoplastics in which a metallic preform is placed in the joint area to convert electromagnetic energy into heat for fusion bonding.

**electromagnetic cathode-ray tube**—A cathode-ray tube that uses electromagnetic deflection to deflect the electron beam.

**electromagnetic communications**—The electromagnetic wave conductor is space itself. The

electromagnetic frequencies available today for communications fall into two categories: frequencies that form "wireless" communications (such as visual light of fairly high frequency), and frequencies that humans use for wireless communications (such as radio, shortwave, and microwave transmitting, of relatively lower frequencies). In communicating by radio, shortwave, and microwave frequencies, translators similar in principle to those used in electrical communications are needed, although the equipment requirement increases.

**electromagnetic compatibility**—Abbreviated EMC. 1. The ability of electronic devices and communications equipment, subsystems, and systems to operate in their intended environments without suffering or causing unacceptable degradation of performance as a result of unintentional electromagnetic radiation or response. 2. A directive that specifies the acceptable limits for electromagnetic emissions from an electronic device, and how much electromagnetic interference the device should tolerate. 3. Abbreviation for electronic message center (Ford Motor). Digital dashboard electronics displaying digital readouts of speed, miles, fuel, clock, etc.

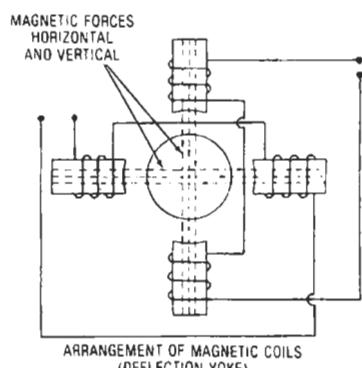
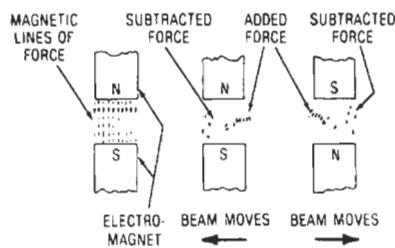
**electromagnetic complex**—The electromagnetic configuration of an installation, including all radiators of significant amounts of energy.

**electromagnetic coupling**—The mutual relationship between two separate but adjacent wires when the magnetic field of one induces a voltage in the other.

**electromagnetic crack detector**—An instrument for detecting hidden cracks in iron or steel objects by magnetic means.

**electromagnetic deflection**—The deflection of an electron stream by means of a magnetic field. In a television receiver, the magnetic field for deflecting the electron beam horizontally and vertically is produced by two pairs of coils, called the deflection yoke, around the neck of the picture tube.

**electromagnetic deflection coil**—A coil around the neck of a CRT, for deflecting the electron beam.



*Electromagnetic deflection coil.*

**electromagnetic delay line**—A delay line whose operation is based on the time of propagation of electromagnetic waves through distributed or lumped capacitance and inductance.

**electromagnetic energy**—Forms of radiant energy, such as radio waves, heat waves, light waves, X-rays, gamma rays, and cosmic rays.

**electromagnetic environment**—The rf field or fields existing in an area or desired in an area to be shielded.

**electromagnetic field**—1. The field of influence produced around a conductor by the current flowing through it. 2. A rapidly moving electric field and its associated magnetic field. The latter is perpendicular to both the electric lines of force and their direction. 3. The field associated with radio or light waves, consisting of a magnetic and an electric field at right angles to each other and to the direction of wave propagation.

**electromagnetic focusing**—In a television picture tube, the focusing produced by a coil mounted on the neck. Direct current through the coil produces magnetic field lines parallel to the tube axis.

**electromagnetic horn**—A horn-shaped structure that provides highly directional radiation of radio waves in the 100-megahertz or higher frequency range.

**electromagnetic induction**—The voltage produced in a coil as the number of magnetic lines of force (flux linkages) passing through the coil changes.

**electromagnetic inertia**—1. The characteristic delay of a current in an electric circuit in reaching its maximum or zero value after application or removal of the source voltage. 2. The property of self-induction.

**electromagnetic interference**—Abbreviated EMI. 1. Unintentional interfering signals generated within or external to electronic equipment. Typical sources could be power-line transients, noise from switching-type power supplies, and/or spurious radiation from oscillators. EMI is suppressed with power-line filtering, shielding, etc. EMI suppression requirements are frequently specified for military equipment. 2. Electromagnetic phenomena which, either directly or indirectly, can contribute to a degradation in performance of an electronic receiver or system. (The terms *radio interference*, *radio-frequency interference*, *noise*, *emi*, and *rifi* have been employed at various times in the same context.) 3. Disturbances caused by electromagnetic waves (radio, heat, light, etc.) that can impair the reception of the desired transmitted signal. 4. Unwanted electromagnetic emissions, generated by lightning or by electronic or electrical devices, that degrade the performance of another electronic device. Interference may be reduced by shielding. Maximum acceptable levels of EMI from electronic devices are detailed by the Federal Communications Commission.

**electromagnetic lens**—1. An electron lens in which the electron beams are focused electromagnetically. 2. An electromagnet that produces a suitably shaped magnetic field for the focusing and deflection of charged particles in electron-optical systems. 3. An electron lens consisting of a homogeneous axial electric field and a magnetic field, used in high-quality image tubes for high MTF and small geometrical distortion requirements.

**electromagnetic mirror**—A surface or region capable of reflecting radio waves, such as one of the ionized layers in the upper atmosphere.

**electromagnetic oscillograph**—An oscilloscope in which a mechanical motion is derived from electromagnetic forces to produce a record.

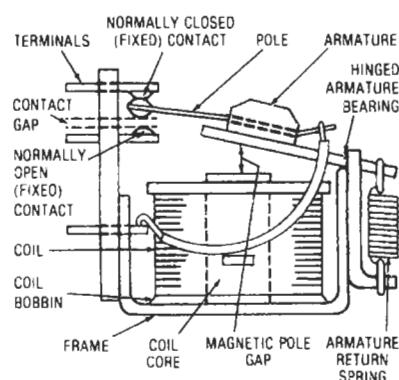
**electromagnetic pollution**—The effects of electromagnetic interference (EMI) produced by human-made apparatus. The seriousness of this interference ranges from annoying interference that affects a radio or television channel to interference that causes failure of an important communication channel or a cardiac pacemaker.

**electromagnetic pulse**—Abbreviated EMP. A reaction of large magnitude resulting from the detonation of nuclear weapons.

**electromagnetic radiation**—1. That form of energy which is characterized by transversely oscillating electric and magnetic fields and which propagates at velocity  $c$  in free space. At a sufficient distance from the source, the electric-field vector and the magnetic field vector are at right angles to each other, forming a right-handed (coordinate) system. In an ionized medium, a longitudinal component may be present. 2. A form of power emitted from vibrating charged particles. A combination of oscillating electric and magnetic fields, electromagnetic radiation propagates through otherwise empty space with the velocity of light. This (constant) velocity equals the alternation frequency multiplied by the wavelength; hence the frequency and wavelength are inversely proportional to each other. The spectrum of electromagnetic radiation is continuous over all frequencies. 3. Abbreviated EMR. When discussing shielding, describes radiation generated by electrical means, ranging from a stationary magnetic or electrostatic field to high-frequency changing fields and transmitted plane waves of radio frequency.

**electromagnetic reconnaissance**—Activity conducted to locate and identify potential hostile sources of electromagnetic radiation, including radar, communication, missile-guidance, and air-navigation equipment.

**electromagnetic relay**—1. Device that opens or closes contacts by setting "moving" contacts against "fixed" contacts when current passes through an electromagnet. Current sets up a magnetic attraction between the core of the electromagnet and a hinged arm to the tip of which is attached the moving contact. The movement of the arm toward the core of the electromagnet brings moving and fixed contacts together. When current is withdrawn, a spring returns the arm to its original position and the contacts separate. 2. A mechanical switch operated by electric power.

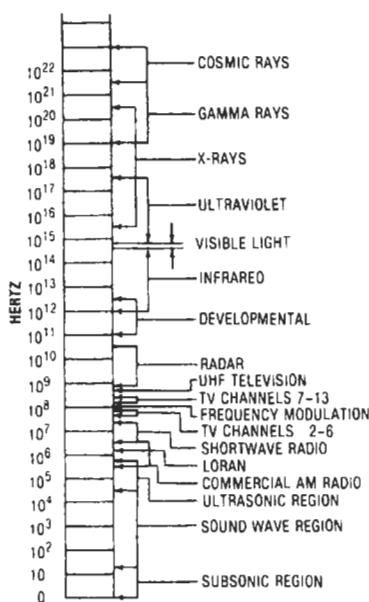


Electromagnetic relay.

**electromagnetic repulsion**—The repelling action between like poles of electromagnets.

**electromagnetics**—In physics, the branch concerned with the relationships between electric currents and their associated magnetic fields.

**electromagnetic spectrum**—1. A chart or graph showing the relationships among all known types of electromagnetic radiation classified by wavelengths. 2. The continuous range of frequencies, from 0.1 to  $10^{22}$  hertz, of which a radiated signal is composed. Spectral dimensions are more conveniently described in terms of wavelength (angstroms), where 1 angstrom is equivalent to  $10^{-7}$  mm. The electromagnetic spectrum includes radio-frequency waves, light waves, microwaves, infrared, X-rays (Roentgen rays), and gamma rays. 3. The ordered array of known electromagnetic radiations, extending from the shortest wavelengths, cosmic rays, through gamma rays, X-rays, ultraviolet radiation, visible radiation, and infrared, and including microwave and all other wavelengths of radio energy. 4. The entire range of wavelengths, extending from the shortest to the longest or conversely, that can be generated physically. This range of electromagnetic wavelengths extends almost from zero to infinity and includes the visible portion of the spectrum known as light. *See also* visible spectrum. 5. The total range of wavelengths or frequencies of electromagnetic radiation, extending from the longest radio waves to the shortest known cosmic rays.



Electromagnetic radiation spectrum chart.

**electromagnetic tester**—A nondestructive test method for engineering materials, including magnetic materials, that uses electromagnetic energy having frequencies less than those of visible light to yield information regarding the quality of the tested materials.

**electromagnetic theory**—The theory of propagation of energy by combined electric and magnetic fields included in Maxwell's equations.

**electromagnetic theory of light**—The theory that states that electromagnetic and light waves have identical properties.

**electromagnetic transduction**—1. Conversion of the measurand into the output induced in a conductor by a change in magnetic flux. 2. A wave produced by the oscillation of an electric charge. 3. A wave in which there are both electric and magnetic displacements. 4. A transverse wave associated with the transmission of electromagnetic energy.

**electromagnetic-type microphones**—Microphones in which the voltages are varied by an electromagnet (namely, ribbon or velocity, dynamic or moving-coil, and reluctance or moving-vane microphones).

**electromagnetic unit**—Abbreviated emu. A unit of electricity based primarily on the magnetic effect of an electric current. The fundamental centimeter-gram-second unit is the abampere. Now considered obsolete.

**electromagnetic vibrator**—A mechanical device for interrupting the flow of direct current and thereby making it a pulsating current. This is done where a circuit requires an alternating current to operate. A reed within the vibrator is alternately attracted to two electromagnets.

**electromagnetic wave**—1. The radiant energy produced by oscillation of an electric charge. It includes radio, infrared, visible and ultraviolet light waves, and X-, gamma, and cosmic rays. 2. A wave in which both electric and magnetic displacement are present. 3. Waves of radiation identified by individual fluctuations of electric and magnetic fields. All such waves propagate at the speed of light in free space, which includes most realistic atmospheric conditions. Three material parameters are necessary and sufficient to describe electromagnetic waves in a given medium: dielectric constant (or permittivity), permeability, and conductivity.

**electromagnetism**—1. The magnetic field around a wire or other conductor when, and only when, current passes through it. 2. Magnetism caused by an electric current in a conductor.

**electromanometer**—Instrument used for measuring pressure of gases or liquids by electronic methods.

**electromechanical**—Any device using electrical energy to produce mechanical movement.

**electromechanical bell**—A bell with a prewound spring-driven clapper that is tripped electrically to ring the bell.

**electromechanical breakdown**—A mechanical runaway that occurs when the mechanical restoring force fails to balance the electrical compressive force.

**electromechanical chopper**—*See* contact modulator.

**electromechanical diffused-collector transistor**—*See* EDCT.

**electromechanical energy**—Energy present in an induction coil or solenoid.

**electromechanical frequency meter**—A meter that uses the resonant properties of mechanical devices to indicate frequency.

**electromechanical recorder**—A device that transforms electrical signals into equivalent mechanical motion that is transferred to a medium by cutting, embossing, or writing.

**electromechanical timer**—Usually refers to a motor-driven timer, with or without an electrically operated clutch. Can also apply to pneumatic and thermal timers, or slow pull-in or drop-out relays.

**electromechanical transducer**—A device that transforms electrical energy into mechanical energy and vice versa. A speaker is an example of the first, and a microphone of the second.

**electromechanics**—That branch of electrical engineering concerned with machines producing or operated by electric currents.

**electrometallurgy**—That branch of science concerned with the application of electrochemistry to the extraction or treatment of metals.

**electrometer**—1. An electrostatic instrument that measures a potential difference or an electric charge by the mechanical force exerted between electrically charged surfaces. 2. A dc voltmeter with an extremely high input resistance, usually around  $10^{10}$  megohms, as opposed to 10 megohms or less for a conventional type.

**electrometer amplifier**—An amplifier circuit having sufficiently low current drift and other noise components, sufficiently low amplifier input-current offsets, and adequate power and current sensitivities to be usable for measuring current variations of considerably less than  $10^{-12}$  A.

**electrometer tube**—A vacuum tube having a very low control-electrode conductance, to facilitate the measurement of extremely small direct currents and voltages.

**electromigration**—Motion of ions of a metal conductor (such as aluminum) in response to the passage of high current through it. Such motion can lead to the formation of "voids" in the conductor, which can grow to a size such that the conductor is unable to pass current. Electromigration is aggravated at high temperature and high current density and therefore is a reliability "wear-out" process. Electromigration is minimized by limiting current densities and by adding metal impurities such as copper or titanium to aluminum.

**electromotive force**—Abbreviated emf. 1. The force that causes electricity to flow when there is a difference of potential between two points. The unit of measurement is the volt. 2. Electrical pressure at the source. Not to be confused with potential difference, which is the voltage developed across a resistance or impedance due to current flowing through it. Both are measured in volts. 3. Electric pressure that causes a current to flow in a circuit; it is the energy put into the circuit by the source per unit electric charge that it supplies to the circuit. The unit of emf is the volt, being the electromotive force required to cause a current of 1 ampere to flow in a resistance of 1 ohm. 4. The difference of electrical potential found across the terminals of a source of electrical energy; more precisely, the limit of the potential difference across the terminals of a source as the current between the terminals approaches zero.

**electromotive force series**—A list of elements arranged according to their standard electrode potentials, with noble metals, such as gold, being positive and active metals, such as zinc, being negative.

**electromotive series**—A list of metals arranged in decreasing order of their tendency to pass into ionic form by losing electrons.

**electromyogram**—A waveform of the contraction of a muscle as a result of electrical stimulation. Usually the stimulation comes from the nervous system (normal muscular activity). The record of potential difference between two points on the surface of the skin resulting from the activity or action potential of a muscle.

**electromyograph**—An instrument for measuring and recording potentials generated by muscles.

**electromyography**—Abbreviated EMG. Recording and interpretation of the electrical activity of muscle tissue. A single electrical spike potential is generated when a muscle fiber contracts. The magnitude of the spike potentials is roughly proportional to the amount of muscular tension. Surface detecting electrodes (for many muscle fibers) or needle electrodes (for one or a few fibers) provide a signal that is amplified and displayed on a cathode-ray tube.

## electrometallurgy — electron-beam tube

**electron**—An elementary atomic particle that carries the smallest negative electric charge ( $1.6 \times 10^{-19}$  coulombs). Electrons are light in mass ( $1/1840$  of the mass of the hydrogen atom, or  $9.107 \times 10^{-31}$  gram), highly mobile, and orbit the nucleus of an atom. Electrons are responsible for the bonds between atoms. Positive electrons, or positrons, also exist.

**electronarcosis**—1. The induction of unconsciousness by passage of a weak current through the brain. 2. Anesthesia induced by the passage of a precisely controlled electric current through the brain.

**electron attachment**—Process by which an electron is attached to a neutral molecule to form a negative ion. Often characterized by the attachment coefficient  $\eta$ , which is the number of attachments per centimeter of drift. Also characterized by the ratio  $h = \sigma/\theta$ , where  $\sigma$  is the attachment cross section and  $\theta$  the total cross section.

**electron avalanche**—The chain reaction started when one free electron collides with one or more orbiting electrons and frees them. The free electrons then free others in the same manner, and so on.

**electron band**—A spectrum band composed of molecules that is usually found in the visible or the ultraviolet because of the electron transition taking place with the molecule.

**electron beam**—1. A narrow stream of electrons moving in the same direction under the influence of an electric or magnetic field. 2. A stream of electrons, emitted by a single source, that move in the same direction and at the same speed. 3. The electrons emitted by the cathode in a picture tube and focused into a beam that is deflected line by line across the phosphor screen to produce an image.

**electron-beam bonding**—Process using a stream of electrons to heat and bond two conductors within a vacuum.

**electron-beam evaporation**—An evaporation technique in which the evaporant is heated by electron bombardment.

**electron-beam generator**—A velocity-modulated generator, such as a klystron tube, used to generate extremely high frequencies.

**electron-beam gun**—A device generally used in a cathode-ray or camera tube to emit a stream of electrons moving at uniform velocity in a straight line. It consists of an emitting cathode and an anode, with an aperture for passage of some of the electrons.

**electron-beam instrument**—Also called a cathode-ray instrument. An instrument in which a beam of electrons is deflected by an electric or magnetic field (or both). Usually the beam is made to strike a fluorescent screen so the deflection can be observed.

**electron-beam machining**—A process in which controlled electron beams are used to weld or shape a piece of material.

**electron-beam magnetometer**—An instrument that measures the intensity and direction of magnetic forces by the immersion of an electron beam into the magnetic field.

**electron-beam mode discharge**—Abbreviated ebmd. A form of discharge produced by a perforated-wall hollow cathode operating under conditions of pressure, voltage, and geometry usually associated with the abnormal glow discharge.

**electron-beam recording**—The recording of the information contained in a modulated electron beam onto photographic or silicon-resin-coated materials.

**electron-beam tube**—An electron tube that depends for its operation on the formation and control of one or more electron beams.

**electron-beam welding**—1. The process of using a focused beam of electrons to heat materials to the fusion point. 2. Process in which a welder generates a stream of electrons traveling at up to 60 percent of the speed of light. It focuses the beam to a small, precisely controlled spot in a vacuum and converts the kinetic energy into an extremely high temperature on impact with the work piece.

**electron-bombarded semiconductor amplifier**—Abbreviated EBS amplifier. An amplifier consisting of an electron-gun modulation system, semiconductor target, and output coupling network all within a glass or ceramic envelope. The semiconductor target is a pair of silicon diodes, each consisting of two metallic electrodes with a pn junction under the top contact. Amplifier operation is based on the fact that a modulated electron beam can control the current in a reverse-biased semiconductor junction.

**electron-bombardment-induced conductivity**—In a multimode display storage tube, a process by which the image on the surface of the cathode-ray tube is erased by the use of an electron gun.

**electron charge**—Also called elementary charge. The charge of a single electron. Its value is  $1.602189 \times 10^{-19}$  coulomb. The fundamental unit of electrical charge.

**electron-coupled oscillator**—Abbreviated ECO. A circuit using a multigrid tube in which the cathode and two grids operate as a conventional oscillator and the electron stream couples the plate-circuit load to the oscillator.

**electron coupling**—In vacuum (principally multigrid) tubes, the transfer of energy between electrodes as electrons leave one and go to the other.

**electron device**—Any device in which the passage of electrons through a vacuum, gas, or semiconductor is the device's principal means of conduction.

**electron diffraction**—1. The phenomenon or the technique of producing diffraction patterns through the incidence of electrons on matter. 2. The bending of an electron stream that occurs when the stream travels through a medium such as very thin metal foil.

**electron-diffraction camera**—A special evacuated camera equipped with means for holding a specimen and bombarding it with a sharply focused beam of electrons. A cylindrical film placed around the specimen records the electrons that may be scattered or diffracted by it.

**electron drift**—The movement of electrons in a definite direction through a conductor, as opposed to the haphazard transfer of energy from one electron to another by collision.

**electronegative**—Having an electric polarity that is negative.

**electronegative developer**—A developer containing negatively charged toner particles.

**electron emission**—The freeing of electrons into space from the surface of a body under the influence of heat, light, impact, chemical disintegration, or a potential difference.

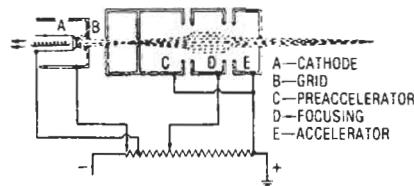
**electron emitter**—In a cathode tube, the electrode that serves as a source for electrons.

**electron filter lens**—An electrostatic device that uses an electric potential barrier to allow the transmittance of electrons at or above a set level of energy while stopping the passage of those below it.

**electron flow**—The movement of electrons from a negative to a positive point in a metal or other conductor, or from a negative to a positive electrode through a liquid, gas, or vacuum.

**electron gun**—1. An electrode structure that produces and may control focus and may deflect and

converge one or more electron beams. 2. A device for producing and accelerating a beam of electrons. 3. The portion of a TV picture tube or cathode-ray tube that produces the stream of electrons and may also focus and center the stream. 4. The source of the electron beam in a picture tube, comprising a cathode plus several focusing electrodes that collimate and focus the electron beam into a spot on the screen. In a color tube there may be three electron guns usually integrated into a single unit (unitized gun), or a single gun for the three colors.



Electron gun.

**electronic**—1. Pertaining to that branch of science which deals with the motion, emission, and behavior of currents of free electrons, especially in vacuum, gas, or phototubes and special conductors or semiconductors. This is contrasted with electric, which pertains to the flow of large currents in metal conductors. 2. Of or pertaining to devices, circuits, or systems using the principle of electron flow through a conductor. Examples: electronic control, electronic equipment, electronic instrument, electronic circuit.

**electronic autopilot**—An arrangement of gyroscopes, electronic amplifiers, and servomotors for detecting deviations in the flight of an aircraft and applying the required corrections directly to its control cables.

**electronic balance**—Weighing balance that uses forces produced by known currents to balance unknown currents, and thereby unknown weights, very accurately to within parts of a microgram.

**electronic "bug"**—A keying system that converts the Morse signals from a hand key into correctly proportioned and spaced dots and dashes.

**electronic bulletin board**—A shared file where users can enter information for other users to read or download. Many bulletin boards are set up according to general topics and are accessible throughout a network.

**electronic calculator**—Electronic device for arithmetic and logarithmic computations; may also include digital printer and computer.

**electronic camouflage**—Use of electronic means or exploitation of electronic characteristics to reduce, submerge, or eliminate the radar-echoing properties of a target.

**electronic carburetor**—A fuel-metering actuator in which the air/fuel ratio is controlled by continual variations of the metering rod position in response to an electronic control signal.

**electronic charge**—The quantity of charge represented or possessed by one electron. It is equal to  $1.602189 \times 10^{-19}$  coulomb.

**electronic circuit**—A circuit containing one or more electron tubes, transistors, integrated circuits, magnetic amplifiers, etc.

**electronic commutator**—A type of switch that provides a continuous switching or sampling of a number of circuits by means of a radial-beam electronic tube or electronic switching circuit.

**electronic confusion area**—Amount of space that a target appears to occupy in a radar resolution cell, as it appears to that radar beam.

**electronic control**—Also called electronic regulation. The control of a machine or condition by electronic devices.

**electronic control unit**—*See ECU.*

**electronic counter**—An instrument capable of counting up to several million electrical pulses per second.

**electronic counter-countermeasures**—Abbreviated ECCM. 1. Equipment and techniques that allow electronic systems such as radar and communication systems to operate effectively while attempts are made to disrupt or jam their operation. 2. That division of electronic warfare involving actions taken to ensure friendly and effective use of the electromagnetic spectrum despite the enemy's use of electronic warfare. 3. Retaliatory tactics used to reduce the effectiveness of electronic countermeasures.

**electronic countermeasures**—Abbreviated ECM. 1. All measures taken to reduce the effectiveness of enemy electronic systems such as radar and communications. There are two distinct areas: passive measures, or reconnaissance, and active measures, such as jamming. 2. That division of electronic warfare involving actions taken to prevent or reduce an enemy's effective use of the electromagnetic spectrum. Includes techniques such as chaff and barrage jamming as well as sophisticated methods to deceive the systems without indication to the opposing operators that their systems are being affected. 3. Methods of jamming or otherwise hindering the operation of enemy electronic equipment.

**electronic countermeasures control**—1. Collection and sorting of large quantities of data for the purpose of measuring and defining radar signals. 2. Examination of the data received in order to determine selection and switching of countermeasure devices with little or no time delay.

**electronic coupling**—The method of coupling electrical energy from one circuit to another through the electron stream in a vacuum tube.

**electronic crowbar**—An electronic switching device generally used in a power supply to divert a fault current from more delicate components until a fuse, circuit breaker, or the like has time to respond.

**electronic data exchange**—*See EDI.*

**electronic data processing**—Abbreviated EDP.

1. Operations on data carried out mainly by electronic equipment. 2. Use of electronic memories to store, update, and read information automatically, and using that information in accounting, filing, etc. 3. Any computerized information system and the equipment used in that system.

**electronic data-processing center**—Abbreviated EDP center. A place in which is kept automatically operated equipment, including computers, designed to simplify the interpretation and use of data gathered by instrumentation installations or information-collection agencies.

**electronic data-processing machine**—Abbreviated EDPM. A machine or its device and attachments used primarily in or with an electronic data-processing system.

**electronic data-processing system**—Any machine or group of automatically intercommunicating machines capable of entering, receiving, sorting, classifying, computing, and/or recording alphabetical or numerical accounting or statistical data (or all three).

**electronic deception**—Deliberate radiation, reradiation, alteration, absorption, or reflection of electromagnetic radiations in a manner intended to cause the enemy to obtain misleading data or false indications from

## electronic confusion area — electronic flash unit

his electronic equipment. There are two categories of electronic deception: (a) Manipulative deception—the alteration or simulation of friendly electromagnetic radiation to accomplish deception. (b) Imitative deception—the introduction into enemy channels of radiations that imitate the enemy's own emissions.

**electronic device**—1. A device in which conduction is principally by the movement of electrons through a vacuum, gas, or semiconductor. 2. An electronic tube or valve, transistor, or other semiconductor device. This definition excludes inductors, capacitors, resistors, and similar components.

**electronic differential**—An input or output type of circuit that only amplifies or responds to the difference of two signals, and does not respond to the signal with respect to ground or a supply voltage.

**electronic differential analyzer**—A form of analog computer using interconnected electronic integrators to solve differential equations.

**electronic digital computer**—A machine that uses electronic circuitry in the main computing element to perform arithmetic and logical operations on digital data (i.e., data represented by numbers or alphabetic symbols) automatically by means of an internally stored program of machine instructions. Such devices are distinguished from calculators, on which the sequence of instructions is externally stored and is impressed manually (desk calculators) or from tape or cards (card-programmed calculators).

**electronic efficiency**—The ratio of (a) the power at the desired frequency delivered by the electron stream to the oscillator or amplifier circuit to (b) the direct power supplied to the stream.

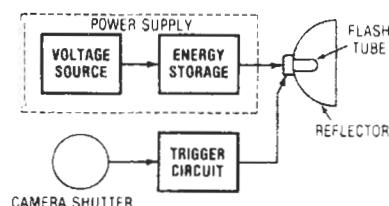
**electronic engine control**—*See EEC.*

**electronic engineering**—A branch of electrical engineering that applies the principles of electronics to the solution of practical problems. *See also electronics.*

**electronic flash**—Also called strobe. 1. The firing of special light-producing, high-voltage, gas-filled glass tubes with a high instantaneous surge of current furnished by a capacitor or bank of capacitors that have been charged from a high-voltage source (usually 450 volts or higher). 2. A device that upon command produces a pulse of luminous energy caused by a discharge of electrical energy through a gas. The term usually implies the use of a flash tube and associated power source and trigger circuit.

**electronic flash tube**—*See flash tube.*

**electronic flash unit**—A small xenon-filled tube with metal electrodes fused into the ends. The gas flashes brilliantly when a capacitor is discharged through the tube. The duration of the flash primarily depends on the capacitance of the capacitor. As a rule of thumb, flash time is approximately equal in microseconds to capacitance in microfarads. Sometimes the flash recurs at a specified frequency, which may reach many thousands per second; such a device is called a strobe unit because it



Electronic flash unit.

produces stroboscopic effects and makes rapidly moving parts appear to stand still.

**electronic frequency synthesizer**—A device that generates two or more selectable frequencies from one or more fixed-frequency sources.

**electronic funds transfer system**—See EFTS.

**electronic gate**—A device in which diodes and/or transistors provide input-output relations that correspond to a Boolean-algebra function (AND, OR, etc.).

**electronic heating**—Also called high-frequency heating. A method of heating a material by inducing a high-frequency current in it or having the material act as the dielectric between two plates charged with a high-frequency current.

**electronic hookup wires**—Wires used to make the internal connections between the various electrical parts of electronic assemblies.

**electronic industries**—Industrial organizations engaged in the manufacture, design, development, and/or substantial assembly of electronic equipment, systems, assemblies, or the components thereof.

**Electronic Industries Association**—Abbreviated EIA. A trade association of the electronics industry. Some of its functions are the formulation of technical standards, dissemination of marketing data, and the maintenance of contact with government agencies in matters relating to the electronics industry. The association was originally known as the Radio Manufacturers Association (RMA), and later as the Radio-Electronics-Television Manufacturers Association (RETMA).

**electronic instrument**—Any instrument that depends for its operation on the action of either one or more electron devices.

**electronic instrument cluster**—See EIC.

**electronic intelligence**—The technical and intelligence information derived from foreign noncommunications electromagnetic radiations emanating from other than nuclear detonations or radioactive sources.

**electronic interference**—Electrical or electromagnetic disturbances that result in undesired response in electronic equipment.

**electronic jamming**—Intentional radiation, re-radiation, or reflection of electromagnetic energy for the purpose of reducing the effectiveness of enemy electromagnetic devices or impairing the use of any electronic devices, equipment, or systems being used by an enemy.

**electronic keyboard**—A keyboard that is used to generate characters through electronic means rather than through mechanical linkages.

**electronic keying**—A method of keying whereby the dots and dashes are produced solely by electronic means.

**electronic line scanning**—Facsimile scanning in which a spot on a cathode-ray tube moves across the copy electronically while the record sheet or subject copy is moved mechanically in a perpendicular direction.

**electronic mail**—Abbreviated e-mail or email. 1. Electronic messages that can be sent over a communications network from one computer to another. 2. Sending messages electronically between computers or terminals.

**electronic microphone**—A device that depends for its operation on the generation of a voltage by the motion of one of the electrodes in a special electron tube.

**electronic mine detector**—See mine detector

**electronic multimeter**—A device employing the characteristics of an electron-tube circuit for the measurement of electrical quantities, at least one of which is voltage or current, on a single calibrated scale.

**electronic music**—The electronic generation and processing of audio signals, or the electronic processing of natural sound, and the manipulation and arrangement

of these signals via tape recorders into a finished musical composition.

**electronic music synthesizer**—An audio signal processor that contains sound generators (oscillators) and additional circuitry such as filters to produce familiar sounds, such as those produced by conventional musical instruments, or to create unique sounds and effects.

**electronic news-gathering**—Abbreviated ENG. The use of video cameras, recording, and other ancillary electronic gear to collect news stories for TV airing.

**electronic organ**—The electronic counterpart of the pipe organ. All tones and tone variations, such as vibrato, tremolo, etc., are produced by electronic circuits instead of by pipes.

**electronic pacemaker**—Also called a pacemaker. An electrical device, usually with electrodes planted in the myocardium, that performs the pacing function in a diseased heart no longer capable of pacing itself. Electronic pacemakers can receive power from implanted batteries, radio-frequency signals, biological energy sources, etc.

**electronic packaging**—The coating or surrounding of an electronic assembly with a dielectric compound.

**electronic part**—A basic circuit element that cannot be disassembled and still perform its intended function. Examples of electronic parts are capacitors, connectors, filters, resistors, switches, relays, transformers, crystals, electron tubes, and semiconductor devices.

**electronic photometer**—Also called photoelectric photometer. A photometer with a photocell, phototransistor, or phototube for measuring the intensity of light.

**electronic power supply**—A circuit that transforms electrical input energy, that is, alternating or direct current. (Sources operating on rotating machine principles, or deriving electrical power from other energy forms such as batteries and solar cells, are excluded.) Supplies covered by this definition fall into one of four groups: 1) ac in, dc out—most common supplies. 2) ac in, ac out—line regulators, variable-frequency supplies. 3) dc in, dc out—converters. 4) dc in, ac out—inverters.

**electronic products**—Materials, parts, components, subassemblies, and equipment that employ the principles of electronics in performing their major functions. These products may be used as instruments and controls in communications, detection, amplification, computation, inspection, testing, measurement, operation, recording, analysis, and other functions employing electronic principles.

**electronic profilometer**—An electronic instrument for measuring surface roughness. The diamond-point stylus of a permanent-magnet dynamic pickup is moved over the surface being examined. The resultant variations in voltage are amplified and then measured with a meter calibrated to read directly in microinches of deviation from smoothness.

**electronic raster scanning**—Scanning by electronic means so that substantially uniform coverage of an area is provided by a predetermined pattern of scanning lines.

**electronic reconnaissance**—Search for electromagnetic radiations to determine their existence, source, and pertinent characteristics for electronic warfare purposes.

**electronic rectifier**—A rectifier using electron tubes or equivalent semiconductor elements as rectifying elements.

**electronic regulation**—See electronic control.

**electronic relay**—An electronic circuit that provides the functional equivalent of a relay but has no moving parts.

**electronics**—1. The field of science and engineering concerned with the behavior of electrons in devices and

the utilization of such devices. 2. Of or pertaining to the field of electronics, such as electronics engineer, course, laboratory, committee. 3. Name given to that branch of electrical engineering which deals with devices whose operation depends upon the movement of electrons in space as opposed to the movement of electrons in liquids or solid conductors, e.g., radio tubes, photoelectric cells. It includes the study of radio, radar, television, sound films, and control of industrial processes. 4. That branch of science involved in the study and utilization of the motion, emissions, and behaviors of currents of electrical energy through gases, vacuums, semiconductors, and conductors; not to be confused with electrics, which deals primarily with the conduction of large currents of electricity through metals. 5. That branch of science and technology which deals with the study, application, and control of the phenomena of conduction of electricity in a vacuum, in gases, in liquids, in semiconductors, and in conducting and superconducting materials.

**electronic search reconnaissance** — The determination of the presence, source, and significant characteristics of electromagnetic radiations.

**electronic security** — Protection resulting from measures designed to deny to unauthorized persons information of value that might be obtained by interception and analysis of noncommunications electromagnetic radiations.

**electronic shock absorption** — An integrated data bit storage buffer inside a CD portable, which receives information at twice the normal speed but supplies information to the digital-to-analog converter at normal speed, ensuring that any interruption of the data flow caused by shocks or bumps does not result in interruption of play.

**electronic shutter** — A mechanical shutter with an electronic timing circuit. This circuit allows a wider range of exposure times, can be more accurate, and, placed in a circuit with a photconductive cell, allows automatic setting of shutter speeds.

**electronic sky screen equipment** — An electronic device for indicating the departure of a missile from a predetermined trajectory.

**electronic speed control** — 1. A system whereby a motor's speed is controlled by feedback from a frequency-sensing circuit attached to the device being powered; changes from the desired speed cause corrective signals to speed up or slow down the motor. 2. Changes in speed in a record player, whether gross (as from  $33\frac{1}{3}$  to 45 rpm) or small (as an order of  $\pm 3$  percent), can be made by alternating components in the external speed-regulation circuit, rather than by mechanically shifting belts or idler wheels.

**electronic sphygmomanometer** — Device that measures and/or records blood pressure electronically.

**electronic stethoscope** — An electronic amplifier of sounds within a body. Its selective controls permit tuning for low heart tones or high pulmonary tones. It has an auxiliary output for recording or viewing audio patterns.

**electronic stimulator** — A device for applying electronic pulses or signals to activate muscles, or to identify nerves, or for muscular therapy, etc.

**electronic surge arrester** — A device used to switch high-energy surges to ground so as to reduce the transient energy to a level that is safe for secondary protectors (e.g., zener diodes, silicon rectifiers).

**electronic switch** — 1. A circuit element causing a start and stop action or a switching action electronically, usually at high speeds. 2. An electronic circuit used to perform the function of a high-speed switch. Applications

include switching a cathode-ray oscilloscope back and forth between two inputs at such high speed that both input waveforms appear simultaneously on the screen.

**electronic switching** — Electronic circuits and solid-state devices used to perform most telephone central office switching functions.

**electronic switching system** — Abbreviated ESS.

1. A telephone switching system that uses a computer with a storage containing program switching logic. The output of the computer actuates reed or electronic switches that establish telephone connections automatically. 2. A system that uses solid-state switching devices and computerlike operations to accomplish switching of telephone calls. 3. A type of telephone switching system that uses a special-purpose digital computer to direct and control the switching operation. ESS permits custom-calling services such as speed dialing, call transfer, and three-way calling.

**electronic thermal conductivity** — The part of thermal conductivity due to the transfer of thermal energy by means of electrons and holes.

**electronic timer** — 1. A synchronizer, pulse generator, modulator, or keyer that originates a series of continuous control pulses at an unvarying repetition rate known as the pulse-recurrence frequency. 2. A timer using electronic circuits (either tube or transistor type) to control a time period, in place of a motor or other means.

**electronic tube relay** — A relay that employs electronic tubes as components.

**electronic tuning** — 1. Altering the frequency of a reflex klystron oscillator by changing the repeller voltage. 2. Frequency changing in a transmitter or receiver by changing a control voltage rather than circuit components.

**electronic video recording** — The recording of video images by means of photographic film, or magnetic tape or disk, so that the image's record can be played back in a video format at a later time.

**electronic viewfinder** — Also called viewfinder monitor. 1. A small TV screen attached to a video camera that allows the operator to view a given scene exactly as it is being viewed by the camera. 2. A small television camera that replaces the reflex viewfinder of a motion picture camera. This permits the image photographed to be viewed simultaneously by a number of people, since the TV image may be transmitted to several receivers.

**electronic voltmeter** — Also called vacuum-tube voltmeter. A voltmeter that utilizes the rectifying and amplifying properties of electron tubes or semiconductors and their circuits to secure such characteristics as high input impedance, wide frequency range, peak-to-peak indications, etc.

**electronic volt-ohmmeter** — A device employing the characteristics of an electron-tube or semiconductor circuit for the measurement of voltage and resistance on a single-calibrated scale.

**electronic warfare** — Abbreviated EW. 1. Military usage of electronics to reduce an enemy's effective use of radiated electromagnetic energy and to ensure our own effective use. 2. Military action involving the use of electromagnetic energy to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum, and action that retains friendly use of the electromagnetic spectrum. There are three divisions within electronic warfare: electronic warfare support measures (ESM), electronic countermeasures (ECM), and electronic counter-countermeasures (ECCM).

**electronic warfare support measures** — Abbreviated ESM. That division of electronic warfare involving actions taken to search for, intercept, locate, and immediately identify radiated electromagnetic energy for the purpose of immediate threat recognition. Thus, ESM

provides a source of information required for immediate action involving electronic countermeasures, electronic counter-countermeasures, avoidance, targeting, and other tactical employment of forces.

**electronic watch** — A timepiece in which a battery replaces the mainspring, and semiconductor elements replace the mechanical switching-contact arrangement.

**electronic waveform synthesizer** — An instrument using electron devices to generate an electrical signal of a desired waveform.

**electron image** — A representation of an object formed by a beam of electrons focused by an electron optical system.

**electron image tube** — 1. A cathode-ray tube having a photoemissive mosaic upon which an optical image is projected, and an electron gun to scan the mosaic and convert the optical image into corresponding electrical current. 2. A cathode-ray tube that increases the brightness or size of an image, or forms a visible image from invisible radiation. The focal plane for the optical image is a large, light-sensitive cold cathode. The emission from the cathode is first accelerated through a suitable lens system and then strikes a fluorescent screen, where an image is formed that is an enlarged and brightened reproduction of the original image.

**electron lens** — 1. The convergence of the electrons into a narrow beam in a cathode-ray tube by deflecting them electromagnetically or electrostatically. So called because its action is analogous to that of an optical lens. 2. A system of deflecting electrodes or coils designed to produce an electric field that influences a beam of electrons in the same manner in which a lens affects a light beam.

**electron metallurgy** — That branch of metallurgy that uses electron microscopic techniques in the examination of the nature of metals.

**electron micrograph** — A reproduction of an image formed by the action of an electron beam on a photographic emulsion.

**electron micrography** — The photographic recording of images produced by the electrons from an electron microscope. The electron beam carries the images through an array of lenses, and an enlarged electron image is used to stimulate a fluorescent screen that is photographed by a camera system.

**electron microradiography** — The photographic recording and later enlarging of very thin specimens, using an electron beam to form the image.

**electron microscope** — A device utilizing an electron beam for the observation and recording of submicroscopic samples with the aid of photographic emulsions or other short-wavelength sensors. Useful magnification is over 300,000.

**electron microscopy** — The study of materials by means of the electron microscope.

**electron mirror** — An electron instrument used to totally reflect an electron beam.

**electron multiplier** — A vacuum tube in which electrons liberated from a photosensitive cathode are attracted to a series of electrodes called dynodes. In doing so, each electron liberates others by secondary emission and thereby greatly increases the number of electrons flowing in the tube.

**electron-multiplier section** — A section of an electron tube in which an electron current is amplified by one or more successive dynode stages.

**electron optical system** — A combination of parts capable of producing and controlling a beam of electrons to produce an image of an object.

**electron optics** — 1. The branch of electronics concerned with the behavior of the electron beam under

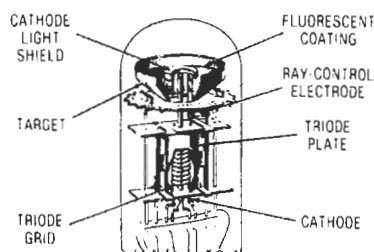
the influence of electrostatic and electromagnetic forces. 2. The control of free electron movement through the use of electric or magnetic fields, and use of the electron movement in research investigation of electronic diffraction phenomena, directly analogous to the control of light through use of lenses. 3. The area of science devoted to the directing and guiding of electron beams using electric fields in the same manner as lenses are used on light beams. 4. Pertaining to devices whose operation relies on modification of a material's refractive index by electric fields, for example, image-converter tubes and electron microscopes.

**electron-pair bond** — A valence bond formed by two electrons, one from each of two adjacent atoms.

**electron paramagnetic resonance** — A condition in which a paramagnetic solid subjected to two magnetic fields, one of which is fixed and the other normal to the first and varying at the resonance frequency, emits electromagnetic radiation associated with changes in the magnetic quantum number of the electrons.

**electron probe** — A narrow beam of electrons used to scan or illuminate an object or screen.

**electron-ray tube** — Also called a magic eye. 1. A tube that indicates visibly on a fluorescent target the effects of changes in control-grid voltage applied to the tube. Used as a tuning indicator in receivers. 2. A type of recording-level indicator using a luminous display in a special tube. The display is typically like an "eye" with a keyhole in the middle, and maximum recording level corresponds to the closing-up of a slot at the bottom of the keyhole (largely superseded by meters in current-model recorders).



Electron-ray tube.

**electron scanning** — 1. The moving of an electron beam back and forth and/or up and down by deflecting the beam electromagnetically or electrostatically. 2. A deflection of a beam of electrons, at regular intervals, across a CRT screen, according to a definite pattern.

**electron spectroscopy** — The theory and interpretation of spectra produced by the electron emissions of substances after their irradiation by X-rays.

**electron spin** — The twirling motion of an electron, independent of any orbital motion.

**electron-stream potential** — The time average of the difference in potential between a point in an electron stream and the electron-emitting surface.

**electron-stream transmission efficiency** — With respect to an electrode through which an electron stream passes, the ratio of the average stream current through the electrode to the stream current approaching the electrode. (In connection with multitransit tubes, the electron stream is considered to include only those electrons approaching the electrode for the first time.)

**electron telescope** — 1. An apparatus for seeing through haze and fog. An infrared image is formed

optically on the photoemissive mosaic of an electron-image tube and then made visible by the tube. 2. An instrument that serves to produce an enlarged electron image on a fluorescent screen by focusing an infrared image of a distant object on a photosensitive cathode.

**electron trajectory**—The path of an electron.

**electron transit time**—The time required for electrons to travel between two electrodes in a vacuum tube. This time is extremely important in tubes designed for ultrahigh frequencies.

**electron tubes**—Devices used to control the flow of electrons. They may be either gas filled or partially or fully evacuated (vacuum). Common tubes include vacuum tubes, cathode-ray tubes, phototubes, mercury vapor tubes, thyratrons, and microwave tubes.

**electron-tube static characteristic**—The relationship between two variables of an electron tube, such as the voltage and current of an electrode, with all other variables maintained constant.

**electron unit**—The unit of charge (negative or positive) equal to the charge on an electron.

**electron velocity**—The rate of motion of an electron.

**electronvolt**—Abbreviated ev or eV. The amount of kinetic energy gained by an electron when it is accelerated through an electric potential difference of 1 volt. It is equivalent to  $1.602189 \times 10^{-12}$  erg, or  $1.602189 \times 10^{-9}$  J. It is a unit of energy or work, not of voltage.

**electron-wave tube**—An electron tube in which streams of electrons having different velocities interact and cause a progressive change in signal modulation along their length.

**electro-oculography**—Recording and interpretation of the voltages that accompany eye movements. Eye-position voltages from electrodes placed on the skin near the eye are amplified and applied to a strip-chart recorder.

**electro-optical detector**—A device that detects radiation by utilizing the influence of light in forming an electrical signal. The detector may be a phototube; a photoconductive, photovoltaic, or photojunction cell; a phototransistor; or a thermal detector, such as a thermocouple or bolometer.

**electro-optical transistor**—A transistor capable of responding in nanoseconds to both light and electrical signals.

**electro-optic coefficient**—A measure of the extent to which the index of refraction changes with applied high electric fields, such as several parts per ten thousand for applied fields of the order of 20 volts per centimeter. Since the phase shift of a light wave is a function of the index of refraction of the medium in which it is propagating, the change in index can be used to phase modulate the light wave by shifting its phase at a particular point along the guide by changing the propagation time to the point.

**electro-optic effect**—The change in the index of refraction of a material when subjected to an electric field. The effect can be used to modulate a light beam in a material since many properties—such as light-conducting velocities, reflection and transmission coefficients at interfaces, acceptance angles, critical angles, and transmission modes—are dependent on the refractive indexes of the media in which the light travels.

**electro-optic material**—A material having refractive indexes that can be altered by an applied electric field.

**electro-optic modulator**—A device that uses an applied electric field to alter the polarization properties of light.

## electron trajectory — electrophoretic display

**electro-optic phase modulation**—Modulation of the phase of a light wave, such as by changing the index of refraction and thus the velocity of propagation and hence the phase at a point in the medium in which the wave is propagating, in accordance with an applied field serving as the modulating signal.

**electro-optic radar**—A radar system in which electro-optic instead of microwave techniques and equipment are used to perform the acquisition and tracking operation.

**electro-optics**—The study of the effects of electric fields on optical phenomena.

**electro-optic shutter**—A device used to control or block a light beam by means of the Kerr electro-optical effect.

**electropad**—The part of an electrocardiograph body electrode that makes contact with the skin.

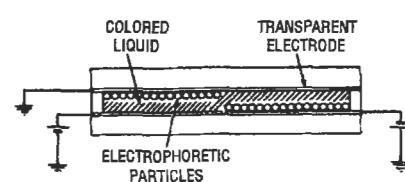
**electrophonic effect**—The sensation of hearing produced when an alternating current of suitable frequency and magnitude from an external source is passed through an animal or human body.

**electrophoresis**—1. The movement of particles or ions in solution caused by applying an electric field, as reported by O. Lodge in 1886. 2. The migration of colloidal particles under the influence of an applied electrical field. A colloidal particle, such as a protein molecule, has large numbers of positive and negative radicals that act as if they were on the surface. Thus, since protein molecules carry electric charges, they will migrate when subjected to an electric field. The fractional nature of the net charge makes possible a wide variety of electrophoretic patterns at a given pH. 3. The migration of molecules under the influence of an electric field. 4. The migration of dispersed solid, liquid, or gaseous material to one of two electrodes under the influence of an impressed direct-current voltage. 5. The motivation of particles or ions, suspended in a solution, toward the electrode having the opposite sign, due to the application of an electrical field.

**electrophoresis apparatus**—An apparatus for causing migration of charged particles (ions) in solution in an electric field. Types include paper, cascading electrodes, high voltage, gel, and thin layer.

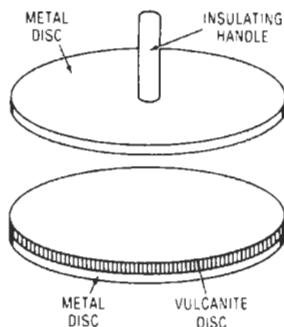
**electrophoresis scanner**—An instrument for reading bands on paper strips or gel, for the purpose of measuring particle movement due to electrophoresis.

**electrophoretic display**—1. A reflective display that offers a wide choice of colors and has a short-to-medium-term memory that consumes no power. The heart of the display is a suspension of charge pigment particles in a liquid of another color. The suspension, a layer typically 50 micrometers thick, is sandwiched between a pair of electrodes, one of which is transparent. When direct current of the right polarity is applied to the electrodes, the particles are pulled toward the transparent electrode, thus displacing the contrasting liquid and showing their own coloration. When the polarity is reversed, they move to the other electrode and are hidden by the liquid. 2. The movement of suspended particles through a fluid by an electromotive force.



*Electrophoretic display.*

**electrophorus**—1. An early type of static-electricity generator. 2. Simple piece of apparatus used in the laboratory to obtain a number of charges of static electricity from a single initial charge. Typically, it consists of a thick ebonite disc held in a brass sole, and a brass disc with insulated handle. The ebonite disc is charged by rubbing with fur, and the metal disc is brought near and allowed to pick up an induced charge that can be lifted and conveyed where required. 3. A device in which the electric field of an object that has been electrified by friction is used to induce charges in conductors.



*Electrophorus.*

**electrophotograph**—The image formed in electrophotography.

**electrophotographic process**—The process in which images are formed by various electrical and photographic means. Examples are processes employing selenium-coated drums or zinc-oxide-coated paper.

**electrophotography**—1. A term referring to a photographic process in which electrical energy is used to make materials sensitive to light. 2. The photographic recording of an image formed by the alteration in electrical properties of the sensitive materials, induced by the action of light.

**electrophotometer**—An instrument using a photoelectric sensor for colorimetric determinations.

**electrophysiology**—The science of physiology as related to electric reactions of the body.

**electroplaques**—Individual electricity-producing cells in eels and other electric fishes connected in series-parallel arrays, like miniature elements of a battery. They are usually thin waferlike cells, the two surfaces of which differ markedly.

**electroplate**—1. To deposit a metal on the surface of certain materials by means of electrolysis. 2. To effect the transfer of one metal to another by means of electrolysis. 3. To apply a metallic coating on a conductive surface by means of electrolytic action.

**electroplating**—The electrodeposition of an adherent metal coating on a conductive object for protection, decoration, or other purposes, such as securing a surface with properties or dimensions different from those of the basis metal. The object to be plated is placed in an electrolyte and connected to one terminal of a dc voltage source. The metal to be deposited is similarly immersed and connected to the other terminal. Ions of the metal provide transfer to the metal as they make up the current between the electrodes. *See also* electroforming.

**electropolishing**—1. The process of producing a smooth, lustrous surface on a metal by making it the anode in an electrolytic solution and preferentially dissolving

the minute protuberances. 2. The improvement in surface finish of a metal effected by making it anodic in an appropriate solution.

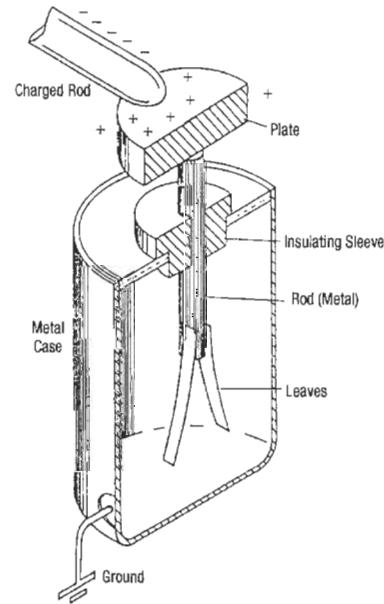
**electropositive developer**—A developer containing positively charged toner particles.

**electrorefining**—1. The removal of impurities from a metal by electrolysis. 2. The process of anodically dissolving a metal from an impure anode and depositing it cathodically in a purer form.

**electroretinograph**—An instrument for measuring the electrical response of the human retina to light stimulation.

**electroretinography**—Recording and interpretation of the voltage generated by the retina of the eye. An electrode fitted to a plastic contact lens is used to pick up voltage from the surface of the eyeball.

**electroscope**—An electrostatic instrument for measuring a potential difference or an electric charge by means of the mechanical force exerted between electrically charged surfaces.



*Electroscope.*

**electrosection**—A surgical cutting technique that makes use of a radio-frequency arc.

**electrosensitive paper**—A paper that turns blue, brown, or black wherever a direct current passes through it. Used with facsimile and high-speed printers.

**electrosensitive processor**—A facsimile printing process whereby imaging is based on a two-layer paper composed of a white titanium oxide coating and dark underlayer. The paper (which may be sheet or roll fed) is imaged via contact with an electric stylus; as the charged wire touches the paper, the white coating is burned off, line by line, to correspond to the dark image areas of the original.

**electrosensitive recording**—1. The passage of electric current into a sheet of sensitive paper to produce a permanent record. 2. A technique that uses the passage of an electric current through a recording medium to produce a permanent image on that medium.

**electroshock**—A state of shock produced by passing an electric current through the brain. It is useful in the treatment of certain mental disorders.

**electroshock therapy**—Treatment of certain mental disorders by passing an electric current through the brain.

**electrospinograph**—A device for detecting and recording electric signals of the spinal cord.

**electrostatic**—1. Pertaining to static electricity—that is, electricity, or an electric charge, at rest. A constant-intensity electric charge. 2. Applied to speakers and microphones (capacitance type). An electrostatic force is used to activate the diaphragm. The charged diaphragm is suspended between two perforated plates. As an ac signal is applied to the outer plates, the diaphragm vibrates. 3. A form of electrical energy that has the capability of attracting and holding small particles having an opposite electrical charge. 4. A headphone drive system using a thin plastic membrane in a high-voltage electrostatic field, whose variation by the signal voltage moves the entire diaphragm to create a sound pressure wave. 5. The effects produced by electrical charges or fields, alone, without interaction with magnetic influence.

**electrostatic actuator**—An apparatus comprising an auxiliary external electrode that permits known electrostatic forces to be applied to the diaphragm of a microphone for the purpose of obtaining a primary calibration.

**electrostatic capacitor**—Two conducting electrodes separated by an insulating material such as air, ceramic, mica, gas, paper, plastic film, or glass. These are generally high-impedance devices.

**electrostatic charge**—1. An electric charge stored in a capacitor or on the surface of an insulated object. 2. The algebraic sum of all positive and negative electric charges present in a specific volume or surface element. 3. An electric charge that is in a state of equilibrium.

**electrostatic charge mobility**—The property of a barrier material that facilitates or impedes the movement of electrostatic charges internally or on the surface.

**electrostatic coating**—Process in which the coating material is electrically charged as it leaves the spray gun and is attracted to the part, which has an opposite charge.

**electrostatic component**—The portion of radiation due to electrostatic fields.

**electrostatic-convergence principle**—The principle of electron-beam convergence through use of an electrostatic field.

**electrostatic copier**—A type of copier that employs the principles of photoconductivity and electrostatic attraction.

**electrostatic coupling**—Method of coupling by which charges on one surface influence those on another through capacitive action.

## electroshock — electrostatic latent image

**electrostatic deflection**—1. In a cathode-ray tube, the deflection of the electron beam by means of pairs of charged electrodes on opposite sides of the beam. The electron beam is bent toward a positive electrode and bent away from a negative electrode. 2. The deflection of an electron beam by the action of an electrostatic field that has a component perpendicular to the direction of the beam.

**electrostatic discharge**—See ESD.

**electrostatic electrography**—That branch of electrostatalography which produces a visible record by employing an insulating medium to form latent electrostatic images with the aid of electromagnetic radiation.

**electrostatic electrophotography**—That branch of electrostatalography which produces a visible record by employing a photoresponsive medium to form latent electrostatic images with the aid of electromagnetic radiation.

**electrostatic energy**—The energy contained in electricity at rest, such as in the charge of a capacitor.

**electrostatic field**—The vector force field set up in the vicinity of nonmoving electrical charges. The strength of this static field at a point is defined as the force per unit charge on a stationary positive test charge, provided the test charge is so small that it does not disturb the original charge distribution.

**electrostatic flux**—The electrostatic lines of force existing between bodies at different potentials.

**electrostatic focusing**—1. The focusing of an electron beam by the action of an electric field. 2. A method of focusing the cathode-ray beam to a fine spot by application of electrostatic potentials to one or more elements of an electron lens system.

**electrostatic galvanometer**—Galvanometer operated by the effects of two electric charges on each other.

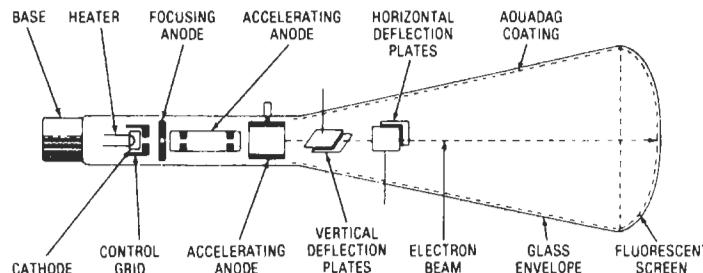
**electrostatic generator**—A device for the production of electric charges by electrostatic action.

**electrostatic headphones**—A device held against the ear that reproduces incoming electrical signals as sound. It relies on changes in electrical charge across a diaphragm stretched between two perforated, polarized plates. All parts of the diaphragm experience equal force, and the sound is inherently more linear.

**electrostatic induction**—1. The process of inducing stationary electric charges on an object by bringing it near another object that has an excess of electric charges. A positive charge will induce a negative charge, and vice versa. 2. Capacitive induction of interfering signals over an air gap separating an instrument (e.g., from its wiring or housing).

**electrostatic instrument**—An instrument that depends for its operation on the attraction and repulsion between electrically charged bodies.

**electrostatic latent image**—In an electrostatic copier, the invisible image formed on the zinc-oxide-coated paper by the action of light.



Electrostatic deflection.

**electrostatic lens**—A lens producing a potential field capable of deflecting electron rays to form an image of an object.

**electrostatic loudspeaker**—Loudspeaker in which the mechanical forces are produced by the action of electrostatic fields.

**electrostatic memory**—Also called electrostatic storage. A memory device in which information is retained by an electrostatic charge. A special type of cathode-ray tube is usually employed, together with associated circuitry.

**electrostatic memory tube**—Also called storage tube. An electron tube in which information is retained by electric charges.

**electrostatic meter**—A meter with a movement consisting of fixed and movable metal plates interleaved to form a capacitor. Rotation of the movable plates is proportional to the dc or ac voltage applied across the capacitor.

**electrostatic microphone**—Also called capacitor microphone or condenser microphone. 1. A microphone that contains a metal plate and a thin metal diaphragm set close together. The capacitance of the microphone is thus affected by movement of the diaphragm from air pressure waves. A polarizing voltage is applied to the plates. 2. A microphone whose transduction principle is based on the varying electrical charge across a sound-modulated capacitor. 3. A microphone whose capacitance varies with sound pressure; electronic circuits within the microphone convert this change in capacitance to a varying voltage signal. Electrostatic microphones, unlike other types, require a battery or other voltage source. 4. A type of microphone characterized by its wide frequency range and low distortion. Used for precision measurements and high-quality recording. Can be omnidirectional or cardioid.

**electrostatic potential**—The voltage that can be measured between any two objects that have different static charges.

**electrostatic precipitation**—The process of removing smoke, dust, and other particles from the air by charging them so that they can be attracted to and collected by a properly polarized electrode.

**electrostatic printer**—1. A nonimpact printing technique that forms a copy by attracting toner particles to a static charge on the surface of a photoconductor, then transferring the toner image to the surface of a sheet of copy paper. The image is formed by a laser that develops an electrostatic image charge on the photoconductor according to information being supplied through the input data stream. Each bit of data can be related to a character shape in the memory of the printing system; in most cases, characters are formed by a dot-matrix method similar in concept to that of the matrix printer. Paper is sheet or roll fed. 2. A nonimpact printer that prints dot-matrix characters one at a time by means of wires or pins that supply an electrical charge in the desired patterns onto an aluminum-coated paper; particles of dry ink adhere to the magnetized areas and are then fixed by heat.

**electrostatic process**—1. A reproduction method in which image formation depends on electrical rather than chemical changes induced by light. 2. A nonchemical, nonimpact imaging process in which a light source, corresponding to the image to be formed, discharges a charged dielectric photoconductive surface to form a latent image. This surface (a photoconductor) containing the latent image is then dusted with dielectric toner powder, which adheres to the charged areas, rendering the image visible.

**electrostatic recording**—Recording by means of a signal-controlled electrostatic field.

**electrostatic relay**—A relay in which two or more conductors that are separated by insulating material move because of the mutual attraction or repulsion produced by electric charges applied to the conductors.

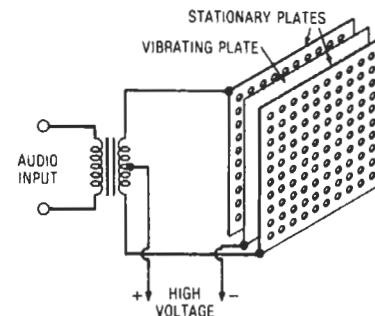
**electrostatics**—The branch of physics concerned with electricity at rest.

**electrostatic separator**—An apparatus in which a finely pulverized mixture of the materials to be separated is passed through the powerful electrostatic field between two electrodes.

**electrostatic series**—See triboelectric series.

**electrostatic shield**—1. A shield that prevents electrostatic coupling between circuits, but permits electromagnetic coupling. 2. A metallic enclosure or screen placed around a device so it will not be affected by external electric fields.

**electrostatic speaker**—Also called capacitor or condenser speaker. A speaker in which the mechanical forces are produced by the action of electrostatic fields.



Electrostatic speaker.

**electrostatic spraying**—A technique of spraying wherein the material being sprayed is given a high electrical charge, while the test piece is grounded.

**electrostatic storage**—1. The storage of changeable information in the form of charged or uncharged areas, usually on the screen of a cathode-ray tube. 2. Information storage on a dielectric medium that represents the data as those spots on the medium having electrostatic charges, forming an observable record of the data.

**electrostatic transducer**—A transducer that consists of a capacitor, at least one plate of which can be set into vibration. Its operation depends on the interaction between its electric field and a change in its electrostatic capacity.

**electrostatic tweeter**—A speaker with a movable flat metal diaphragm and a nonmovable metal electrode capable of reproducing high audio frequencies. The diaphragm is driven by the varying high voltages applied across it and the electrode.

**electrostatic unit**—An electric unit based primarily on the dynamic interaction of electric charges. Defined as a charge that, if concentrated on a small sphere, would repel with a force of 1 dyne a similar charge 1 centimeter away in a vacuum.

**electrostatic voltmeter**—A voltmeter depending for its action on electrostatic forces. Its scale is usually graduated in volts or kilovolts.

**electrostatalography**—The process of recording and reproducing visible patterns by the formation and utilization of latent electrostatic charge patterns.

**electrostriction**—1. A mechanical deformation caused by the application of an electric field to any dielectric material. The deformation is proportional to the square of the applied field. This phenomenon results from the induced dipole movement caused by the applied field, resulting in the mechanical distortion. 2. Elastic deformation of a dielectric caused by volume force when the dielectric is placed in an inhomogeneous electric field.

**electrostrictive effect**—The elastic deformation of a dielectric by an electrostatic field.

**electrostrictive relay**—A relay whose operation is produced by an electrostrictive dielectric actuator.

**electrosurgery**—The surgical use of electricity in such applications as dissection, coagulation, laser heating, laser welding, diathermy, desiccation of tumors, and hemostasis.

**electrosurgical unit**—An rf generator whose output is applied to a blade or wire loop used instead of a conventional scalpel for surgical incision or excision.

**electrotape**—An electronic distance-measuring device.

**electrotherapeutics**—See electrotherapy.

**electrotherapy**—Also known as electrotherapeutics. 1. The medical science or use of electricity to treat a disease or ailment. 2. Applying electric current to the body for massage or heat treatment.

**electrotherapy apparatus**—Equipment for applying electric current to the body for massage or heat treatment.

**electrothermal**—The heating effect of electric current, or the electric current produced by heat.

**electrothermal expansion element**—An actuating element consisting of a wire strip or other shape and having a high coefficient of thermal expansion.

**electrothermal recorder**—A recorder in which heat produces the image on the recording medium in response to the received signals.

**electrothermal recording**—See electrothermal recorder.

**electrothermic instrument**—An instrument that depends for its operation on the heating effect of a current. Examples are the thermocouple and bolometric, hot-wire, and hot-strip instruments.

**electrothermics**—The branch of science concerned with the direct transformation of electric energy into heat.

**electrotinning**—Electroplating tin on an object.

**electrotyping**—The production of printing plates by electroforming.

**electrowinning**—The process by which metals are recovered from a solution by electrolysis.

**element**—1. One of the 104 known chemical substances that cannot be divided into simpler substances by chemical means. A substance whose atoms all have the same atomic number (e.g., hydrogen, lead, uranium). 2. In a computer, the portion or subassembly that constitutes the means of accomplishing one particular function, such as the arithmetic element. 3. Any electrical device (such as an inductor, resistor, capacitor, generator, line, or electron tube) with terminals at which it may be connected directly to other electrical devices. 4. The dot or dash of an International Morse character. 5. A radiator, either active or parasitic, that is part of an antenna. 6. The smallest portion of a televised picture that still retains the characteristics of the picture. 7. A portion of a part that cannot be renewed without destruction of the part. 8. A part of an integrated circuit that contributes directly to its electrical characteristics. An active element exhibits gain, such as a transistor; a passive element does not have gain, such as a resistor or capacitor. 9. Lowest level design entity having an identifiable logical, electrical, or mechanical function.

**elemental area**—See picture element.

**elemental semiconductor**—A semiconductor containing only one element in the undoped state.

**elementary charge**—A natural unit or quantum into which both positive and negative charges appear to be subdivided. It is the charge on a single electron and has a value of about  $4.8037 \times 10^{-10}$  electrostatic units.

**element error rate**—The ratio of the number of elements incorrectly received to the total number of elements sent.

**elevation**—The angular position perpendicular to the earth's surface.

**elevation-position indicator**—A radar display that simultaneously shows angular elevation and slant range of detected objects.

**elevator leveling control**—A positioning control used to align the platform of an elevator with the floor level of the building. Metal vanes are mounted in the elevator shaft at each floor level, and an oscillator is mounted on the elevator car. When the elevator is properly leveled, the metal vane is between the plate and the grid coils of the oscillator. A relay connected in the oscillator circuit now energizes. The contacts of this relay are connected in the motor-control circuit of the elevator so that the elevator stops in alignment with the floor level.

**ELF**—Abbreviation for extremely low frequency.

**eliminator**—Also called a battery eliminator. A device operated from an ac or dc power line and used for supplying direct current and voltage to a battery-operated circuit.

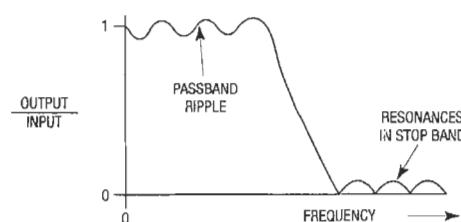
**E-lines**—Contour lines of constant electrostatic field strength with respect to some reference base.

**elliptically polarized wave**—An electromagnetic wave whose electric intensity vector describes an ellipse at one point.

**elliptical polarization**—Polarization in which the wave vector rotates in an elliptical orbit about a point.

**elliptical stylus**—A stylus whose cross section, as seen from above, is an ellipse placed across the record groove. Elliptical styli can more readily trace the finer high-frequency modulations of the groove than can spherical styli. Such styli have two radii (e.g., 0.4 × 0.7 mil). See biradial stylus.

**elliptic function**—A mathematical function employed in obtaining the squarest possible amplitude response, or the sharpest passband magnitude rolloff, of a filter with a given number of circuit elements. The elliptic function has a Tchebychev response in both the passband and the stopband. The phase response and transient response of an elliptic-function filter are poorer than for any of the classical transfer functions.



Elliptic-function filter passband.

**elongation**—Extension of the envelope of a signal as a result of the delayed arrival of certain of the multipath components.

**e/m**—The ratio of the electric charge to the mass for particles such as electrons and positive rays. For slow-moving electrons, the value of  $e/m$  is  $1.7588 \times 10^4$  coulombs per gram. The value decreases with increasing velocity, however, because of an increase in effective mass.

**e-mail**—Abbreviation for electronic mail. 1. Messages, usually text, sent from one person to another via computer. E-mail can also be sent automatically to a large number of addresses (mailing list). 2. A system for transmitting messages from one computer terminal to another, where it can be displayed at the receiver's convenience.

**embedded code**—Machine instructions for checking copy protection that are interspersed with code for other purposes.

**embedded software**—Computer code that is not visible to the end user.

**embedded system**—A system into which one or more computing devices (which may be microprocessors or microcontrollers) are incorporated in such a way that the embedded device or devices are not directly accessible to the user of the system.

**embedding**—A general term for all methods of surrounding or enclosing components and assemblies with a substantial thickness of electrically insulating solid or foam material that substantially fills the voids or interstices between parts.

**embedding**—The complete encasement of a part or assembly to some uniform external shape. A relatively large volume of a complete package consists of the embedding material.

**embossed-foil printed circuits**—A printed circuit formed by indenting the desired pattern of metal foil into an insulating base and then mechanically removing the remaining unwanted raised portion.

**embossed-groove recording**—A method of recording sounds on discs or film strips by embossing sound grooves with a blunt stylus rather than by cutting into them with a sharp stylus. Embossing throws the material up in furrows on each side of the sound groove without actually removing any of the material in the disc or strip.



*Embossed-groove recording.*

**embossing stylus**—A recording stylus with a rounded tip that forms a groove in the recording medium by merely displacing the material instead of removing it completely.

**EMC**—Abbreviation for electromagnetic compatibility.

**emergency communication**—The transmission or reception of distress, alarm, urgent, or safety signals or messages relating to the safety of life or property, or the occasional operation of equipment to determine whether it is in working condition.

**emergency radio channel**—Any radio frequency reserved for emergency use, particularly for distress signals.

**emergency receiver**—Receiver immediately available in a station for emergency communication and capable of being energized solely by a self-contained or emergency power supply.

**emergency service**—The radiocommunication service carrier used for emergency purposes.

**emf**—Abbreviation for electromotive force.

**EMG**—Abbreviation for electromyography.

**EMI**—Abbreviation for electromagnetic interference.

**emission**—1. The waves radiated into space by a transmitter. 2. The ejection of electrons from the surface of a material (under the influence of heat, for example).

**emission characteristic**—The relationship between the emission and the factor controlling it, such as temperature, voltage, or current of the filament or heater. This relationship is usually shown on a graph.

**emission current**—The current produced in the plate circuit of a tube when all the electrons emitted by the cathode pass to the plate.

**emission efficiency**—The rating of a hot cathode. Expressed in milliamperes per watt.

**emission power**—The time rate at which radiant energy is given off in all directions per unit surface area of a radiating body at a given temperature.

**emission spectrum**—1. The spectrum showing the radiation emitted by a substance, such as the light emitted by a metal when placed in an electric arc, or the light emitted by an incandescent filament. 2. The spectrum formed by radiation from an emitting source, in contrast to absorption spectra.

**emission types**—The classification of modes of radio transmission adopted by international agreement. The AM designations are as follows:

Type A0: Unmodulated continuous-wave transmission

Type A1: Telegraphy or pure continuous waves

Type A2: Modulated telephony

Type A3: Telephony

Type A4: Facsimile

Type A5: Television

**emission-type tube tester**—Also called an English-reading tube tester. A tube tester for checking the electron emission from the filament or cathode. The indicating meter is generally calibrated to read "good" or "bad." The tester connects all elements, such as the plate and screen, suppressor, and control grids, together and uses them as an anode.

**emission velocity**—The initial velocity at which electrons emerge from the surface of a cathode, ranging from zero up to a few volts (attained by very few electrons). This effect accounts for the existence of virtual cathodes and also for the shape of the cutoff region of plate current.

**emissive power**—The emissivity of a body times the emissive power of a blackbody at the same temperature. For a blackbody, it is the total radiation per unit area of radiating surface.

**emissivity**—1. The ratio of the radiant energy emitted by a radiation source to the radiant energy of a perfect (blackbody) radiator having the same area and at the same temperature and conditions. 2. The percentage of infrared energy emitted from a surface for a given temperature compared with the total energy it should emit for that temperature. Instead of percentage, emissivity ( $E$ ) is expressed in terms of unity. A perfect blackbody has an  $E = 1.0$ . When the surface has less than 100-percent radiating efficiency, the difference between the  $E$  of the surface and 1.0 represents the approximate reflectivity of the surface. Reflectance varies inversely with emissivity. This allows surrounding ambient surfaces to add to or subtract from the temperature.

**emiton** — A cathode-ray tube developed in England by J. H. Hixenweaver in 1955.

**emiton camera** — A British television camera tube resembling an iconoscope.

**emittance** — The power per unit area radiated by a source of energy.

**emitter** — Also called source. 1. One of the three regions that form a bipolar transistor. Under forward bias of the emitter-base pn junction, the emitter injects minority carriers (electrons or holes) into the base region, where they either recombine or diffuse into the collector. The flow of minority carriers from the emitter to the collector is controlled by the base-emitter pn junction, thereby giving rise to signal amplification. 2. An electrode within a transistor from which carriers are usually minority carriers; when they are majority carriers, the emitter is referred to as a majority emitter. 3. In fiber optics, the source of optical power. *See* coherent emitter; incoherent emitter.

**emitter-base and collector-base junction** — In a semiconductor, the region where the base and collector and the emitter and base meet. These junctions are defined on the surface of the chip as an oxide step.

**emitter bias** — The bias voltage applied to the emitter of a transistor.

**emitter-coupled logic** — *See* ECL.

**emitter current** — The direct current flowing in the emitter circuit of a transistor.

**emitter cutoff frequency** — That frequency at which the  $\beta$  of a transistor is down 3 dB from the low-frequency value.

**emitter depletion-layer capacitance** — The part of the capacitance across an emitter-base junction of a semiconductor that is associated with its depletion layer. The emitter depletion-layer capacitance is a function of the total potential drop across the depletion layer.

**emitter follower** — A transistor amplifier circuit configuration analogous to a vacuum-tube follower. The circuit is characterized by relatively high input impedance, low output impedance, and a voltage gain of less than unity.

**emitter junction** — 1. A semiconductor junction normally biased in the low-resistance direction so that minority carriers are injected into the interelectrode region. 2. A junction between the base and emitter regions of a semiconductor normally biased in the forward direction, and through which the charge carriers flow from a region in which they are majority carriers to one in which they are minority carriers.

**emitter region** — That part of a transistor lying between the emitter junction and the emitter electrode from which carriers flow across the emitter junction.

**emitter resistance** — The resistance in series with the emitter lead in the common-T equivalent circuit of a transistor.

**emitter semiconductor** — A junction normally biased in the low-resistance direction to inject minority carriers into an interelectrode region.

**emitter series resistance** — The resistance between the emitter terminal of a semiconductor and the internal inaccessible emitter point in an equivalent circuit.

**emitter terminal** — The specified externally available point of connection to the emitter region.

**emitter voltage** — The voltage between the emitter terminal and a reference point.

**EMP** — Abbreviation for electromagnetic pulse.

**emphasizer** — A circuit or device that provides an intentional increase in signal strength at certain audio frequencies.

**empire cloth** — A cotton or linen cloth coated with varnish and used as insulation on coils and other parts of electrical equipment.

**empirical** — 1. Based on actual measurement, observation, or experience, as opposed to theoretical determination. 2. Based solely on experiment or observation, rather than on scientific theory. 3. Pertaining to a statement or formula based on experience or observation rather than on deduction or theory.

**EMR** — Abbreviation for electromagnetic radiation.

**emu** — Abbreviation for electromagnetic unit.

**emulate** — 1. To imitate one system with another, such that the imitating system accepts the same data, executes the same programs, and achieves the same results as the imitated system. 2. To imitate a computer system by a combination of hardware and software that allows programs written for one computer to be run on another. *See* simulate.

**emulation** — 1. The imitation of all or part of one device, terminal, or computer by another, so that the emulating device accepts the same data, performs the same functions, and appears to other network devices as if it were the emulated device. 2. The imitation of a computer system, performed by a combination of hardware and software, that allows programs to run between incompatible systems. 3. For PCs, the process of imitating the behavior of one operating system using a completely different operating system. 4. The generation of one system's code set by another so that the two may communicate. For example, a system with TTY emulation appears like a Teletype system when communicating with another Teletype. 5. The use of hardware or software to generate in real time the expected correct output responses for comparison to the device under test. 6. A hardware model of the target microprocessor used to check out the target system. This can be either the same microprocessor model as used in a target system, or bit-slice architecture that mimics the target microprocessor's function. Using the target microprocessor is called substitutional emulation or in-circuit emulation. *See also* in-circuit emulation.

**emulator** — 1. A device that is capable of operating in such a manner that it appears to have all of the characteristics of another device. For example, a hardware and software combination that enables one computer to execute programs written for another computer, or a device that produces the same set of outputs for a given set of inputs as does another device. 2. The combination of programming techniques and special machine features that permit a given computing system to execute programs written for another system. 3. A program or a hardware device that duplicates the instruction set of one computer on a different computer, allowing program development for the emulated computer without that computer being available.

**emulsion** — A suspension of finely divided photosensitive chemicals in a viscous medium, used in semiconductor processing for coating glass masks.

**enable** — To permit a circuit to be activated by the removal of a suppression signal.

**enabling gate** — A circuit that determines the start and length of a generated pulse.

**enabling pulse** — 1. A pulse that opens a normally closed electric gate, or otherwise permits occurrence of an operation for which it is a necessary but not sufficient condition. 2. A pulse that prepares a circuit for some subsequent action.

**enameled wire** — Wire coated with a layer of baked-enamel insulation.

**encapsulant** — A material, usually epoxy, used to encase and seal all components in an electronic circuit.

**encapsulate**—To embed electronic components or other entities in a protective coating, usually done when the plastic encapsulant is in fluid state so that it will set in solid form as an envelope around the work.

**encapsulated relay**—A relay embedded in a suitable potting compound.

**encapsulating**—1. Coating by dipping, brushing, spreading, or spraying an electronic component or assembly. An encapsulated unit usually retains its original geometry. 2. Enclosing an article in an envelope of plastic by immersing the object in a casting resin and allowing the resin to polymerize or, if hot, cool.

**encapsulating material**—A composition primarily adapted for use on or around an electrical device to provide protection from the surrounding environment.

**encapsulation**—1. A protective coating of cured plastic placed around delicate electronic components and assemblies. It is similar to potting, except the cured plastic is removed from the mold. The plastic therefore determines the color and surface hardness of the finished part. The molds may be made of any suitable material. 2. An embedding process using removable molds or other techniques in which the insulating material forms the outer surfaces of the finished unit. 3. The process of either (a) applying a conformal coating by dipping an object in a high viscosity or thixotropic material, or (b) using containment and a low viscosity material to provide a relatively thin protective encasement (50 to 100 mils or 1.27 to 2.54 mm) to a part or assembly.

**encased control**—A self-contained motor speed/torque control completely housed in an enclosure. Switching, indicating, and adjusting devices are provided on the outside of the enclosure. Unit portability, safety, and component protection are leading assets of this design.

**encipher**—To convert a message from ordinary language into a secret form. *See also encode*

**enciphered facsimile communications**—Communications in which security is provided by mixing pulses from a key generator with the output of a facsimile converter. Plain text is recovered at the receiving terminal by subtracting identical key pulses. Unauthorized persons are unable to reconstruct the plain text unless they have an identical key generator and they know the daily key setting.

**enclosed relay**—A relay in which both the coil and the contacts are protected from the environment.

**enclosed switch**—Switch having internal parts protected by a housing. The enclosed switch can be dust proof, moisture proof, oil or contamination proof, or hermetically sealed.

**enclosure**—1. An acoustically designed housing or structure for a loudspeaker; also any cabinet for a component, electrical, or electronic device. 2. A surrounding case designed to provide a degree of protection for equipment against a specified environment and to protect personnel against accidental contact with the enclosed equipment.

**encode**—Also called encipher. 1. To use a code, frequently one composed of binary numbers, to represent individual characters or groups of characters in a message. 2. To change from one digital code to another. If the codes are greatly different, the process usually is called conversion. 3. To substitute letters, numbers, or characters, usually with the intention of hiding the meaning of the message except from persons who know the encoding scheme. 4. The process of converting an event such as a switch closure into a form suitable for transmission over a communication channel.

**encoder**—1. A device used to electronically alter a signal so that it can only be viewed on a receiver

equipped with a special decoder. 2. Any device that modifies information into the desired pattern or form for a specific method of transmission. 3. An electromechanical device that can be attached to a shaft to produce a series of pulses to indicate shaft position; when the output is differentiated, the device is an accurate tachometer. (It is fundamentally oriented to digital rather than analog techniques.) An encoder contains a disc with a printed pattern; as the disc rotates, it makes and breaks a circuit. The more make-and-break cycles per revolution, the better the resolution. 4. A digital-to-analog converter. 5. Circuitry in a quadraphonic sound system that, by matrixing in the recording process, turns four signals into two for inscribing, stereo style, on each wall of the record groove. 6. Electromechanical device that transforms analog motion into digital electrical signals. The outputs are incrementally constant for uniform motion characterized by a staircase function, where the output remains constant for a small range of input values. 7. A digital device for converting an input digital signal into its equivalent binary code. *See also code converter.*

**encoder accuracy**—The maximum positional difference between the input to an encoder and the position indicated by its output; includes both deviation from theoretical code transition positions and quantizing uncertainty caused by converting from a scale having an infinite number of points to a digital representation containing a finite number of points.

**encoding**—1. Translation of information from an analog or other easily recognized form to a coded form without a significant loss of information. 2. The process of converting an event such as a switch closure into a form suitable for transmission over a communication channel. 3. The scrambling of a signal to prevent viewing of a program by nonsubscribers.

**encryption**—1. A change made to data, code, or a file such that it can no longer be read or accessed without processing (or unencrypting). 2. The technique of modifying a known bit stream on a transmission line to make it appear like a random sequence of bits to an unauthorized observer.

**end-around carry**—A computer operation in which the carried information from the left-most bit is added to the results of the right-most addition. It is used for ones complement and nines complement arithmetic.

**end-around shift**—In a computer, the movement of characters from one end of the register to the other end of the same register.

**end bell**—An accessory that is similar to a cable clamp and attaches to the back of a plug or receptacle. It serves as an adapter for the rear of connectors. Some angular end bells have built-in cable clamps. Angular end bells up to 90° are available. *See also end shield.*

**end bracket**—*See end shield.*

**end-cell rectifier**—A small trickle-charge rectifier for maintaining the voltage of storage-battery end cells.

**end cells**—Cells that can be switched in series with a storage battery to maintain the output voltage of the battery when it is not being charged.

**end central office**—The local central telephone office that interconnects customer lines and trunks. It is designated a Class 5 office in the DDD or intertoll network.

**end distortion**—A shifting of the ends of all marking pulses of start-stop teletypewriter signals from their proper positions relative to the beginning of the start pulse.

**end effect**—The capacitive effect at the ends of a half-wave antenna. To compensate for this effect, a dipole is cut slightly shorter than a half wave.

**end effector — energy conversion devices**

**end effector** — Terminal on a robot arm that carries a hand, welding gun, painting nozzle, or other tool.

**end finish** — Surface condition at the optical conductor face.

**end-fire array** — A linear or cylindrical antenna having its direction of maximum radiation parallel to the long axis of the array.

**end instrument** — A device connected to one terminal of a loop and capable of converting usable intelligence into electrical signals or vice versa. Includes all generating, signal-converting, and loop-terminating devices at the transmitting and/or receiving location.

**endless loop recorder** — A dictation system in which a nonremovable magnetic tape is sealed in a tank and the tape runs in a continuous loop.

**end mark** — In a computer, a code or signal used to indicate the termination of a unit of information.

**endocardiac electrodes** — See implantable pacemaker.

**endodyne reception** — A British term applying to reception of unmodulated code signals. A vacuum-tube circuit having a local oscillator whose frequency is slightly different from that of the carrier signal. Thus, a beat signal in the audio range is produced.

**end-of-block signal** — A symbol or indicator that defines the end of a block of data.

**end of file** — Abbreviated EOF. A code placed by a program after the last byte of a file to tell the computer's operating system that no additional data follows.

**end-of-file mark** — In a computer, a code instruction indicating that the last record of a file has been read.

**end of message** — The end of data to be transmitted. It can be indicated by a special control code, as in the ASCII code set; by an absence of data for a specified time interval; or by a particular sequence of block gaps and data, as is done on magnetic tape.

**end of tape** — The point on a computer tape at which the system or operator is given a warning that the physical end of the tape is approaching. It is approximately 25 feet (7.62 m) from the actual end of the tape on  $\frac{1}{2}$ -inch (12.7-mm) computer tape and approximately 50 feet (15.24 m) from the halt marker on  $\frac{1}{4}$ -inch (6.35-mm) tape.

**end-of-tape marker** — A marker placed on a magnetic tape to indicate the end of the permissible recording area. It may be a photoreflective strip, a transparent section of tape, or a particular bit pattern.

**end-of-transmission card** — Last card of each message; used to signal the end of a transmission. Contains the same information as the header card, plus additional data for traffic analysis.

**endogenous variable** — A variable whose value is determined by relationships included within the model. See also exogenous variable.

**end-on armature** — Of a relay, an armature that moves in the direction of the core axis, with the pole face at the end of the core and perpendicular to this axis.

**end-on directional antenna** — A directional antenna that radiates chiefly toward the line on which the antenna elements are arranged.

**endoradiograph** — Equipment for X-ray examination of internal organs and cavities by means of radiopaque materials.

**endoradiosonde** — Also called radio pill. A device for detecting and transmitting physiological data from the gastrointestinal tract or other inaccessible body cavities.

**endothermic** — A term describing a chemical reaction in which heat is absorbed.

**endothermic reaction** — A reaction that is accompanied by the absorption of heat.

**end point** — The shaft positions immediately before the first and after the last measurable change(s) in output ratio after wiper continuity has been established, as the shaft of a precision potentiometer moves in a specified direction.

**end-point control** — Quality control by means of continuous automatic analysis. In highly automatic processes, the final product is analyzed, and if any undesirable variations are detected, the control system automatically brings about the necessary changes.

**end-point sensitivity** — The algebraic difference in electrical output between the maximum and minimum value of the measurand over which an instrument is calibrated.

**end-point voltage** — The terminal voltage of a cell below which equipment connected to it will not operate or should not be operated.

**end resistance** — The resistance of a precision potentiometer measured between the wiper terminal and an end terminal, with the shaft positioned at the corresponding end point.

**end-resistance offset** — In potentiometers, the residual resistance between a terminal and the moving contact, at a position corresponding to full rotation against that terminal.

**end-scale value** — The value of the actuating electrical quantity that corresponds to end-scale indication of an instrument. When zero is not at the end or at the electrical center of the scale, the higher value is taken. Certain instruments such as power-factor meters, ohmmeters, etc., are necessarily excepted from this definition.

**end setting** — In a potentiometer, the minimum resistance that is measured between one end of a potentiometer and the wiper, with the wiper mechanically positioned at that end.

**end shield** — 1. Frequently called end bracket or end bell. In a motor housing, the part that supports the bearing and also guards the electrical and rotating parts inside the motor. 2. In a magnetron, the shield that confines the space charge to the interaction space.

**end spaces** — In a multicavity magnetron, the two cavities at either end of the anode block that terminate all the anode-block cavity resonators.

**end-to-end check** — Tests conducted on a completed wire and/or cable run to ensure electrical continuity.

**end use** — The way the ultimate consumer uses a device.

**energize** — To apply the rated voltage to a circuit or device, such as to the coil of a relay, in order to activate it.

**energized** — Also called alive, hot, and live. Electrically connected to a voltage source. Turned on, alive.

**energized part** — A part at some potential with respect to another part, or the earth.

**energy** — 1. The capacity for performing work. A particle or piece of matter may have energy because it is moving or because of its position in relation to other particles or pieces of matter. A rolling ball is an example of the first; a ball at rest at the top of an incline is an example of the second. 2. The capacity for doing work and overcoming resistance.

**energy conversion** — The change of energy from one form to another, e.g., from chemical energy to electrical energy.

**energy conversion devices** — Devices including primary and secondary cells; fuel cells; photovoltaic systems; electrochemical energy converters; radiation conversion devices; thermionic converters; converters using solar, ionic, or nuclear energy sources; devices for creating a plasma in an interaction space between an emitter and a collector; electrostatic generators for creating an

electrical output; organic and inorganic ion exchange and membrane devices; electron volt energy devices; devices for direct conversion of fuel to electricity; and electrical-energy storage-unit devices capable of delivering a power output.

**energy density** — 1. The energy output of a battery, expressed in watt-hours, per unit weight or volume of the battery. 2. The energy per unit volume of a medium.

**energy dispersal waveform** — A triangular-shaped signal at 30 Hz synchronized with the vertical blanking interval in the TV signal from the satellite, which ensures that the signal will average its power out over the whole channel, even when just the carrier is present. This waveform is removed by the receiver after FM demodulation.

**energy efficiency ratio** — Term used to gauge the relative electrical efficiency of appliances; found by dividing btu-per-hour output by the number of electrical watts used.

**energy gap** — The energy range between the bottom of the conduction band and the top of the valence band of a semiconductor.

**energy level** — A particular value of energy of a physical system, such as a nucleus, that the system can maintain for a reasonably long length of time. Systems on an atomic scale have only certain discrete energy levels and cannot occupy values between these levels.

**energy-level diagram** — A line drawing that shows the increase or decrease in electrical power as current intensities rise and fall along a channel of signal communications.

**energy-measuring equipment** — Equipment used to measure energy in electrical, electronic, acoustical, or mechanical systems.

**energy of a charge** — Represented by  $E = 1/2QV$ , given in ergs, when the charge  $Q$  and the potential  $V$  are in electrostatic units.

**energy product** — The product of the magnetic flux density  $B$  in gauss times the magnetic field strength  $H$  in oersteds. Used as an index of magnet quality. The larger the maximum energy product, the smaller the required magnet for a given job.

**energy-product curve** — A curve obtained by plotting the product of the value of magnetic induction  $B$  and demagnetizing force  $H$  for each point of the demagnetization curve of a permanent magnetic material. Usually shown together with the demagnetization curve.

**energy redistribution** — A method of finding the duration of an irregularly shaped pulse by considering it as a power curve. The area under the curve can be represented by an equivalent rectangle of the same area and peak amplitude. The original-pulse duration is equal to the rectangle width.

**energy state** — The position and speed of an electron relative to the position and speed of other electrons in the same atom or adjoining atoms.

**energy storage capacitor** — Specifically designed capacitor for use in applications wherein the capacitor can be charged over a relatively long period and discharged in a short period, thus increasing the instantaneous power in energy storage systems. Provisions are made to permit the very high currents that accompany the high rate of energy discharge. When the number of discharges is very large, the actual total time during which the capacitor may be subjected to the maximum operating voltage is relatively short.

**energy-variant sequential detection** — A technique for sequential detection in which a fixed number of transmitted pulses of varying energy are received with a single (upper) threshold device.

**ENG** — See electronic news-gathering.

**engineered military circuit** — 1. Leased long lines of which only the station equipment, local loops, and reserved positions of interexchange channels are paid for continuously. The unreversed portions of leased long lines or interexchange channels are on a steady status and are placed in an operational status and paid for only when required by the command concerned. 2. A standby or on-call circuit that is engineered specifically to meet military criteria.

**engineering** — A profession in which a knowledge of the natural sciences is applied with judgment to develop ways of utilizing the materials and forces of nature.

**English-reading tube tester** — See emission-type tube tester.

**enhanced carrier demodulation** — An amplitude-demodulation system in which a synchronized local carrier of the proper phase is added to the demodulator. This has the effect of materially reducing the distortion produced in the demodulation process.

**enhancement** — Modification of the subjective features of an image to increase its impact on the observer.

**enhancement mode** — 1. An MOS transistor that is normally off with zero gate voltage applied. A gate voltage of the correct polarity attracts majority carriers to the gate area, thus "enhancing" it and forming a current-conducting channel. 2. A device type that is normally off with zero gate voltage. A threshold voltage is then required to turn the device on.

**enhancement-mode field-effect transistor** — A field-effect transistor in which no device current flows (leakage only) when  $V_{GS}$  is zero volts. Conduction does not begin until  $V_{GS}$  reaches the threshold voltage.

**enhancement mode operation** — The operation of a field-effect transistor such that changing the gate-to-source voltage from zero to a finite value increases the magnitude of the drain current.

**enhancement MOS transistor** — A type of MOS transistor in which no current flows in the absence of an input control signal on the control terminal (called the gate) of the transistor; i.e., a control signal input is required to turn on the device. This reduces power dissipation (power dissipation occurs only when an input signal is present) and results in excellent logic state recognition (full off being one state and on the other).

**ensemble** — A collection of sample functions of a random process, all of which start from the same zero time.

**enterprise number** — Also called toll-free number. Unique telephone exchange number that permits the called party to be automatically billed for incoming calls.

**entrance box** — A metal box that houses overcurrent-protection devices and serves as the point of distribution for the various electrical circuits in a structure.

**entrance cable** — A cable by means of which electrical power is brought from an outside power line into a building.

**entrance delay** — The time between actuating a sensor on an entrance door or gate and the sounding of a local alarm or transmission of an alarm signal by the control unit. This delay is used if the authorized access switch is located within the protected area, and permits a person with the control key to enter without causing an alarm. The delay is provided by a timer or timing circuit within the control unit.

**entrapped material** — Gas or particles bound up in an electrical package so that they cannot escape the package.

**entropy** — 1. A measure of the unavailable energy in a thermodynamic system. 2. The unavailable information in a set of documents. 3. An inactive or static condition (total entropy). 4. A measure of the amount of information

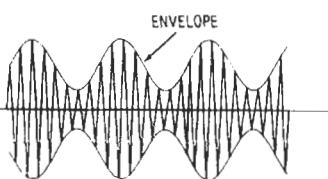
in a communication signal, equal to the average number of bits per symbol.

**entry**—Each statement in a computer programming system.

**entry point**—In a computer, the programmer-defined instruction at which a task is to begin execution.

**enunciation**—The act of pronouncing words clearly and distinctly. Articulation.

**envelope**—1. Also referred to as a bulb. The glass or metal housing of a vacuum tube. The glass housing that encloses an incandescent source. 2. The curve passing through the peaks of a graph and showing the waveform of a modulated radio-frequency carrier signal.



Envelope, 2.

**envelope delay**—1. The time that elapses as a transmitted wave passes any two points of a transmission circuit. Such delay is determined primarily by the constants of the circuit and is measurable in milliseconds or microseconds. 2. Sometimes called time delay or group delay. The propagation time delay undergone by the envelope of an amplitude-modulated signal as it passes through a filter. Envelope delay is proportional to the slope of the curve of phase shift as a function of frequency. Envelope-delay distortion is introduced when the delay is not the same at all frequencies in the passband. 3. The time difference between the longest delay and the shortest delay for a given band of frequencies. 4. A type of distortion on an analog line in which the signal delay varies with signal frequency. 5. Characteristics of a circuit that result in some frequencies arriving ahead of others, even though they were transmitted together.

**envelope-delay distortion**—The distortion that occurs during transmission when the phase shift of a circuit or system is not constant over the frequency range.

**envelope generator**—A circuit in a synthesizer that produces a single, carefully defined waveform. Useful in creating attacks and decays to define notes or for special effects.

**environment**—The aggregate of all conditions that externally influence a device's performance.

**environmental chambers**—Test chambers designed to expose the subject being tested to external conditions, such as heat, shock, pressure, and moisture, for the study of their effects on the subject.

**environmental conditions**—External conditions of heat, shock, vibration, pressure, moisture, etc.

**environmentally sealed**—Provided with gaskets, seals, potting, or other means to keep out contamination that might reduce performance.

**environmental testing**—The testing of a system or component under controlled environmental conditions, each of which tends to affect its operation or life.

**environmentproof switch**—A switch that is completely sealed to ensure constant operating characteristics. Sealing normally includes an O-ring on the actuator shaft and fused glass-to-metal terminal seals or complete potting and an elastomer plunger-case seal.

**EOG**—Abbreviation for electro-oculography.

**episcotister**—A device consisting of alternate opaque and transparent discs that rotate at a speed that interrupts light beams at an audio-frequency rate. It modulates the light beam used to excite a photoelectric element.

**epitaxial**—Pertaining to a single crystal layer on a crystalline substrate, oriented the same as the substrate. In certain semiconductor processes, an epitaxial layer is grown on a silicon substrate during the fabrication of transistors and integrated circuits.

**epitaxial deposition**—1. The growth of additional material, usually in a thin film, on a substrate. Often the added material has a crystal structure and orientation controlled by matching that of the substrate. 2. Epitaxy. The technique of growing a semiconductor layer on an existing crystal by depositing it directly from reactant vapors, so that the structure of the new layer is isomorphic with, or simply an extension of, that of the original crystal.

**epitaxial device**—A device constructed in such a manner that the crystalline structure of successive layers is oriented in the same direction as that of the original base material.

**epitaxial film**—1. A film of single-crystal semiconductor material that has been deposited onto a single-crystal substrate. 2. Any deposited film, provided the orientation of its crystal is the same as that of the substrate material.

**epitaxial growth**—1. A semiconductor fabrication process in which single-crystal p or n material is deposited and grows on the surface of a substrate. Usually, this material has a different conductivity than the substrate. 2. Crystal growth obtained by depositing a film of monocrystalline semiconductor material on a monocrystalline substrate. 3. The process of producing an additional crystal layer of semiconductor material on a semiconductor substrate. The crystalline structure of the substrate is continued into the epitaxial layer; however, the impurity concentration can be made to differ greatly. 4. The deposition of a single-crystal film on the surface of a single-crystal substrate so that the crystal orientations of the two layers are alike. 5. A process of growing layers of material on a selected substrate. Usually silicon is grown in a silicon substrate. Silicon and other semiconductor materials may be grown on a substrate with compatible crystallography, such as sapphire (silicon-on-sapphire).

**epitaxial-growth mesa transistor**—A transistor made by overlaying a thin mesa crystal over another mesa crystal.

**epitaxial growth process**—The process of growing a semiconductor material by depositing it in vaporized form on a semiconductor seed crystal. The deposited layer continues the single-crystal structure of the seed.

**epitaxial layer**—1. A grown or deposited crystal layer with the same crystal orientation as the parent material and, in the case of semiconductor circuits, of the same basic material as the original substrate. 2. A single-crystal p-type or n-type material deposited on the surface of a substrate. 3. A thin, precisely doped monocrystalline silicon layer grown on a heavily doped thick wafer, into which are diffused semiconductor junctions. In conventional processing of an integrated circuit, the thick wafer is p doped and the epitaxial layer is n doped. 4. A single crystal layer that has been deposited or grown on a crystalline substrate having the same structural arrangement. 5. A layer of silicon grown atop single-crystal silicon that reproduces the same crystallographic orientation as the single-crystal material.

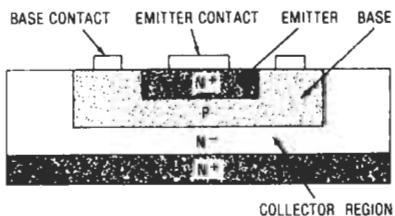
**epitaxial material**—A material whose atoms are arranged in single-crystal fashion upon a crystalline

substrate so that its lattice structure duplicates that of the substrate.

**epitaxial planar transistor** — A transistor in which a thin collector region is epitaxially deposited on a low-resistivity substrate, and the base and emitter regions are produced by gaseous diffusion with the edges of the junction under a protective oxide mask.

**epitaxial process** — The process of growing from the vapor phase a single-crystal semiconductor material with controlled resistivity and thickness.

**epitaxial transistor** — A transistor with one or more epitaxial layers.



Epitaxial transistor (triple diffused).

**epitaxy** — 1. The controlled growth on a crystalline substrate of a crystalline layer, called an epilayer. In homoepitaxy (e.g., silicon layers on a silicon substrate), the epilayer exactly duplicates the properties and crystal structure of the substrate. In heteroepitaxy (e.g., silicon on sapphire), the deposited epilayer is a different material with a different crystalline structure than that of the substrate. 2. The growth of a crystal on the surface of a crystal of another substance in such a way that the orientation of the atoms in the original crystal controls the orientation of the atoms in the grown crystal.

**E-plane** — The plane of an antenna containing the electric field. The principal E-plane also contains the direction of maximum radiation.

**E-plane bend** — Also called E-bend. The smooth change in direction of the axis of a waveguide. The axis remains parallel to the direction of polarization throughout the change.

**E-plane T-junction** — Also called series T-junction. A waveguide T-junction in which the structure changes in the plane of the electric field.

**epoxy** — 1. Pertaining to a family of thermosetting materials that are widely used for casting and potting and as adhesives. 2. A family of thermosetting resins used in the packaging of semiconductor devices. Epoxies form a chemical bond to many metal surfaces.

**EPROM** — Abbreviation for erasable programmable read-only memory. A type of nonvolatile memory device whose contents can be erased by exposure to ultraviolet light. *See also EEPROM; PROM.*

**epsilon** — The Greek letter E. or  $\epsilon$ , frequently used to represent 2.71828, which is the base of the natural system of logarithms.

**equal-energy source** — A source of electromagnetic or sound energy that emits the same amount of energy at each frequency in the spectrum.

**equal-energy white** — The light produced by a source that radiates equal energy at all visible wavelengths.

**equalization** — 1. The process of reducing the frequency and/or phase distortion of a circuit by the introduction of networks to compensate for the difference in attenuation and/or time delay at the various frequencies in

the transmission band. 2. A process of compensating for increases in attenuation (signal loss) with frequency. Different signal frequencies are attenuated differently over a given distance. 3. An intentional departure from response flatness to compensate for complementary characteristics introduced elsewhere in the system (as with discs, tape, and FM broadcasting). Also used to correct for response deficiencies in speakers and other components. 4. Different equalization characteristics are used in the recording and playback amplifiers of a tape recorder, to compensate for the magnetic characteristics of the tape and the heads. Playback equalization is standardized to give flat frequency response with any properly recorded tape, while recording equalization is a property of a particular machine, depending on its head design and the tape for which it was meant. 5. Reshaping the playback characteristics of a recording during playback mode. The simplest way is to adjust the treble and bass controls, but true equalization requires continuous adjustment of the playback frequency response curve at several points. A graphic equalizer is often used for this. 6. The selective amplification or attenuation of certain frequencies. Also refers to recognized industry standards for recording and reproducing characteristics, such as the NAB Standard. 7. The intentional increase in level of certain portions of the audio-frequency spectrum. The term is sometimes misapplied when actually referring to the attenuation of portions of the audio-frequency spectrum. 8. A technique used to compensate for distortions present on a communication channel. Equalizers add loss or delay to signals in inverse proportion to the channel characteristics. The signal response curve is then relatively flat and can be amplified to regain its original form.

**equalize** — To apply to a circuit an electrical network whose transmission characteristics are complementary to those of the line, so that when the loss (or delay) in the line and that in the equalizer are combined, the overall loss (or delay) is almost the same at all frequencies.

**equalizer** — 1. A passive device designed to compensate for an undesired amplitude-frequency and/or phase-frequency characteristic of a system or component. 2. A series of connections made in paralleled, cumulatively compound direct-current generators to give the system stability. 3. A network, usually adjustable, that corrects the transmission-frequency characteristics of a circuit to permit it to transmit all the frequencies that it passes in a uniform manner. 4. An electronic circuit that introduces compensation for frequency-discriminative effects of elements within a television system. 5. An electronic device that amplifies (boosts) and/or attenuates certain portions of the audio-frequency spectrum. There are many different types of equalizers. 6. A device to allow the frequency response of an audio-signal path to be adjusted in some way.

**equalizer circuit breaker** — A breaker that serves to control or to make and break the equalizer or the current-balancing connections for a machine field, or for regulating equipment, in a multiple-unit installation.

**equalize voltage** — A voltage applied to a battery for charging at installation and as a periodic boost charge, common in lead-antimony lead-acid battery systems.

**equalizing current** — A current circulated between two parallel-connected compound generators to equalize their output.

**equalizing network** — A network connected to a line to correct or control its transmission frequency characteristics.

**equalizing pulses** — 1. A series of pulses (usually six) occurring at twice the line frequency before and after the serrated vertical TV synchronizing pulse. Their purpose is to cause vertical retrace to occur at the correct

instant for proper interlace. 2. In the standard television signal, pulses that minimize the effect of line-frequency pulses on the interlace.

**equal-loudness contours** — See Fletcher-Munson curves.

**equation function** — As applied to microelectronic circuitry, a combination of electronic elements or circuits capable of solving the electronic-counter portion of a mathematical or Boolean equation. In obtaining the solution, it performs the necessary function within an electronic or electromechanical system.

**equation solver** — A computer, usually of the analog type, designed to solve systems of linear simultaneous (nondifferential) equations or to find the roots of polynomials.

**equilibrium** — In a semiconductor context, that state of a semiconductor crystal when there is no net current through the crystal. A crystal is normally in this state when no external voltages or current are impressed on it.

**equilibrium brightness** — The brightness of the viewing screen when a display storage tube is in a fully written condition.

**equilibrium electrode potential** — A static electrode potential when the electrode and the electrolyte are in equilibrium with respect to a specified electrochemical reaction.

**equiphasic surface** — In a wave, any surface over which the field vectors at the same instant are either in phase or  $180^\circ$  out of phase.

**equiphasic zone** — In radionavigation, the region in space within which the difference in phase between two radio signals is indistinguishable.

**equipment** — 1. An item having a complete function apart from being a substructure of a system. Sometimes called a set. 2. A general term referring to practically every part of an electrical system, including the parts consuming electrical energy. (Devices are also included in this category.)

**equipment augmentation** — 1. Procuring additional automatic data-processing equipment capability to accommodate increased workload within an established data system. 2. Obtaining additional automatic data-processing equipment capability to extend an established data system to additional sites or locations.

**equipment bonding jumper** — The connection between two or more portions of the equipment grounding conductor.

**equipment chain** — A group of units of equipment that are functionally in series. The failure of one or more individual units results in loss of the function.

**equipment characteristic distortion** — A repetitive display or disruption peculiar to specific portions of a teletypewriter signal. Normally, it is caused by improperly adjusted or dirty contacts in the sending or receiving equipment.

**equipment ground** — A connection from earth ground to a non-current-carrying metal part of a wiring installation of electric equipment. It reduces shock hazard and provides electrostatic shielding.

**equipment life** — The arithmetic mean of the cumulative operating times of identical pieces of equipment beginning with the time of acceptance by the ultimate consumer and ending when the equipment is no longer serviceable.

**equipotential** — A conductor having all parts at a single potential. The cathode of a heater-type tube is equipotential, whereas the filament is not because its voltage varies from one end to the other.

**equipotential cathode** — See indirectly heated cathode.

**equipotential line** — An imaginary line in space having the same potential at all points.

**equipotential surface** — A surface or plane passing through all points having the same potential in a field of flow.

**equisignal localizer** — Also called tone localizer. A type of localizer in which lateral guidance is obtained by comparing the amplitudes of two modulation frequencies.

**equisignal radio-range beacon** — A radio-range beacon used for aircraft guidance. It transmits two distinctive signals, which are received with equal intensity only in certain directions called equisignal sectors.

**equisignal surface** — The surface formed around an antenna by all points that have a constant field strength (usually measured in volts per meter) during transmission.

**equisignal zone** — In radionavigation, the region in space within which the difference in amplitude between two radio signals is indistinguishable.

**equivalence** — A logic operator having the property that if P is a statement, Q is a statement, R is a statement, etc., then the equivalence of P, Q, R... is true if and only if all statements are true or all statements are false.

**equivalent absorption** — The rate at which a surface will absorb sound energy, expressed in sabins. Defined as the area of a perfect absorption surface that will absorb the same sound energy as the given object under the same conditions.

**equivalent absorption area** — Area of perfectly absorbing surface that will absorb sound energy at the same rate as the given object under the same conditions. The acoustic unit of equivalent absorption is the sabin.

**equivalent binary digits** — 1. The number of binary digits equivalent to a given number of decimal digits or other characters. 2. The number of binary places required to count the elements of a given set.

**equivalent circuit** — 1. An arrangement of common circuit elements that has characteristics over a range of interest electrically equivalent to those of a different or more complicated circuit or device. 2. A simplified circuit that has the same response to changing voltage and frequency as a more complex circuit. Used to facilitate mathematical analysis.

**equivalent circuit of a piezoelectric crystal unit** — The electric circuit that has the same impedance as the unit in the frequency region of resonance. It is usually represented by an inductance, capacitance, and resistance in series, shunted by the direct capacitance between the terminals of the crystal unit.

**equivalent component density** — In circuits in which discrete components are not readily identifiable, the volume of the circuit divided by the number of discrete components necessary to perform the same function.

**equivalent conductance** — The normal conductance of an atr tube in its mount, measured at its resonance frequency.

**equivalent dark-current input** — The incident luminous flux required to give an output current equal to the dark current.

**equivalent differential input capacitance** — The equivalent capacitance looking into the inverting or non-inverting inputs of a differential amplifier with the opposite input grounded. *See also* equivalent differential input impedance.

**equivalent differential input impedance** — The equivalent impedance looking into the inverting or non-inverting input, with the opposite input grounded and the operational amplifier operated in the linear amplification region.

**equivalent differential input resistance** — The equivalent resistance looking into the inverting or non-inverting input of a differential amplifier with the opposite input grounded. *See also* equivalent differential input impedance.

**equivalent diode** — An imaginary diode consisting of the cathode of a triode or multigrid tube and a virtual anode to which is applied a composite controlling voltage of such a value that the cathode current would be the same as the current in the triode or multigrid tube.

**equivalent faults** — Two or more faults that cause the same output responses and that cannot be isolated from the board output pins and internal nodes being monitored by the tester.

**equivalent four-wire system** — A transmission system using frequency division to obtain full-duplex operation over only one pair of wires.

**equivalent grid voltage** — The grid voltage plus plate voltage divided by the mu of the tube.

**equivalent height** — The virtual height of an ionized layer of the ionosphere.

**equivalent input noise current** — The equivalent input noise current that would reproduce the noise seen at the output of an operational amplifier if all amplifier noise sources were set to zero and the source impedances were large compared with the optimum source impedance.

**equivalent input noise voltage** — The equivalent input noise voltage that would reproduce the noise seen at the output of an operational amplifier if all amplifier noise sources and the source resistances were set at zero.

**equivalent input offset current** — The difference between the two currents flowing into the inverting and noninverting inputs of a differential amplifier when the output voltage is zero.

**equivalent input offset voltage** — The amount of voltage required at the input to bring the output to zero. Usually this voltage is adjustable to zero by using either a built-in or an external variable resistor (balance control).

**equivalent input wideband noise voltage** — The output noise voltage of a differential amplifier with the input shorted, divided by the dc voltage gain of the amplifier. This voltage is measured with a true rms voltmeter and is limited to the combined bandwidth of the amplifier and meter.

**equivalent loudness** — The intensity level of a sound relative to some arbitrary reference intensity, such as a 1000-hertz pure tone, that is judged by the listeners to be equivalent in loudness.

**equivalent network** — One network that replaces another in a system without altering in any way the electrical operation of the system external to the network.

**equivalent noise conductance** — The spectral density of a noise-current generator expressed in conductance units at a specified frequency.

**equivalent noise input** — In a photosensitive device, the value of incident luminous flux that produces an rms output current equal to the rms noise current within a specified bandwidth when the flux is modulated in a stated manner.

**equivalent noise pressure** — *See* transducer equivalent noise pressure.

**equivalent noise resistance** — A measure of the residual noise output of a potentiometer while the slider is being actuated. (The residual noise consists of active components in the form of self-generated voltages arising in the slider contact interface, and passive components in the form of ohmic contact resistance at the point of slider contact.)

**equivalent noise temperature** — The absolute temperature at which a perfect resistor with the same

resistance as the component would generate the same noise as the component at room temperature.

**equivalent open-circuit rms noise current** — That noise which occurs at the input of the noiseless amplifier due only to noise currents. It is expressed in picoamperes per hertz at a specified frequency or in nanoamperes in a given frequency band.

**equivalent periodic line** — A periodic line that, when measured at its terminals or at corresponding section junctions, has the same electrical behavior at a given frequency as the uniform line with which it is compared.

**equivalent permeability** — The relative permeability that a component would have under specified conditions if it had the same reluctance as a component of the same shape and size but different materials.

**equivalent plate voltage** — The plate voltage plus mu times the grid voltage.

**equivalent resistance** — The concentrated or lumped resistance that would cause the same power loss as the actual small resistances distributed throughout a circuit.

**equivalent series resistance** — Abbreviated ESR or R. 1. In a circuit or component, the square root of the difference between the impedance squared and the reactance squared. All internal series resistance of the circuit or component treated as being concentrated in a single resistance at one point. 2. All internal ac series resistance of a capacitor treated as a single resistor. 3. An effective resistance that, if connected in series with an ideal capacitor of a capacitance value equal to that of the capacitor in question, would result in a power loss equal to the active power dissipated in that capacitor at a given frequency.

**equivalent time** — In random-sampling oscilloscope operation, the time scale associated with the display of signal events.

**equivalent time sampling** — A method of allowing the storage of repetitive events that occur faster than the maximum digital oscilloscope sampling frequency. The scope acquires the waveform during multiple sweeps by taking samples at various times until scope memory is filled.

**equivocation** — In a computer, the conditional information contained in an input symbol given an output symbol, averaged over all input-output pairs.

**erasable programmable read-only memory** — Abbreviated EPROM. A field-programmable read-only memory that can have the data content of each memory cell altered more than once. An EPROM is bulk-erased by exposure to high-intensity ultraviolet light. Sometimes referred to as a reprogrammable read-only memory.

**erasable storage** — Storage media in a computer that hold information that can be changed.

**erase** — 1. To replace all the binary digits in a storage device by binary zeros. In a binary computer, erasing is equivalent to clearing; in a coded decimal computer, in which the pulse code for decimal zero may contain binary ones, clearing leaves decimal zero, whereas erasing leaves all-zero pulse codes in all storage locations. 2. To remove all information from a register or a memory. Sometimes this consists of writing a zero into all memory positions.

**erase head** — 1. A head on a tape recorder that applies a strong high-frequency alternating magnetic field to the tape so that earlier recordings may be erased as the tape runs past the head. 2. A magnetic tape head that removes previously recorded signals from a tape, usually by applying inaudible high-level, high-frequency bias signals.

**erasing speed** — In charge-storage tubes, the rate of erasing successive storage elements.

**erasure** — 1. A process by which a signal recorded on a tape is removed and the tape made ready for rerecording. This may be accomplished by ac erasure, in which the tape is demagnetized by an alternating field that is reduced in amplitude from an initially high value, or by dc erasure, in which the tape is saturated by applying a primarily unidirectional field. 2. The neutralization of the magnetic pattern stored on tape.

**E region** — The region of the ionosphere about 50 to 100 miles (80 to 160 km) above the earth's surface.

**E register** — The extension of the computer A-register for use in double-precision arithmetic or logic-shift operations.

**E<sub>r</sub> — E<sub>y</sub>** — The resultant color television signal when E<sub>y</sub> is subtracted from the original full red signal.

**erg** — 1. The absolute centimeter-gram-second unit of energy and work. The work done when a force of 1 dyne is applied through a distance of 1 centimeter. 2. Measure of energy. 1 erg = 10<sup>7</sup> joules = 6.25 × 10<sup>10</sup> eV.

**ergonomics** — The science of designing office systems to meet the needs of the human body.

**ERP** — Abbreviation for effective radiated power. The amount of power radiated by an antenna, which may be more or less than the power absorbed by it from the transmitter.

**error** — 1. In mathematics, the difference between the true value and a calculated or observed value. A quantity (equal in absolute magnitude to the error) added to a calculated or observed value to obtain the true value is called a correction. 2. Any discrepancy between a computed, observed, recorded, or measured quantity and the true, specified, or theoretically correct value or condition. 3. In a computer or data-processing system, any incorrect step, process, or result. In addition to the mathematical usage in the computer field, the term also commonly refers to machine malfunctions, or machine errors, and to human mistakes, or human errors. 4. In data communications, *error* means that a bit transmitted as a 1 was received as a 0 (or vice versa). 5. A deviation occurring during transmission such that a mark signal is received instead of a space signal, or vice versa. 6. A situation in which the data readout of a memory location is different from the data originally stored in that location. The term *error* is normally not applicable to circuits that do not contain memory elements. It can be applied, however, to complex logic arrays that contain memory elements, such as flip-flops or small arrays of RAM. Errors can be classified into three categories: hard error, medium error, and soft error.

**error-correcting code** — 1. A code in which each acceptable expression conforms to specific rules of construction that also define one or more equivalent unacceptable expressions, so that if certain errors occur in an acceptable expression, the result will be one of its equivalents and thus the error can be corrected. 2. A computer code using extra bits that automatically detect and correct errors. 3. Code for information transmission that makes it possible to detect errors and to fix them. This involves sending extra information along with each word, with a corresponding reduction in the transmission rate.

**error-correcting telegraph system** — A system that employs an error-detecting code in such a way that any false signal initiates retransmission of the character incorrectly received.

**error-correction routine** — A series of computer instructions programmed to correct a detected error condition.

**error detecting and feedback system** — A system employing an error-detecting code and so arranged that a signal detected as being in error automatically initiates a request for retransmission of that signal.

**error-detecting code** — In a digital computer, a system of coding characters such that any single error produces a forbidden or impossible code combination.

**error detection** — 1. An arrangement that senses flaws in received data by examining parity bits, verifying block check characters, or using other techniques. 2. System that detects errors occasioned by transmission equipment or facilities.

**error detector** — That portion of an automatic control system that determines when the regulated quantity has deviated outside the dead zone.

**error rate** — 1. A measure of quality of a digital circuit or equipment item. 2. The number of erroneous bits or characters in a sample; it is frequently taken as the number of errors per 100,000 characters. 3. A measure of the ratio of the number of characters of a message incorrectly received to the number of characters of the message received. 4. The ratio of incorrectly received data (bits, elements, characters, or blocks) to the total amount of data transmitted.

**error-rate damping** — A damping method in which a signal proportional to the rate of change of error is added to the error signal for anticipatory purposes.

**error signal** — In an automatic control device, a signal whose magnitude and sign are used to correct the alignment between the controlling and the controlled elements.

**error tape** — A special tape developed and used for writing out errors in order to correct them by study and analysis after printing.

**error voltage** — A voltage that is present in a servo system when the input and output shafts are not in correspondence. The error voltage, which actuates the servo system, is proportional to the angular displacement between the two shafts.

**ESA** — Abbreviation for electronic shock absorption.

**Esaki diode** — See tunnel diode.

**ESC** — Abbreviation for electronic spark control. For General Motors turbocharged engines, a system that controls timing and engine knock.

**escape character** — A code-extension character used, sometimes with one or more succeeding characters, to form an escape sequence, which indicates that the interpretation of the succeeding characters is to be different from the code currently in use.

**E-scope** — A radar display in which targets appear as blips with distance indicated by the horizontal coordinate and elevation by the vertical coordinate.

**escutcheon** — A backing plate around an opening. Commonly the ornamental metal, wood, plastic, or other framework around a radio tuning dial, control knob, or other panel-mounted part in a radio receiver or television receiver, audio-frequency amplifier, etc.

**ESD** — Abbreviation for electrostatic discharge. Discharge of a static charge on a surface or body through a conductive path to ground. An electronic component may suffer irreparable damage when it is included in the discharge path.

**ESM** — See electronic warfare support measures.

**ESR** — Abbreviation for equivalent series resistance.

**ESS** — 1. Abbreviation for electronic spark selection. An electronic system (General Motors) that controls timing on fuel-injected engines to increase fuel economy and improve emissions. Operates on inputs from engine temperature, rpm, and vacuum sensors. 2. Abbreviation for electronic switching system.

**essential loads** — Those loads that must be served to keep plant operations at an acceptable level during a prolonged commercial power outage. Such loads might be interruptible for periods of a few seconds to several minutes.

**established reliability**—A quantitative maximum failure rate demonstrated under controlled test conditions in accordance with a military specification; usually expressed as percent failures per thousand hours of test.

**Estiatron**—A special type of electrostatically focused traveling-wave tube.

**etch**—The process of removing material from a wafer (such as oxides or other thin films) by chemical, electrolytic, or plasma (ion bombardment) means. Examples: nitride etch, oxide etch.

**etchant**—1. A chemical agent that can remove a solid material. For example, a highly selective etchant that acts on silicon dioxide, silicon, or both is employed in semiconductor processing to pattern the silicon surface for diffusion masking. 2. A solution used, by chemical reaction, to remove the unwanted portion of a conductive material bonded to a base. 3. A liquid solution of a chemical or combination of chemicals used to preferentially dissolve metal.

**etchback**—The controlled removal of all components of base material by a chemical process on the side wall of holes in order to expose additional internal conductor areas.

**etched metal mask**—A metal mask used for screening wherein the pattern is created in a sheet of metal by the etching process.

**etched printed circuit**—A type of printed circuit formed by chemically or electrolytically (or both) removing the unwanted portion of a layer of material bonded to a base.

**etch factor**—A ratio of etched depth to the lateral etch at the boundary of the interface of the photoresist and the substrate.

**etching**—1. The selective removal of unwanted material from a surface, usually by chemical means. 2. A process using either acids or a gas plasma to remove unwanted material from the surface of a wafer.

**etching resist**—Material deposited on the surface of a copper-clad base material that prevents the removal by etching of the conductive areas the material covers.

**etching to frequency**—Finishing a crystal blank to its final frequency by etching it in hydrofluoric acid.

**ether**—A hypothetical medium that pervades all space (including vacuum) and all matter; assumed to be the vehicle for propagation of electromagnetic radiations.

**Ethernet**—1. A high-speed network connection. 2. A network standard first developed by Xerox, and refined by DEC and Intel. Ethernet interconnects personal computers and transmits at 10 megabits per second. It uses a bus topology that can connect up to 1024 PCs and workstations within each main branch, and uses a protocol known as carrier sense multiple access with collision detection (CSMA/CD) to regulate communication line traffic. Nodes are linked using coaxial cable, fiber-optic cable, or twisted-pair wiring. Ethernet is codified as the IEEE 802.3 standard. 3. A very common method of networking computers in a LAN. Ethernet will handle about 10 megabits per second and can be used with almost any kind of computer.

**E-transformer**—A special form of differential transformer employing an E-shaped core. The secondaries of the transformer are wound on the outer legs of the E, and the primary is on the center leg.

**ETSI**—See European Telecommunications Standards Institute.

**Ettingshausen effect**—Analogous to the Hall effect. The different temperatures found on opposite edges of a metal strip that is perpendicular to a magnetic field and through which an electric current flows longitudinally.

**eTV**—Abbreviation for educational TV. A nonprofit television station operating to serve community needs in the areas of instruction and cultural development.

**Eureka**—A ground transponder in the British Rebecca-Eureka radar navigational system.

**Euro connector**—See SCART

**European Telecommunications Standards Institute**—Abbreviated ETSI. One of the European organizations responsible for establishing common industry-wide standards for telecommunications.

**eutectic**—1. An isothermal reversible reaction in which a liquid solution is converted into two or more intimately mixed solids on cooling, the number of solids formed being the same as the number of components in the system. 2. An alloy having the composition indicated by the eutectic point on an equilibrium diagram. 3. An alloy structure of intermixed solid constituents formed by a eutectic reaction. 4. Referring to an alloy or solid solution that has the lowest possible melting point, usually below that of its components. 5. The most fusible series of alloys (e.g., 63/37 tin-lead solder). 6. The specific proportions of the constituents of an alloy having the lowest melting point. The system goes from totally molten to totally solid without going through a slushy range at the eutectic composition.

**eutectic alloy**—1. A combination of two or more metals that has a sharply defined melting point and no plastic range. 2. An alloy with a low and sharp melting point that converts from a solid to a liquid state at a specific recurring point. Used in thermal overload devices.

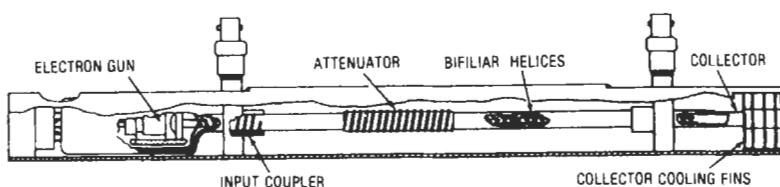
**eutectic bonding**—Formation of a metallurgical joint in similar or dissimilar metals through the introduction of a thin film of another metal at the joint interface. Upon application of heat and moderate pressure, the intermediate film and the metals to be joined form a molten eutectic phase, which is then eliminated from the joint by thermal diffusion into the base metals.

**eutectic solder**—Solder that has the lowest possible melting point for its combination of elements. Eutectic tin-lead solder is composed of 63 percent tin and 37 percent lead. It melts at 361°F. Eutectic tin-silver solder has 96.5 percent tin with 3.5 percent silver, and melts at 430°F.

**ev or ev**—Abbreviation for electron-volt.

**evaporation**—The deposition in high vacuum of insulation that is thermally liberated from a parent source. Silica films of low optical absorption have been produced by electron bombardment of the parent oxide.

**evaporation materials**—Metals used for evaporation charges and sputtering targets, including chromium



Estiatron.

and its alloys, for (a) a thin adhesive layer on IC substrates to allow better deposition of gold or other metal, (b) resistor material, and (c) vacuum deposition in mask production.

**evaporation of electrons**—The cooling that occurs on the surface of a cathode during emission. It is analogous to the cooling of a liquid or solid as it evaporates.

**evaporation sources**—Boats and filaments used as heat sources for vacuum evaporation to form thin layers on substrates. The process is frequently done by resistively heating the evaporant in a ceramic crucible or by self-heating of boats constructed of tungsten, molybdenum, or tantalum.

**evaporative deposition**—The process of condensing a thin film of evaporated material upon a substrate. Evaporation usually is produced by heating a material in a high vacuum.

**E-vector**—A vector representing the electric field of an electromagnetic wave. In free space it is perpendicular to the direction of propagation.

**even harmonic**—Any harmonic that is an even multiple (2, 4, 6, etc.) of the fundamental frequency. The even harmonics of 60 Hz are 120 Hz, 240 Hz, 360 Hz, etc.

**even parity**—1. Parity bit that is added to a word so that the total number of 1s is even. 2. The condition that occurs when the sum of the number of 1s in a binary word is always even. 3. A dumb-terminal data verification method in which each character must have an even number of 1 bits.

**event counter**—Instrument that records and totals occurring events; can include time of occurrence of events.

**event flag**—In a computer, an easily implemented synchronization mechanism that can be used for passing messages and data buffers between two cooperating tasks.

**EW**—Abbreviation for electronic warfare.

**E-wave**—Designation for TM (transverse magnetic) wave, one of the two classes of electromagnetic waves that can be sent through waveguides.

**EX**—In a calculator, it is the abbreviation for exchange key. Interchanges the last entry with the preceding value in the calculator.

**exalted-carrier receiver**—A receiver that counteracts selective fading by maintaining the carrier at a high level at all times.

**exalted-carrier reception**—A method of receiving either amplitude- or phase-modulated signals in which the carrier is separated from the sidebands, filtered and amplified, and then recombined with the sidebands at a higher level prior to demodulation.

**except gate**—A gate in which the specified combination of pulses producing an output pulse is the presence of a pulse on one or more input lines and the absence of a pulse on one or more other input lines.

**exception**—In a computer, a condition that is out of the ordinary in normal task execution; e.g., arithmetic overflow.

**excess carriers**—Any carriers present in a semiconductor material or region in addition to those present in equilibrium.

**excess conduction**—Conduction by excess electrons in a semiconductor.

**excess electron**—An electron introduced into a semiconductor by a donor impurity and available to promote conduction. An excess electron is not required to complete the bond structure of the semiconductor.

**excess fifty**—In a computer, a representation in which a number  $N$  is denoted by the equivalent of  $(N + 50)$ .

## evaporation of electrons — excitation purity

**excess meter**—An electricity meter that measures and registers the integral, with respect to time, of those portions of the active power in excess of the predetermined value.

**excess minority carriers**—In a semiconductor, the number of minority carriers that exceed the normal equilibrium number.

**excess modified index of refraction**—See refractive modulus.

**excess noise**—Also called current noise, bulk noise, and  $1/f$  noise. Noise resulting from the passage of current through a semiconductor material.

**excess sound pressure**—The total instantaneous pressure at a point in a medium containing sound waves, minus the static pressure when no sound waves are present. The unit is the dyne per square centimeter.

**excess-three BCD**—Abbreviation for excess-threec binary-coded decimal. Pertaining to a code based on adding 3 to a decimal digit and then converting the result directly to binary form. Use of this code simplifies the execution of certain mathematical operations in a binary computer that must handle decimal numbers.

**exchange**—To remove the contents of one storage unit of a computer and place it in a second, at the same time placing the contents of the second storage unit into the first.

**exchange cable**—A lead-covered, nonquadded, paper-insulated cable used in providing cable pairs between local subscribers and a central office.

**exchange code**—The three digits following an area code in a telephone number.

**exchange key**—See EX.

**exchange line**—A line that joins a subscriber or switchboard to a commercial exchange.

**exchange plant**—Facilities used to serve the needs of subscribers, as distinguished from facilities used for long-distance communication.

**exchange register**—See memory register.

**exciplex**—From excited state complex. A chemical reaction occurring in certain lasing materials known as organic dyes and used for adjusting a laser so that it emits light in a color range from near ultraviolet to yellow.

**excitation**—1. Also called stimulus. An external force or other input applied to a system to cause it to respond in some specified way. 2. Also called drive. A signal voltage applied to the control electrode of an electron tube. 3. In electric or electromagnetic equipment, supplying with a potential, a charge, or a magnetic field. 4. The addition of energy to a system so as to transfer the system from its ground state to an excited state. 5. That energy which is present in a crystalline material as a result of its dynamic interaction with the external environment. This includes the energy acquired by the material in the form of sound, heat, light, and other forms of radiation. 6. Current supplied to energize the field coils of a generator. 7. The signal applied to a power amplifier. 8. The signal applied to a transmitting antenna.

**excitation anode**—An auxiliary anode of a pool-cathode tube, used to maintain a cathode spot when the output current is zero.

**excitation current**—The resultant current in the shunt field of a motor when voltage is applied across the field.

**excitation energy**—The external electrical energy required for proper operation of a transducer.

**excitation purity**—Also called purity. The ratio between the distance from the reference point to the point representing the sample and the distance along the same straight line from the reference point to the spectrum locus or to the purple boundary, both distances being measured

(in the same direction from the reference point) on the CIE chromaticity diagram.

**excitation voltage** — The voltage required for excitation of a circuit.

**excited-field speaker** — A speaker in which the steady magnetic field is produced by an electromagnet.

**exciter** — 1. In a directional transmitting antenna system, the part connected directly to the source of power, such as to the transmitter. 2. A crystal or self-excited oscillator that generates the carrier frequency of a transmitter. 3. A small, auxiliary generator that provides field current for an ac generator.

**exciter lamp** — 1. A high-intensity incandescent lamp having a concentrated filament. It is used in making variable-area, sound-on-film recording and in reproducing all types of sound tracks on film, as well as in some mechanical television systems. 2. A light source used in a facsimile transmitter to illuminate the subject copy being scanned. 3. Small incandescent lamp whose intense beam is focused on the optical sound track of a motion picture film. The sound track modulates the beam, which in turn is detected by a photocell that produces an electrical output that is eventually converted into audible sounds.

**exciter or dc-generator relay** — A device that forces the dc machine-field excitation to build up during starting, or which functions when the machine voltage has built up to a given value.

**exciter response** — In rotating electrical machinery, the rate of change of the main exciter voltage when the resistance in the main exciter field circuit is suddenly changed. The exciter response may be expressed in volts per second or by the numerical value obtained by dividing the volts per second by some designated value of voltage, such as the nominal collector-ring voltage.

**exciting current** — Also called magnetizing current. 1. The current that flows in the primary of a transformer when the secondary is open-circuited. This current produces a flux that generates a back emf equal to the applied voltage. 2. The current that passes through the field windings of a generator.

**exciton** — A mobile, electrically neutral, excited state of holes and electrons in a crystal. An example is a weakly bound electron-hole pair; when such a pair recombines, the energy yielded is the bandgap reduced by the binding energy of the pair.

**excitron** — A type of rectifier tube used in applications with heavy power requirements and in power distribution systems. It has a single anode and a mercury-pool cathode and is provided with a means for maintaining a continuous cathode spot.

**exclusion principle** — The principle that states that if particles are considered to occupy quantum states, then only one particle of a given kind can occupy any one state. Particles differ in kind due to their direction of spin momentum, orbit, etc.

**exclusive OR** — A function that is valid (its value is 1) if one and only one of the input variables is valid. The exclusive OR applied to two variables is valid, or 1, if

the binary inputs are different. The term *half-add* is often applied to the exclusive OR with two input variables.

**exclusive OR function** — A logic operation in which the result is logically true when only one input function is true and false when both inputs are true or false.

**exclusive OR gate** — 1. A type of gate that produces an output when the inputs are the same, but not when they are different. 2. An electronic circuit whose output is a logical 1 if its two inputs are different, and a logical 0 if they are the same. This follows the rules for binary addition if carries are disregarded. For this reason, the exclusive OR gate is sometimes known as a half-adder.

**excursion** — A single movement away from the mean position in an oscillating or alternating motion.

**execute** — 1. The process of interpreting an instruction and performing the indicated operation (s). 2. To perform a specified computer instruction. To run a program. 3. The third cycle of the three cycles for program instruction execution. During this time, the operation instruction is performed. *See also* decode; fetch.

**execution** — 1. The performance of an operation or instruction. 2. The performance of a specific operation such as would be accomplished through processing one instruction, a series of instructions, or a complete program.

**execution time** — 1. The time required for a computer to execute an instruction, usually several machine cycles. 2. The total time required for the execution of one specific operation, including fetch, decode, and execute steps.

**executive instruction** — Instruction to determine how a specially written computer program is to operate.

**executive routine** — In computer operation, a set of coded instructions that controls loading and relocation of other routines, and in some cases employs instructions not known to the general programmer. Effectively, an executive routine is a nonhardware part of the computer itself, except that it is superimposed on all lower-level programs and instructional sets.

**exercisers** — 1. Multioutput data generators; e.g., a memory exerciser produces, at different sets of output terminals, data-input words, addresses, and coincidence/complement signals for an error detector (discriminator), as well as appropriate write and read commands. These instruments are actually small test systems, and might properly be classed with them. 2. A test system or program for a device, such as memory, disk, or tape, designed to detect malfunctions prior to use.

**exhaustion** — The removal of gases from a space, such as the bulb of a vacuum tube, by means of vacuum pumps.

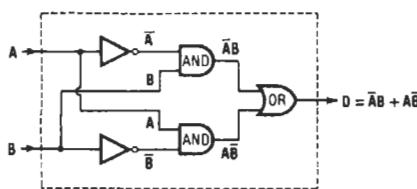
**exit** — In a computer, the means of halting a repeated cycle of operation in a program.

**exitance** — The flux per unit area leaving (diverging) from a source of finite area.

**exit angle** — The exit angle is the angle between the output radiation vector and the axis of the fiber or fiber bundle.

**exit delay** — The time between turning on a control unit and the sounding of a local alarm or transmission of an alarm signal on actuation of a sensor on an exit door. This delay is used if the authorized access switch is located within the protected area and permits a person with the control key to turn on the alarm system and to leave through a protected door or gate without causing an alarm. The delay is provided by a timer within the control unit.

**exogeneous variable** — A variable whose values are determined by considerations outside the model in question. *See also* endogenous variable.



Exclusive OR.

**exosphere** — The outermost region of the earth's atmosphere, where the atoms and molecules move in dynamic orbits under the influence of the gravitational field.

**exothermic** — A chemical reaction in which heat is produced.

**exothermic reaction** — A reaction in which heat is given off.

**expand** — To spread out part or all of the trace of a cathode-ray display.

**expandable breadboarding system** — See micro-computer development system.

**expandable gate** — A logic gate whose number of inputs can be increased by the simple addition of an expander block.

**expanded contact** — In a semiconductor, any pattern that has metallization crossing a diffused junction.

**expanded-position-indicator display** — An expanded display of a sector from a plan-position-indicator presentation.

**expanded-scale meter** — 1. A meter in which the ratio of deflection per unit of applied energy becomes greater as the energy approaches a specified value. 2. A meter that confines its measurements to a selected narrow range, which occupies the entire scale of the meter. Lesser values are ignored, and no deflection is exhibited until the minimum scale value is reached or exceeded.

**expanded scope** — A magnified portion of a cathode-ray-tube presentation.

**expanded sweep** — A preselected portion of a sweep, during which time the electron beam is speeded up in a cathode-ray tube.

**expander** — 1. A transducer that produces a larger range of output voltages for a given amplitude range of input voltages. One important type expands the volume range of speech signals by employing their envelope. 2. A logic block that may be connected easily to an expandable gate to make a larger number of logic inputs available. 3. The part of a compander used at the receiving end of a circuit to restore the compressed signal to its original form. It reduces the amplitude of weak signals and amplifies strong signals. 4. A device used to restore natural dynamic range by counteracting the compression of dynamic range used in the making of recordings and in broadcasting.

**expander inputs** — Gates used for increasing the number of logic-performing inputs.

**expander** — A device that reverses the effect of analog compression. *See also* compander.

**expansion** — 1. A process in which the effective gain applied to a signal is increased for larger signals and decreased for smaller signals. 2. In facsimile transmission, an increase in the contrast between light and dark portions of the transmitted picture.

**expansion board** — 1. A circuit board designed to fit the bus of a computer in order to add additional ports, memory, or functions. 2. A PC board added to a computer and giving it added capabilities, such as increasing the amount of main memory.

**expansion slot** — A socket on the main board of a personal computer where an accessory card, or expansion board, can be inserted.

**experimental model** — An equipment model that demonstrates the technical soundness of a basic idea but does not necessarily have the same form or parts as the final design.

**experimental station** — Any station (except amateur) utilizing electromagnetic waves between 10 kHz and 3000 GHz in experiments, with a view toward the development of a science or technique.

**exploring coil** — *See* magnetic test coil.

**explosion-proof motor** — A motor designed and constructed so as to withstand an internal explosion of a specified gas or vapor and to prevent the ignition of the specified gas or vapor surrounding the motor by sparks, flashes, or explosions of the specified gas or vapor inside the motor casing.

**explosion-proof switch** — A switch (UL listed) that can withstand an internal explosion of a specified gas without causing ignition of surrounding gases.

**explosive atmosphere** — The condition in which air is mixed with dust, metal particles, or inflammable gas in such proportion that it is capable of igniting or exploding.

**exponential** — Pertaining to exponents or to an expression having exponents. A quantity that varies in an exponential manner increases by the square or some other power of a factor, instead of linearly.

**exponential curve** — A curve representing the variation of an exponential function.

**exponential damping** — Damping that follows an exponential law.

**exponential decay** — The decay of signal strength, radiation, charge, or some other quantity at an exponential rate.

**exponential horn** — 1. A horn whose cross-sectional area increases exponentially with axial distance. 2. Speaker horn (low or high frequency) in which the flare rate of the horn follows an exponential curve.

**exponential quantity** — A single quantity that increases or decreases at the same rate as the quantity itself (e.g., the discharge current of a capacitor through a noninductive resistor).

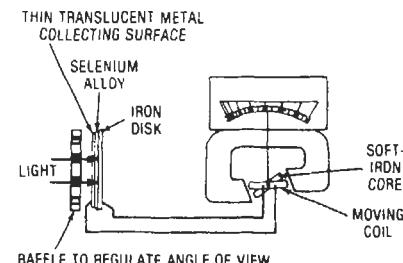
**exponential sweep** — An electron-beam sweep that starts rapidly and slows down exponentially.

**exponential transmission line** — A two-conductor transmission line whose characteristic impedances vary exponentially with the electrical length of the line.

**exponential waveform** — A waveform that is characterized by smooth curves but which possesses pulse properties because it contains numerous constituent frequencies. The exponential waveform undergoes a rate of amplitude change that is either inversely or directly proportional to the instantaneous amplitude.

**exposure** — 1. A measure of the X-ray or gamma radiation at any point; it is used to describe the energy of the radiation field outside the body. 2. The act of subjecting photosensitive surfaces or matter to radiant energy, such as light, to produce an image.

**exposure meter** — In photography, an instrument that measures scene brightness and indicates proper lens opening and exposure time.



Exposure meter.

**expression** — A valid series of constants, variables, and functions that can be connected by operation symbols

and punctuated, if necessary, to describe a desired computation.

**expression control**—In an organ, the control that regulates the overall volume. Usually operated with the right foot.

**extended addressing**—An addressing mode in a computer that can reach any place in memory. *See also* direct addressing.

**extended-area service**—Telephone exchange service, without toll charges, that extends over an area where there is a community of interest, in return for a somewhat higher exchange service rate.

**extended-cutoff tube**—*See* remote-cutoff tube.

**extended foil capacitor**—*See* noninductive capacitor.

**extended-foil construction**—A method of fabricating capacitors in which two foil electrodes, separated by a dielectric, are offset so that they may be wound with one foil extending from one end of the winding and the other foil extending from the opposite end.

**extended-interaction tube**—A microwave tube in which a moving electron stream and a traveling electric field interact in a long resonator. The bandwidth of such a tube is between that of a klystron and a traveling-wave tube.

**extended octaves**—In an organ, tones above or below the notes on the regular keyboard that can be sounded only when certain couplers are on.

**extended play**—Abbreviated EP. A 45-rpm record on a 7-inch disc. It provides 8 minutes of playing time, instead of the 5 minutes of a standard 45-rpm disc.

**extended-play tape**—Recording tape made with thinner base material so that more tape can be spooled onto a given size reel. Generally refers to 1-mil (25.4- $\mu$ m) or 0.5-mil (12.75- $\mu$ m) thick tapes, as opposed to standard 1.5-mil (38.1- $\mu$ m) tape. Extended-play tapes are more susceptible to stretching, breaking, and print-through than standard tapes.

**extended speed range**—An extension of the basic speed range of a motor by means of field voltage control. When operating in this range, the load must be reduced to maintain a constant horsepower output to prevent overheating of the motor.

**extension**—1. A small computer program that can be plugged into a larger one, usually to enhance the main program's capabilities. All operating systems use extensions to enable them to read compact discs. 2. Filenames often end with a period followed by additional characters known as the file extension. An extension is generally a standard abbreviation for a type of file. For example, .text is often used for ASCII files, and .ps for PostScript files. 3. An additional telephone bridged on the same line with the main phone.

**extension number**—The PBX or Centrex telephone number associated with a particular caller.

**extent**—The physical positions on input-output devices occupied by or reserved for a particular data set.

**external armature**—A ring-shaped armature that rotates around the field magnets of a generator or motor.

**external circuit**—All wires and other conductors that are outside the source.

**external control devices**—All control devices mounted external to the control panel.

**external critical damping resistance**—The value of resistance that must be placed in series or in parallel with a galvanometer in order to produce the critically damped condition.

**external device**—1. An input or output device, such as a paper-tape reader, line printer, or magnetic tape recorder, under control of a computer. 2. A unit of

processing equipment in a computer system external to the CPU.

**external feedback**—In a magnetic amplifier, the ampere-turns of auxiliary windings that assist in equalizing the load-winding ampere-turns, thereby reducing the control ampere-turns required for control. External feedback may be degenerative to reduce the gain and improve the stability of an amplifier.

**externally adjustable timer**—A time-delay unit that can be adjusted by varying the resistance of the timer resistor externally, usually by means of a screwdriver.

**externally caused contact chatter**—That chatter resulting from shock or vibration imposed on the relay by external action.

**externally caused failure**—A failure caused by an environment outside the design limitations, such as excessive loads, voltages, etc., resulting from operator error, accident, or failure of another part.

**externally quenched counter tube**—A radiation counter tube that requires an external circuit to prevent it from reigniting.

**external memory**—An auxiliary storage unit apart from the internal memory of a computer (e.g., magnetic tape).

**external photoeffect**—The emission of photon-excited electrons from the surface of a material after overcoming the energy barrier at the surface of a photoemissive material.

**external photoeffect detector**—A photodetector in which the energy of each photon incident on the detector surface is sufficient to liberate one or more electrons; i.e., Planck's constant times the frequency, which is the energy of the photon, is sufficient to overcome the work function of the material, and the liberated electrons move under the influence of an applied electric field. Photoemissive devices make use of the external photoeffect.

**external photoelectric effect**—The ejection of electrons from the surface of a solid by the absorption of a sufficient amount of photons.

**external processor loop**—*See* tape monitor.

**external Q**—In a microwave tube, the reciprocal of the difference between the reciprocal of the loaded *Q* and the reciprocal of the unloaded *Q*.

**external storage**—Storage facilities separate from the computer itself but holding information in a form acceptable to the computer, e.g., magnetic tapes, optical discs, etc.

**external wiring**—Category of electronic wiring that interconnects various subsystems within the weapons system. It is frequently subjected to severe environments.

**extinction potential**—The lowest value to which the plate voltage of a gaseous tube can be reduced without cutting off the flow of plate current.

**extinguishing voltage**—1. The voltage across a glow lamp when the lamp ceases to glow. 2. The lowest anode voltage at which a gas tube can sustain a discharge.

**extraband spurious transmitter output**—A spurious transmitter output that lies outside the specified band of transmission.

**extra-class license**—The highest classification of United States amateur license. Requirements include a code sending and receiving ability of 20 words per minute, a knowledge of advanced theory, and the holding of a general- or conditional-class license for two years.

**extract**—1. To remove from a set of items of information all those items that meet some arbitrary criterion. 2. In computer operations, to obtain specific digits from a stored word. 3. To form a new word from selected segments of given words.

**extract instruction**—In a digital computer, the instruction to form a new word by placing selected segments of given words side by side.

**extractor**—See filter, 3.

**extra-high performance macros**—Computers that have a throughput of 160 gigabits per second, and a memory size of 256 megabytes.

**extramural absorption**—The absorption of light, transmitted radically through the cladding of an optical fiber, by means of a dark or opaque coating placed over the cladding.

**extramural cladding**—A layer of dark or opaque absorbing coating placed over the cladding of an optical fiber to increase internal reflection, protect the smooth reflecting wall of the cladding, and absorb scattered or escaped stray light that might penetrate the cladding.

**extraneous emission**—Any emission of a transmitter or transponder other than the carrier and those sidebands intentionally added to convey intelligence.

**extraneous response**—Any undesired response of a receiver, recorder, or other susceptible device due to the desired signals, undesired signals, or any combination or interaction among them.

**extraordinary wave**—One of two components into which a sky wave is split in the ionosphere. When viewed below the ionosphere in the direction of propagation, it has clockwise or counterclockwise elliptical polarization, depending on whether the magnetic field of the earth has a positive or negative component in the same direction. The extraordinary wave is designated by the letter X and is called the X-wave. The other component is the ordinary wave, or O-wave.

**extra play**—Tape recording term. Originally, all recording tapes were 1.5-mils (38.1- $\mu$ m) thick, and a 7-inch (17.8-cm) reel would accommodate about 1200 feet (365 m) of this tape, for a half-hour of continuous recording at 7½ ips. The later extra-play tapes are 1-mil (25.4- $\mu$ m) thick and allow for 45 minutes of recording, or 15 minutes extra.

**extrapolate**—1. To estimate the value of a function for variables lying outside the range in which values of the function are known (e.g., to extend the graph of the function beyond the plotted points). 2. To estimate the values of a function that are less than or greater than those already known.

**extrapolation**—Estimating the future value of some data series based on past observations. Statistical forecasting represents a common example.

**extraterrestrial noise**—Radio disturbances originating from sources other than those related to the earth; cosmic or solar noise.

**extremely high frequency**—Abbreviated EHF.  
1. The frequency band extending from 30 to 300 GHz.  
2. Any of the radio frequencies in the band 30,000 to 300,000 MHz.

**extremely low frequency**—Abbreviated ELF. A frequency below 300 hertz.

**extrinsic base resistance**—The resistance between the base terminal of a transistor and the internal inaccessible base point in an equivalent circuit.

**extrinsic base resistance-collector capacitance product**—The product of the base resistance and collector capacitance of a transistor. It is expressed in units of time, since it is an RC time constant, and affects the high-frequency operation of a transistor.

**extrinsic conductance**—The conductance resulting from impurities or external causes.

**extrinsic detector**—A photodetector composed of semiconductor material whose responsive properties can be altered by the addition of impurities to the basic material. Copper and mercury-doped germanium are both examples of this semiconductor material.

**extrinsic photoconductivity**—Photoconductivity due to the addition of impurities or external causes.

**extrinsic properties**—The properties exhibited by a semiconductor as the result of its modification by imperfections and impurities in the crystal.

**extrinsic semiconductor**—1. A semiconductor with charge carrier concentration dependent on impurities or other imperfections. 2. The resulting semiconductor produced when impurities are introduced into an otherwise nonsemiconductor crystal. The electrical properties depend on the impurities. 3. A semiconductor whose electrical properties are dependent on impurities.

**extrinsic semiconductor material**—A semiconductor material with charge carrier concentration dependent on impurities or other imperfections.

**extrinsic transconductance**—The quotient of a small change in collector current divided by the small change in emitter-to-base voltage producing it, under the condition that other voltages remain unchanged. Thus, if an emitter-to-base voltage change of 0.1 volt causes a collector-current change of 3 milliamperes (0.003 ampere), with other voltages constant, the transconductance is 0.003 divided by 0.1, or 0.03 siemens. For convenience, a millionth of a siemens (which was formerly termed mho), or a microsiemens, is used to express transconductance. Thus, in the example, 0.03 siemens is 30,000 microsiemens.

**extruded cables**—Cables with conductors that are insulated and formed in a uniform configuration by the application of a homogeneous insulation material in a continuous extrusion process.

**extrusion**—A method of forcing plastic, rubber, or elastomer material through an orifice in a more or less continuous fashion to apply insulation or jacketing to a conductor or cable.

**eyelet**—A tubular metal piece having one end (and possibly a second) headed or rolled over at a right angle.

**E zone**—In the making of frequency predictions, one of three zones into which the earth is divided to show the variations of the F<sub>2</sub> layer with respect to longitude. This zone includes Asia, Australia, the Philippines, and Japan.

# F

**f**—1. Letter symbol for femto ( $10^{-15}$ ). 2. Symbol for focal length, frequency.

**F**—1. Symbol for filament, fuse. 2. Abbreviation for Fahrenheit. 3. Letter symbol for farad.

**F—(F-minus or F-negative)**—See A—(A-minus or A-negative).

**F+ (F-plus or F-positive)**—See A+ (A-plus or A-positive).

**fA**—Letter symbol for femtoampere ( $10^{-15}$  ampere).

**fabrication holes**—See pilot holes.

**fabrication tolerance**—In the construction or assembly of an equipment or portion of an equipment, the maximum variation in the characteristics of a part that, considering the defined variations of the other parts in the equipment, will permit the equipment to operate within specified performance limits.

**Fabry-Perot interferometer**—A resonant cavity bounded by two end mirrors separated so as to produce interference for certain allowed optical frequencies. The enhancements and cancellations produced by the internal reflections are, in fact, optical standing waves. The structure can be used as a laser cavity, mode filter, or frequency selector.

**face**—1. A plane surface on a crystal that stands in a particular and invariable relation to the axes and planes of reference and to other faces. 2. Front, or viewing, surface of a cathode-ray tube. 3. The portion of a meter bearing the scale markings.

**face bonding**—1. A method of attaching active devices to thin-film passive networks. The semiconductor chips are provided with small mounting pads turned face down and bonded directly to the end of the thin-film conductors on the passive substrate. The term includes ultrasonic, solder-reflow, and solder-ball techniques. 2. Process of bonding a semiconductor chip so that its circuitry side faces the substrate. Flip-chip and beam-lead bonding are two common methods. (Opposite of back bonding.)

**faced crystal**—A single or twinned mass of quartz bonded in part or entirely by the original growth faces.

**face-parallel cut**—A Y-cut for a quartz crystal.

**face-perpendicular cut**—An X-cut for a quartz crystal.

**facility**—1. A transmission path between two or more locations without terminating or signaling equipment. 2. Anything used or available for use in providing communication service; a communications path.

**facom**—A long-distance measuring or radionavigational system that derives information of distances by comparing the phases of received and locally generated signals. It is a base-line system operating in the low-frequency band and will work under adverse propagation and noise conditions at ranges of up to 3000 miles (4827 km) from the signal source.

**facsimile**—1. A process or the result of a process by which fixed graphic material, including pictures or images, is scanned and the information converted into electrical signal waves, which are used either locally or remotely to produce in record form a likeness (facsimile) of the subject copy. 2. Electronic transmission of photographs or documents over a telephone channel. 3. Technology that allows a paper message to be scanned optically, translated into digitally encoded pixels, and sent across the public telephone network to a receiving facsimile (fax) machine, or computer which then reconstructs the original image.

**facsimile broadcast station**—A station licensed to transmit images of still objects for reception by the general public.

**facsimile receiver**—An instrument designed to receive facsimile transmissions and translate them into a reproduced image.

**facsimile recorder**—Apparatus that reproduces on paper the image transmitted by a facsimile system.

**facsimile-signal level**—An expression of the maximum signal power or voltage created by a scanning of the subject copy as measured at any point in a facsimile system. According to whether the system employs positive or negative modulation, this will correspond to picture white or black, respectively. It may be expressed in decibels with respect to some standard value, such as 1 milliwatt or 1 volt.

**facsimile system**—An integrated assembly of the elements used for facsimile transmission and reception.

**facsimile transmitter**—An apparatus employed to convert the subject copy into suitable facsimile signals.

**factory calibration**—The tuning or altering of a circuit by the manufacturer to bring the circuit into specification. Normally stated as a percent deviation.

**fade**—1. The gradual lowering in amplitude of a signal. 2. A gradual change of signal strength. 3. To change the strength of a signal gradually. 4. Reducing signal level until it is largely attenuated or completely inaudible (faded away). Short fades occur almost immediately; long fades take from 5 to 30 seconds. Fades are most often done at the end of a recording.

**fade chart**—A graph of the null areas of an air-search radar antenna; it is used as an aid in estimating target altitude.

**fade in**—To increase the signal strength gradually in a sound or television channel.

**fade out**—1. The gradual decrease in signal strength in a sound or television channel. 2. The cessation or near cessation of radio-wave propagation through parts of the ionosphere due to a sudden atmospheric disturbance.

**fader**—1. A multiple-unit control used in radio for gradual changeover from one microphone or audio channel to another; in television, from one camera to another; and in motion-picture projection, from one projector to

another. 2. A control or group of controls for effecting fade in and fade out of video or audio signals.

**fading**—1. A drift in the level of received radio signals beyond intelligibility. It is often caused by changes in the upper atmosphere. 2. Variations in intensity of some or all components of a received (radio) signal due to changes in the propagation path. 3. Deliberate slow reduction of signal level by means of the volume control.

**fading margin**—The number of decibels of attenuation that can be added to a specified radio-frequency propagation path before the signal-to-noise ratio of the channel falls below a specified minimum.

**Fahnestock clip**—A spring-type terminal to which a temporary connection can readily be made.

**Fahrenheit temperature scale**—A temperature scale in which the freezing point of water is defined as 32° and the boiling point as 212° under normal atmospheric pressure (760 mm of mercury).

**fail hardover**—Failure that results in a steady-state maximum system output with no input signal.

**fail-safe**—1. Describing a circuit or device that fails in such a way as to maintain circuit continuity or prevent damage. 2. A feature of a system or device that initiates an alarm or trouble signal when the system or device either malfunctions or loses power. 3. A control system that either continues to function safely after a failure or lapses into a predefined condition known to be safe.

**fail-safe circuit**—A circuit that has an output state that indicates that either a circuit input or the circuit itself has failed. Finds circuit application in complex systems where self-healing subsystems exist. When a subsystem failure is detected, a backup subsystem is automatically inserted.

**fail-safe control**—A system of remote control for preventing improper operation of the controlled function in event of circuit failure.

**fail-safe operation**—An electrical system so designed that the failure of any component in the system will prevent unsafe operation of the controlled equipment.

**fail soft**—1. An active failure that can be compensated for by the system, or one in which the operator can safely assume control. 2. A method of system implementation that prevents irrecoverable loss of computer usage due to failure of any system resource. It provides for graceful degradation of service.

**fail-soft system**—A system in a computer that continues to process data despite the failure of parts of the system. Usually accompanied by a deterioration in performance.

**failure**—1. The inability of a system, subsystem, component, or part to function in the required or specified manner. 2. The termination of a capability of an item to perform its required function.

**failure-activating cause**—A stress or force (e.g., shock or vibration) that induces or activates a failure mechanism.

**failure analysis**—1. Examination of electronic parts to determine the cause of performance variations outside previously established limits, for the purpose of identifying failure modes and failure-activating causes. 2. The logical, systematic examination of an item or its diagram(s) to identify and analyze the probability, causes, and consequences of potential and real failures.

**failure indicator**—The observed characteristic that shows that an item is defective.

**failure mechanism**—1. A structural or chemical defect, such as corrosion, a poor bond, or surface inversion, that causes failure. 2. The process of degradation or chain of events that results in a particular failure mode. 3. The basic chemical or physical change that

results in a catastrophic, degradation, or intermittent failure. 4. Underlying physical or chemical phenomenon that causes a failure. *See* failure mode, 1.

**failure mode**—1. Also called failure mechanism. The manner in which a failure occurs, including the operating condition of the equipment or part at the time of the failure. 2. An electrical parameter that is sensitive to degradation and therefore is useful in the identification of failure mechanisms. 3. A catastrophic, degradation, or intermittent failure, usually in the form of opens, shorts, or parameters out of specification.

**failure rate**—Also called hazard. 1. The average proportion of units failing per unit of time, normally expressed in percent per thousand hours. It is used in assessing the life expectancy of a device. To be meaningful, a statement of the failure rate must be accompanied by complete information regarding the testing conditions, failure criteria, parameters monitored, and confidence level. 2. The statistical probability of the incidence of catastrophic failure in a large number of identical components operated continuously for a given period under stated environmental conditions. Usually expressed as maximum percentage of units predicted to fail under continuous service at maximum rated power (or voltage, if that limit is reached first) at a stated ambient temperature. 3. Expected number of failures in a given time interval under specified conditions.

**failure unit**—One failure in  $10^9$  device operating hours.

**fall-in**—In a synchronous motor, the point at which synchronous speed is reached.

**fallouts**—*See* transistor seconds.

**fall time**—1. The length of time during which a pulse is decreasing from 90 to 10 percent of its maximum amplitude. 2. A measure of time required for a circuit to change its output from a high level (1) to a low level (0). 3. The time required for the pointer of an electrical indicating instrument to move from a steady full-scale deflection to 0.1 ( $\pm$  specified tolerance) of full scale when the instrument is short circuited. 4. The time interval between the instants at which the magnitude of the pulse at the output terminals of a switching transistor reaches specified upper and lower limits, respectively, when the transistor is being switched from its conducting to its nonconducting state. The upper and lower limits are usually 90 and 10 percent, respectively, of the amplitude of the output pulse.

**false add**—To form a partial sum; that is, to perform an addition without carries.

**false alarm**—1. A radar indication of a detected target even though one does not exist. It is caused by noise or interference levels that exceed the set threshold of detection. 2. An alarm signal transmitted in the absence of an alarm condition. These may be classified according to causes: environmental, e.g., rain, fog, wind, hail, lightning, temperature; animals, e.g., rats, dogs, cats, insects; human-made disturbances, e.g., sonic booms, electromagnetic interference, vehicles; equipment malfunction, e.g., transmission errors, component failure; operator error; and unknown.

**false course**—In navigation normally providing one or more course lines, a spurious additional course-line indication due to undesired reflections or maladjusted equipment.

**false-echo device**—A device for producing an echo different from that normally observed.

**false statement**—A statement having a value of 0 in Boolean algebra.

**falsing**—Extraneous signal or signals that cause a decoding device to operate without the normal input of proper encoding signals.

**FAMOS**—Abbreviation for floating-gate avalanche-injection MOSFET. A type of MOSFET capable of long-term memory storage; used in EPROMs.

**fan**—1. The volume of space energized periodically by a radar beam(s) as it repeatedly traverses an established pattern. 2. An air-moving machine used to cool electronic circuitry in applications in which natural convection and radiation cooling are insufficient. Employed in electronics enclosures, fans are capable of moving air past the heat-radiation surfaces of the various active components or their associated heat sinks. The terms *fan* and *blower* are sometimes used interchangeably. In practice, however, the fan is a machine with an axially mounted impeller or fan blade, whereas the blower is one with a paddle-wheel-shaped impeller that draws air in at the side and exhausts it at the end. 3. An axial low-pressure device capable of providing high air flow parallel to the axis of the motor shaft. Available in several types, including the tube-axial with integral venturi porting and, in open construction, without venturi porting.

**fan antenna**—See double-V antenna.

**fan beam**—A field pattern having an elliptically shaped cross section in which the ratio of major to minor axes usually exceeds 3 to 1.

**fan-in**—1. The number of inputs that can be connected to a logic circuit. 2. The number of operating controls in a single device that individually or in combination result in the same output from the device. 3. Number of units that can be input-connected to a single similar unit.

**fan-in circuit**—A circuit that has many inputs feeding to a common point.

**fan marker**—A radio signal having a vertically directed fan beam that tells the pilot the location of his aircraft while flying along a radio range.

**fanned-beam antenna**—A unidirectional antenna so designed that transverse cross sections of the major lobe are almost elliptical.

**fanning beam**—A narrow antenna beam that is scanned repeatedly over a limited arc.

**fanning strip**—An insulated board, often made of wood, that spreads out the wires of a cable for distribution to a terminal board.

**fan-out**—1. The number of parallel loads within a given logic family that can be driven from one output mode of a logic circuit. 2. To spread a group of conductors, such as a cable end, apart so that each can be individually tested or identified. 3. The number of standard loads that can be driven by a circuit output in a logic family. A standard load is the current required to switch the basic gate of the family. 4. In a digital circuit, the number of other ICs that can be driven by the device. 5. The number of elements that can be operated in parallel from a single similar element. "Similar" in this case refers to operating parameters such as impedance and does not mean identical function devices.

**fan-out circuit**—A circuit that has a single output point that feeds many branches.

**"fantasy" decoder**—A type of descrambler used for satellite descrambling. It uses a 94-kHz sine-wave scrambling plus video inversion. Audio is encoded on a 15.7-kHz carrier that is one-sixth that of the scrambling sine wave. The 94-kHz sine wave is not an exact multiple of the scan rate, in general.

**farad**—The capacitance of a capacitor in which a charge of 1 coulomb produces a change of 1 volt in the potential difference between its terminals. The farad is the unit of capacitance in the mksa system.

**faraday**—A unit equal to the number of coulombs (96,500) required for an electrochemical reaction involving one electrochemical equivalent. In an electrolytic

process, 1 gram equivalent weight of matter is chemically altered at each electrode for 1 faraday of electricity passed through the electrolyte.

**Faraday cage**—See Faraday shield.

**Faraday dark space**—The relatively nonluminous region between the negative glow and the positive column in a glow-discharge cold-cathode tube. See also glow discharge.

**Faraday effect**—1. The rotation of the plane of polarization of radio waves as they pass through the ionosphere in the earth's magnetic field. This effect produces a decoupling loss between linearly polarized antennas. 2. The rotation of the plane of polarization that occurs when a plane-polarized beam of light passes through certain transparent substances in a direction parallel to the lines of force of a strong magnetic field. This effect also governs the action of a ferrite rotator in a waveguide.

**Faraday rotation**—1. Rotation of a signal's polarization caused by the atmosphere's E- and F-layers. 2. The apparent rotation of the plane of polarization of a linearly polarized wave as it passes through a medium (e.g., a ferrite material) that has a different propagation constant for each of the two component waves of opposite rotational sense.

**Faraday screen**—See Faraday shield.

**Faraday shield**—Also called Faraday screen or Faraday cage. 1. A network of parallel wires connected to a common conductor at one end to provide electrostatic shielding without affecting electromagnetic waves. The common conductor is usually grounded. 2. An electrostatic shield between input and output windings of a transformer. This is done to reduce capacitive coupling between the input and output of the power supply.

**Faraday's laws**—1. The mass of a substance liberated in an electrolytic cell is proportionate to the quantity of electricity passing through the cell. 2. When the same quantity of electricity is passed through different electrolytic cells, the masses of the substances liberated are proportionate to their chemical equivalents. 3. Also called the law of electromagnetic induction. When a magnetic field cuts a conductor, or when a conductor cuts a magnetic field, an electric current will flow through the conductor if a closed path is provided over which the current can circulate.

**faradic current**—An intermittent and nonsymmetrical alternating current, such as that obtained from the secondary winding of the induction coil.

**faradimeter**—An instrument for measuring electric capacitance.

**far-end crosstalk**—Crosstalk that travels along the disturbed circuit in the same direction as the signals in that circuit. To determine the far-end crosstalk between two pairs, 1 and 2, signals are transmitted on pair 1 at station A, and the crosstalk level is measured on pair 2 at station B.

**far field**—The space beyond the near field of an antenna, in which radiation is essentially confined to a fixed pattern, and power density along the axis of the pattern falls off inversely with the square of the distance.

**far-field region**—That region of the field of an antenna where the angular field distribution is essentially independent of the distance from the antenna.

**far-infrared radiation**—That radiation composed of the wavelengths falling between light and microwaves, ranging from 10 to 2000 micrometers. The portion of the infrared spectrum that contains the longest wavelengths.

**Farnsworth image-dissector tube**—A special cathode-ray tube for use in television cameras.

**far-ultraviolet radiation**—That radiation characterized by wavelengths ranging from 0.2 to 0.3 micrometer in the electromagnetic spectrum.

**far zone**—The region distant from a radio transmitting antenna in which the radiation field is stronger than the induction field and in which the intensity of the radiation field varies inversely with the square of the distance from the antenna.

**FAST**—Acronym for Fairchild advanced Schottky TTL (Fairchild Camera & Instrument Corp.). A family of high-speed TTL logic that uses very small, low-junction-capacitance transistors.

**fast-access storage**—In a computer memory or storage, the section from which information may be obtained most rapidly.

**fast answerback**—*See* calculator mode.

**fast automatic gain control**—A radar AGC method in which the response time is long compared with a pulse width, but short compared with the time on target.

**fastener**—A device used to secure a conductor (or other object) to the structure that supports it.

**fast forward**—1. The provision on a tape recorder permitting tape to be run rapidly through the recorder in the play direction, usually for search or selection purposes. 2. High-speed winding (shuttling) of tape from the supply reel onto the takeup reel.

**fast-forward control**—A tape-recorder control that permits running the tape through the machine rapidly in the forward direction.

**fast Fourier transform**—Abbreviated FFT. A computationally efficient mathematical technique that converts digital information from the time domain to the frequency domain for rapid spectral analysis. FFTs generally utilize a time-weighting function to compensate for data records with a noninteger number of samples.

**fast groove**—Also called fast spiral. In disc recording, an unmodulated spiral groove having a much greater pitch than the recorded grooves.

**fast-operate, fast-release relay**—A high-speed relay designed specifically for both short operate and short release times.

**fast-operate relay**—A high-speed relay designed specifically for short operate and long release times.

**fast-operate, slow-release relay**—A relay designed specifically for short operate and long release times.

**fast-release relay**—A high-speed relay designed specifically for short release but not short operate time.

**fast spiral**—*See* fast groove.

**fast time constant**—An antijamming device used in radar video-amplifier circuits. It differentiates incoming pulses so that only the leading edges of the pulses are used.

**fatal error**—An error that causes a program to abort.

**fatigue**—The weakening of a material under repeated stress.

**fault**—1. A defect in a wire circuit due to unintentional grounding, a break in the line, or a crossing or shorting of the wires. 2. A disturbance (such as lightning) that impairs normal operation. 3. A failure of a hardware or software component in a system that may lead to a system failure or error or some other manifestation that can be detected by a user. 4. An anomaly that prevents the correct operation of the device.

**fault current**—1. The current that may flow in any part of a circuit or amplifier under specified abnormal conditions. 2. The current in a circuit that results from loss of insulation between conductors or between a conductor and ground.

**fault dictionary**—A set of fault signatures, each of which indicates the probable faults that could cause the error message matching the signature.

**fault electrode current**—The peak current that flows through an electrode during a fault, such as an arcback or a load short circuit.

**fault finder**—A test set for locating troubles in a telephone system.

**fault indicator**—Equipment that provides an instantaneous alarm, both visual and audible, of failures detected in the various components of its assorted equipment.

**fault isolation**—1. The process of identifying and locating failures in a unit under test. 2. Determining the cause of a test failure, typically by identifying a defective component or process failure on a board.

**fault-isolation resolution**—The average number of components to which a fault can be isolated.

**fault model**—A set of data that logically describes the operations of a device or circuit containing one or more faults.

**fault signature**—1. Data representing the outputs of a known good unit and used to compare against outputs of a unit under test. 2. A particular output response or set of responses generated when a test program is executed on a device containing a fault. A typical fault signature consists of the incorrect output pin numbers and the test step number at which a test program first detects a fault.

**fault simulation**—The process of injecting faults during a simulation run to determine the test comprehensiveness of an input pattern.

**fault-tolerant**—Refers to a computer program or system in which some parts may fail and the program or system will still execute properly.

**fault-tolerant circuits**—Circuits that are designed so that they could continue to function properly even though part of the circuit failed.

**Faure plate**—A storage-battery plate consisting of a conductive lead grid filled with active paste material.

**fax or FAX**—1. Abbreviation for facsimile. 2. A scanner/printer combination that transmits text and graphics over telephone lines. It uses CCITT Group 3 data compression techniques. Small paper documents can be transmitted over long distances very quickly, but the information is not represented as structured data elements, as in EDI.

**fax modem**—A device connected to a personal computer, giving it the ability to send or receive electronic messages or images over telephone lines.

**fc**—Letter symbol for footcandle.

**FCC**—Abbreviation for Federal Communications Commission.

**F-connector**—A small, metallic, male-type connecting device with internal threads that attach to the end of a coaxial cable to secure and electrically connect the coax to a female F-fitting. The internal threads of the male connector screw onto the external threads of the female connector.

**F/D**—*See* focal distance-to-diameter ratio.

**FDDI**—*See* fiber distributed data interface.

**F-display**—Also called F-scan or F-scope. In radar, a rectangular display in which a target appears as a centralized blip when the radar antenna is aimed at it. Horizontal and vertical aiming errors are indicated by the horizontal and vertical displacement of the blip.

**FDM**—*See* frequency-division multiplexer and frequency-division multiplexing.

**FDMA**—Abbreviation for frequency-division multiple access. A method of sharing the capacity of a satellite transponder by assigning each earth terminal a portion of the transponder's bandwidth, into which the terminal

places a carrier modulated by its information. The carrier can be received by all other earth terminals.

**FDX** — See full duplex.

**feasibility study** — An investigation of the advantages and disadvantages of using an alternative approach over the presently used approach.

**FEC** — Abbreviation for forward error correction.

1. Used to describe equipment that corrects transmission errors at a receiver. The technique provides for transmission of additional information with the original bit stream so that if an error is detected, the receiver can recreate the correct information without a retransmission. 2. A system of data transmission in which redundant bits generated at the transmitter are used at the receiving terminal to detect, locate, and correct any transmission errors before delivery to the data sink. The advantage of this system is that it does not require a feedback channel; therefore, it can be used with a one-way transmission system.

**Federal Communications Commission** — Abbreviated FCC. A U.S. federal government agency made up of a board of seven commissioners appointed by the president under the Communications Act of 1934, having the power to regulate all interstate and foreign radio communication originating in the United States, including radio, television, facsimile, telegraph, telephone, and cable systems.

**federal telecommunications system** — System of commercial telephone lines, leased by the government, for use between major government installations for official telecommunications.

**feedback** — 1. In a transmission system or a section of it, the returning of a fraction of the output to the input. 2. In a magnetic amplifier, a circuit connection by which an additional magnetomotive force (which is a function of the output quantity) is used to influence the operating condition. 3. In a control system, the signal or signals returned from a controlled process to denote its response to the command signal. Feedback is derived from a comparison of actual response to desired response, and any variation is used as an error signal combined with the original control signal to help attain proper system operation. Systems employing feedback are termed closed-loop systems; feedback closes the loop. 4. Squeal or howl from a speaker caused by speaker sound entering microphone of same recorder or amplifier. 5. The return of a portion of the output of a circuit or device to its input. With positive feedback, the signal fed back is in phase with the input and increases amplification, but may cause oscillation. With negative feedback, the signal is 180° out of phase with the input and decreases amplification but stabilizes circuit performance and tends to lower an amplifier's output impedance, improve signal stability, and minimize noise and distortion. 6. The process of coupling some of the output of an amplifier back to its input. Negative feedback reduces the gain of an amplifier, but has compensating beneficial results. Positive feedback can be used to boost

gain (regeneration), but usually results in oscillation. 7. The flow of information back into the control system so that actual performance can be compared with planned performance. 8. The transfer of a portion of energy from one point in an electrical system to a preceding point. The transfer may be either electrical or acoustical.

**feedback admittance** — In an electron tube, the short-circuit transadmittance from the output electrode to the input electrode.

**feedback amplifier** — An amplifier that uses a passive network to return a portion of the output signal to modify the performance of the amplifier.

**feedback attenuation** — In the feedback loop of an operational amplifier, an attenuation factor by which the output voltage is attenuated to produce the input error voltage.

**feedback circuit** — A circuit that permits feedback in an electronic device.

**feedback compensation** — The placement of a device, or an additional circuit, into a feedback control system to improve its response in relation to a specific characteristic of a system.

**feedback control** — 1. A type of system control obtained when a portion of the output signal is operated upon and fed back to the input in order to obtain a desired effect. 2. An automatic means of sensing speed variations and correcting to maintain a constant speed or close speed regulation. 3. Guidance technique used by robots to bring the end effector to a programmed point.

**feedback control loop** — A closed transmission path that includes an active transducer and consists of a forward path, a feedback path, and one or more mixing points arranged to maintain a prescribed relationship between the loop input and output signals.

**feedback control signal** — That portion of the output signal that is returned to the input in order to achieve a desired effect, such as fast response.

**feedback control system** — 1. A control system comprising one or more feedback control loops; it combines the functions of the controlled signals and commands, tending to maintain a prescribed relationship between the two. 2. A system designed to control the output quantity of a device by returning a portion of its output signal back to its input. This results in the manipulation of the input quantity so that the desired relationship between the input and output signals can be maintained.

**feedback cutter** — An electromechanical transducer that performs like a disc cutter except it is equipped with an auxiliary feedback coil in the magnetic field. Signals exciting the cutter are induced into the feedback coil, the output of which is fed back in turn to the input of the cutter amplifier. The result is a substantially uniform frequency response.

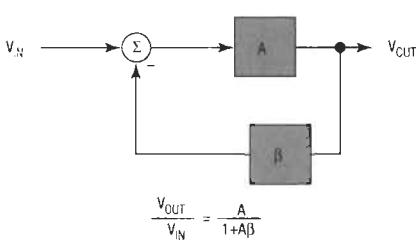
**feedback diode** — See freewheeling diode.

**feedback loop** — The components and processes involved in using part of the output as an input for correction or control of the operation of a system.

**feedback oscillator** — An oscillating circuit, including an amplifier, in which the output is coupled in phase with the input. The oscillation is maintained at the frequency determined by the parameters of the amplifier and the feedback circuits, such as  $LC$ ,  $RC$ , and other frequency-selective elements.

**feedback path** — In a feedback control loop, the transmission path from the loop output signal to the loop feedback signal.

**feedback regulator** — A feedback control system that tends to maintain a prescribed relationship between certain system signals and other predetermined quantities.



Feedback.

**feedback sense voltage**—The voltage, referred to ground, on the feedback terminal of a regulator while it is operating in regulation.

**feedback transfer function**—In a feedback control loop, the transfer function of the feedback path.

**feedback winding**—In a saturable reactor, the control winding to which a feedback connection is made.

**feeder**—1. A conductor or group of conductors connecting two generating stations, two substations, a generating station and a substation or feeding point, a substation and a feeding point, or a transmitter and antenna. 2. A set of conductors between a main distribution center and secondary ones. A radial feeder supplies energy from one source to a substation or a feeding point that does not receive energy from any other source. The normal flow of energy in such a feeder is in one direction only. 3. The circuit conductors between the service equipment and the branch circuit overcurrent device. 4. A transmission line between an antenna and a radio transmitter or receiver.

**feeder cable**—Also called trunk cable. 1. A communication cable extending from the central office along a primary route (main feeder cable), or from a main feeder cable along a secondary route (branch feeder cable), and providing connections to one or more distribution cables. 2. In a CATV system, the transmission cable from the head end (signal pickup) to the trunk amplifier.

**feeder link**—A radio link between an earth station and a satellite, conveying information for a space radio-communication service other than a fixed-satellite service. In the broadcasting-satellite service, all feeder links are uplinks (from the earth to the satellite), but in the mobile-satellite service, feeder links can be both uplinks and downlinks.

**feed-forward**—A frequency-compensation technique in operational amplifiers. A small-value capacitor is used to bypass a gain stage that has poor performance at high frequency.

**feed function**—In automatic control of machine tools, the relative motion between the work and the cutting tool (excluding the motion provided for removal of material).

**feed holes**—A series of small holes in perforated paper tape that convey no information, but are solely for the purpose of engaging the feed pawls or sprocket that transports the tape over the sensing pins of various reading devices.

**feedhorn**—1. A satellite TV receiving antenna component mounted at the focal point of a parabolic dish that collects the signal reflected from the main surface reflector and channels this signal into the low-noise amplifier (LNA). 2. A device that collects microwave signals reflected from the surface of an antenna. It is mounted at the focus of all prime focus parabolic antennas.

**feed pitch**—The distance between the centers of adjacent feed holes in a tape.

**feed reel**—Also called stock, supply, or storage reel. On a tape recorder, the reel from which the tape unwinds while playing or recording.

**feedthrough**—1. The accidental or unintentional transfer of a signal from one track to another on a multitrack tape. 2. The use of special connectors to pass conductors through bulkheads or panels. Contacts can be male on one side and female on the other, or they can be male on both sides or female on both sides. Feedthrough connectors differ from rack-and-panel types in that connection can be made on both sides of the panel. 3. A conductor through the thickness of a substrate, thereby electrically connecting both surfaces. 4. The change in the output voltage of a sample/hold circuit in the hold mode caused by a voltage change in the input. Measured in decibels of attenuation.

## feedback sense voltage — ferret reconnaissance

**feedthrough capacitor**—1. A feedthrough insulator that provides a desired value of capacitance between the feedthrough conductor and the metal chassis or panel through which the conductor is passing. Used chiefly for bypass purposes in UHF. 2. A coaxial capacitor with a central current-carrying conductor, or a conductor connected with a current-carrying rod surrounded by a capacitor element, that is symmetrically bonded to the center conductor and to the outer casing to form a coaxial construction.

**feedthrough insulator**—A type of insulator that permits wire or cable to be fed through walls, etc., with minimum current leakage.

**feed-thru connection**—See thru-hole connection.

**female**—Pertaining to the recessed portion of a device into which another part fits.

**female contact**—A contact located in an insert or body in such a manner that the mating contact is inserted in the unit. This is similar in function to a socket contact.

**femto**—Prefix meaning  $10^{-15}$ . Letter symbol: f.

**femtoampere**—A unit of current equal to  $10^{-15}$  ampere. Letter symbol: fA.

**femtovolt**—A unit of voltage equal to  $10^{-15}$  volt. Letter symbol: fV.

**fence**—1. A line or system of early-warning radar stations. 2. A concentric steel fence placed around a ground radar transmitting antenna to act as an artificial horizon and suppress ground clutter that would otherwise mask weak signals returned from a target at a low angle.

**fence alarm**—Any of several types of sensors used to detect the presence of an intruder near a fence or any attempt by an intruder to climb over, go under, or cut through the fence.

**Fermi-Dirac distribution**—A mathematical description of the way in which the current carriers present in a crystalline material have energies distributed above and below the Fermi level; this distribution is a function of the excitation of the material.

**Fermi level**—The value of electron energy at which the Fermi distribution function is one-half. The average carrier level of a semiconductor region. Hence, a semiconductor crystal in equilibrium has a constant Fermi level throughout.

**ferpic**—Ferroelectric ceramic picture device. A sandwichlike structure made up of transparent electrodes, a photoconductive film, and a thin plate of fine-grained ferroelectric ceramic. The device stores images in the form of a variation of the birefringence of the ceramic plane (that is, as a variation in the way the plate transmits polarized light).

**ferreed**—An electromechanical switch that combines the rapid switching of bistable magnetic material with metallic contacts to produce output indications that persist as long as desired without further application of power. Describes any relay whose contact assembly of individual magnetic reeds is sealed in an evacuated glass tube, operated by an external winding. When operated, it is held by magnetism until released by a current pulse.

**ferret**—An aircraft, ship, or vehicle especially equipped for ferret reconnaissance.

**ferret reconnaissance**—A form of reconnaissance that detects, locates, and analyzes enemy radars. It is a passive technique that listens for signals transmitted by enemy radars and thus cannot be jammed. The maximum effective range is limited only by the radio horizon. Ferret systems flown at altitudes of a few miles can accurately locate and analyze radars 300 miles (483 km) away. Ferret is an all-weather reconnaissance technique, and no camouflage system works against a properly designated ferret.

**ferri-**—Prefix indicating a material having a net dipole moment.

**ferric oxide ( $\text{Fe}_2\text{O}_3$ )**—A red, iron oxide coating for magnetic recording tapes.

**ferrimagnetic amplifier**—A microwave amplifier utilizing ferrite material in the coupling inductors and transformers.

**ferrimagnetic limiter**—A power limiter used to replace rf tubes in microwave systems. Its operation is based on a ferrimagnetic material, such as a piece of ferrite or garnet, that exhibits nonlinear properties.

**ferrimagnetic materials**—Those materials in which spontaneous magnetic polarization occurs in nonequivalent sublattices; the polarization in one sublattice is aligned antiparallel to the other.

**ferrimagnetism**—A type of magnetism that, because the magnetic moment of neighboring ions tends to align antiparallel, appears microscopically similar to antiferromagnetism. The fact that these moments may be of different magnitudes allows a large resultant magnetization that macroscopically resembles ferromagnetism.

**ferristor**—A two-winding ferroresonant magnetic amplifier that operates on a high carrier frequency. A two-winding saturable reactor that may be connected as a coincidence gate, current discriminator, free-running multivibrator, oscillator, or ring counter.

**ferrite**—1. Also called ferrospinel. A powdered, compressed, and sintered magnetic material having high resistivity, consisting chiefly of ferric oxide combined with one or more other metals. The high resistance makes eddy-current losses extremely low at high frequencies. Examples of ferrite compositions include nickel ferrite, nickel-cobalt ferrite, manganese-magnesium ferrite, yttrium-ion garnet, and single-crystal yttrium-ion garnet. 2. The generic term for a class of nonmetallic, ceramic, ferromagnetic materials ( $M\text{Fe}_2\text{O}_4$ ) having a spinel-crystal structure. The materials are noted for their high resistivity relative to ferromagnetic metals. Although in its simplest form the M in the formula is iron (Fe), iron is seldom used in actual ferrite manufacture. Manganese, nickel, zinc, magnesium, or copper are more common, and  $\text{MnZn}$ ,  $\text{NiZn}$ , and  $\text{MgZn}$  are the most popular combinations.

**ferrite bead**—A magnetic device for storage of information. It is made of ferrite powder mixtures in the form of a bead fired on the current-carrying wires of a memory matrix.

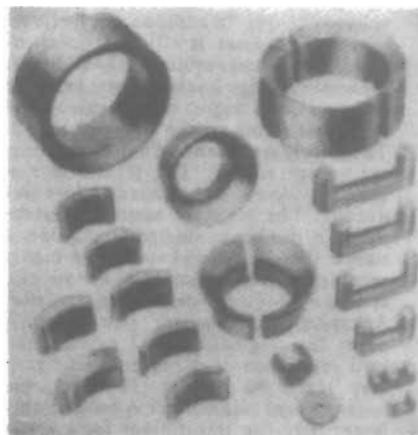
**ferrite circulator**—A nonreciprocal microwave network that transmits power from one terminal to another in sequence. Can replace a conventional duplexer, provide isolation of transmitter from receiver, eliminate the requirement for an atr, and isolate the transmitter from antenna reflections.

**ferrite core**—A core made from iron and other oxides and usually shaped like a doughnut. It is used in circuits and magnetic memories and can be magnetized and demagnetized very rapidly.

**ferrite-core memory**—A magnetic memory in which read-in and read-out wires are threaded through a matrix of very small toroidal cores molded from a square-loop ferrite.

**ferrite isolator**—A device either in a waveguide or coax that allows power to pass through in one direction with very little loss, while the rf power in the reverse direction is absorbed. It is useful for maintaining signal source stability and eliminating long-line and frequency-pulling effects in all types of low-power microwave signal sources.

**ferrite limiter**—A passive low-power microwave limiter that provides an insertion loss of less than 1 dB, with minimum phase distortion, when operating in its



Ferrite cores.

linear range. It is used for protecting sensitive receivers from burnout and from blocking by a strong interfering signal.

**ferrite phase-differential circulator**—A combination microwave duplexer and load isolator that serves as a switching device between a radar antenna and the associated high-power radar magnetron and radar receiver.

**ferrite-rod antenna**—Also called ferrod or loopstick antenna. An antenna used in place of a loop antenna in a radio receiver. It consists of a coil wound around a ferrite rod.

**ferrite rotator**—A gyrator, composed of a ferrite cylinder surrounded by a ring-type permanent magnet, that is inserted in a waveguide to rotate the plane of polarization of electromagnetic waves that travel through the waveguide.

**ferrites**—1. Chemical compounds of iron oxide and other metallic oxides combined with ceramic material. They have ferromagnetic properties but are poor conductors of electricity. Hence, they are useful where ordinary ferromagnetic materials (which are good electrical conductors) would cause too great a loss of electrical energy. 2. Ceramic structures made by mixing iron oxide ( $\text{Fe}_2\text{O}_3$ ) with oxides, hydroxides, or carbonates of one or more of the divalent metals, such as zinc, nickel, manganese copper, cobalt, magnesium, cadmium, or iron.

**ferrite switch**—A ferrite device that obstructs the flow of energy through a wavelength by causing a 90° rotation of the electric field vector.

**ferroacoustic storage**—A delay-line type of storage comprising a thin tube of magnetostrictive material, a central conductor that passes through the tube, and an ultrasonic driver transducer at one end of the tube.

**ferrod**—See ferrite-rod antenna.

**ferrodynamic instrument**—An electrodynamic instrument in which the measuring forces are materially increased by the presence of ferromagnetic material.

**ferroelectric**—1. Pertaining to a phenomenon exhibited by certain materials in which the material is polarized in one direction or the other or reversed in direction by the application of a positive or negative electric field of magnitude greater than a certain amount. The material retains the electric polarization unless it is disturbed. The polarization can be sensed by the fact that a change in the field induces an electromotive force that can cause a current. 2. That property of certain materials that determines that they will be polarized in one direction or the other, or reversed in direction of polarization when a positive or

negative electric field is applied. The material will remain ferroelectric until it is disturbed.

**ferroelectric converter**—A device that generates high voltage when heat is applied to it. Its operation is based on the change in the dielectric constant or the permittivity of certain materials, such as barium titanate, when heated. This change reaches maximum at the Curie point.

**ferroelectric crystal**—A crystal that can be polarized in the opposite direction by applying an electric field weaker than the breakdown strength of the material.

**ferroelectric domain**—The region of a ferroelectric crystal where spontaneous polarization is uniformly directed.

**ferroelectric film**—A film in which electric polarization is reversible when influenced by an electric field.

**ferroelectricity**—A property of certain crystalline materials whereby they exhibit a permanent, spontaneous electric polarization (dipole moment) that is reversible by means of an electric field; the electric analog of ferromagnetism. Materials that show this effect are piezoelectric as well.

**ferroelectric materials**—Those materials in which the electric polarization is produced by cooperative action between groups or domains of collectively oriented molecules.

**ferroelectrics**—Pyroelectric materials whose direction of polarization can be reversed by application of an electric field.

**ferromagnetic**—Pertaining to a phenomenon exhibited by certain materials in which the material is polarized in one direction or the other or reversed in direction by the application of a positive or negative magnetic field of magnitude greater than a certain amount. The material retains the magnetic polarization unless it is disturbed. The polarization can be sensed by the fact that a change in the field induces an electromotive force that can cause a current.

**ferromagnetic amplifier**—A parametric amplifier based on the nonlinear behavior of ferromagnetic resonance at high rf power levels. In one version, microwave pumping power is supplied to a garnet or other ferromagnetic crystal mounted in a cavity containing a strip line. A permanent magnet provides sufficient field strength to produce gyromagnetic resonance in the garnet at the pumping frequency. The input signal is applied to the crystal through the strip line, and the amplified output signal is extracted from the other end of the strip line. Sometimes incorrectly called a garnet maser, but the operating principle differs from that of the maser.

**ferromagnetic material**—1. A material having a specific permeability greater than unity, the amount depending on the magnetizing force. A ferromagnetic material usually has relatively high values of specific permeability, and it exhibits hysteresis. The principal ferromagnetic materials are iron, nickel, cobalt, and certain of their alloys. 2. A paramagnetic material that exhibits a high degree of magnetizability. 3. A material that exhibits hysteresis phenomena and whose permeability, greater than 1, is dependent on the magnetizing field.

**ferromagnetic oxide parts**—Parts consisting primarily of oxides that display ferromagnetic properties.

**ferromagnetic resonance**—A condition under which the apparent permeability of a magnetic material reaches a sharp maximum at a microwave frequency.

**ferromagnetics**—The science that deals with the storage of information and the control of pulse sequences through use of the magnetic polarization properties of materials.

**ferromagnetic tape**—Tape made of magnetic material and used for winding closed cores for toroids and transformers.

**ferromagnetism**—1. A high degree of magnetism in ferrites and similar compounds. The magnetic moments of neighboring ions tend not to align parallel with each other. The moments are of different magnitudes, and the resultant magnetization can be large. 2. Strong magnetic property of such substances as iron, cobalt, nickel, and certain alloys. Ferromagnetic substances are essential to the construction of such pieces of equipment as speakers, transformers, electric generators, etc. 3. A property of certain metals, alloys, and compounds whereby below a certain critical temperature (the Curie point) the magnetic moments of the atoms tend to align, giving rise to a spontaneous permanent magnetism (dipole moment) that is reversible by means of a magnetic field. 4. The properties of certain materials that cause them to have relative permeabilities that exceed unity. This permeability permits the materials to exhibit hysteresis.

**ferromanganese**—An alloy of iron and manganese.

**ferrometer**—An instrument for making permeability and hysteresis tests of iron and steel.

**ferroresonance**—Resonance associated with circuits in which at least one of the circuit elements is nonlinear and contains iron.

**ferroresonant circuit**—A resonant circuit in which one of its elements is a saturable reactor.

**ferroresonant transformer**—1. A voltage-regulating device that gives regulated ac voltages and incorporates some special advantages. Capable of acting as a step-up or step-down voltage transformer as well as an ac voltage regulator, this component delivers a more or less constant ac output voltage even if the magnitude of the input voltage changes. In addition, the ferroresonant transformer is efficient, inexpensive, rugged, and requires no heat sink. It generates no high levels of electrical noise and provides a degree of protection from transients riding on the ac power line. 2. The principal elements of a constant-voltage power supply. The transformer is specially wound to be tuned to line frequency. The resonant condition established is the key to its operation. Only a simple filter is needed to form a highly reliable and very efficient power supply. It does not require a dissipative regulator. A typical ferroresonant power supply offers line regulation of 2 percent and load regulation of 5 percent; efficiency may reach 80 percent. However, the ferroresonant transformer is considerably larger than the transformer for a linear supply and may be twice as heavy.

**ferrospinel**—A ceramic-like material containing iron and other elements combined with oxygen. A poor conductor of electricity, it is used in transformers, antenna, loops and television deflecting yokes. *See also ferrite.*

**ferrous**—Composed of and/or containing iron. A ferrous metal exhibits magnetic characteristics, as opposed to a nonferrous metal, such as aluminum, which does not.

**ferrous oxide**—The substance on magnetic recording disks and tapes. It can be magnetized, thereby permitting information to be recorded on it magnetically.

**ferrule**—1. A short tube used to make solderless connections to shielded or coaxial cable. Also molded into the plastic inserts of multiple-contact connectors to provide strong, wear-resistant shoulders on which contact retaining springs can bear. 2. The metal cap around the end of a cartridge-fuse tube that serves as a contact for the fuse.

**ferrule resistor**—A resistor having ferrule terminals for mounting in standard fuse clips.

**FET**—Abbreviation for field-effect transistor. Also called unipolar transistor. 1. A transistor controlled by

voltage rather than current. The flow of working current through a semiconductor channel is switched and regulated by the effect of an electric charge in a region close to the channel called the gate. A FET has either p-channel or n-channel construction. 2. A transistor whose internal operation is unipolar in nature. The metal-oxide semiconductor FET (MOSFET) is widely used in integrated circuits because the devices are very small and can be manufactured with few steps. 3. A solid-state device in which current is controlled between source terminal and drain terminal by voltage applied to a nonconducting gate terminal. 4. Semiconductor device in which resistance between source and drain terminals is modulated by a field applied to the third (gate) terminal.

**fetal cardiotachometer**—See fetal monitor.

**fetal electrocardiograph**—See fetal monitor.

**fetal monitor**—An instrument that displays or records the fetal electrocardiogram or other indication of heart action. In some instruments, the maternal electrocardiogram is recorded simultaneously. The instrument may be referred to more definitely as a fetal electrocardiograph, fetal cardiotachometer, or fetal phonocardiograph, depending on its primary purpose.

**fetal phonocardiograph**—An instrument that provides continuous instantaneous recording of beat-to-beat changes in the fetal heart rate. *See also* fetal monitor.

**fetch**—1. To go after and return with things. In a microprocessor, the “objects” fetched are instructions that are entered in the instruction register. The next, or a later, step in the program will cause the machine to execute what it was programmed to do with the fetched instructions. Often referred to as an instruction fetch. 2. In a computer, the collective actions of acquiring a memory address and then an instruction or data byte from memory. 3. Reading out an instruction at a particular memory location into the CPU. 4. To obtain a quantity of data from a place of storage. 5. The action of obtaining an instruction from a stored program and decoding that instruction. Also refers to that portion of a computer’s instruction cycle during which that action is performed.

**fetch cycle**—The first cycle in the fetch-decode-execute sequence of instruction execution. During the fetch cycle, the contents of the program counter are placed on the address bus, a read signal is generated, and the program counter is incremented. The data word coming from the memory (the instruction that has been fetched) will then be gated into the instruction register of the control unit.

**FET resistor**—A field-effect transistor in which, generally, the gate is tied to the drain, and the resultant structure is used in place of a resistor load for a transistor.

**“f” factor**—The slope of the straight line from which the nonlinearity of a displacement transducer is calculated in microvolts output per volt excitation per unit stimulus.

**FFC**—Abbreviation for flat flexible cable.

**FFT**—Abbreviation for fast Fourier transform.

**fiber**—1. A tough insulating material, generally of paper and cellulose, compressed into rods, sheets, or tubes. 2. A clear glass or plastic optical cable, consisting of a core and cladding, designed to propagate optical energy. The diameter of a fiber can vary from about 10 to 1000 micrometers, depending on type. 3. Glass, silica, or plastic cable by which light is conducted or transmitted. Can be multimode (capable of propagating more than one mode of given wavelength) or single mode (one that supports propagation of only one mode of given wavelength). 4. A thread or threadlike structure such as composes cellulose, asbestos, or glass yarn. Also, a single discrete element used to transmit optical (light-wave) information. Analogous to a single wire used to transmit electrical information. Usually consists of a core

that transmits the information and a cladding around the core. 5. The material path along which light propagates; a single discrete optical transmission element.

**fiber bundle**—1. A consolidated group of single fibers used to transmit a single optical signal. 2. A rigid or flexible concentrated assembly of glass or plastic fibers used to transmit optical images or light. *See* coherent fiber bundle. 3. An assemblage of transparent glass fibers all bundled together parallel to one another. The length of each fiber is much greater than its diameter. By a process of total reflection, this bundle of fibers can transmit a picture from one of its surfaces to the other around curves and into otherwise inaccessible places with an extremely low loss of definition and light.

**fiber cable**—A cable composed of a fiber bundle or a single fiber, strength members, and a cable jacket.

**fiber dispersion**—In fiber optics, pulse spreading in a fiber caused by differing transit times of various modes of electromagnetic waves.

**fiber distributed data interface**—Abbreviated FDDI. A standard for transmitting data on optical fiber cables at a rate of around 100,000,000 bits per second (10 times as fast as Ethernet and about twice as fast as T-3).

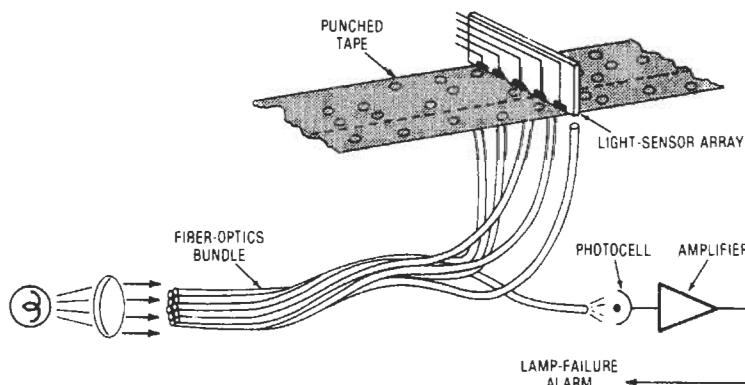
**fiber metallurgy**—The growing of superfine crystal whiskers whose characteristic is relatively great strength in their length-to-diameter ratio.

**fiber needle**—A playback point or phonograph needle made from fiber. Being softer than a metal or diamond needle, it is less scratchy; however, it has an extremely short life.

**fiber-optic field flattener**—A plate consisting of fused optical fibers with both surfaces ground and polished, and having the entrance surface curved to match the image curvature of the input system. The plate transmits to the flat exit surface.

**fiber-optic rod multiplexer-filter**—A graded-index, cylindrically shaped section of optical fiber or rod with a length corresponding to the pitch of the undulations of light waves caused by the graded refractive index, the light beam being injected via fibers at an off-axis end point on the radius, with the undulations of the resulting wave varying periodically from one point to another along the rod with interference layers at the  $\frac{1}{4}$ -pitch point of the undulations, providing for multiplexing or filtering.

**fiber optics**—Abbreviated FO. 1. A technology that uses light as a digital information carrier. The transmission medium is made up of small strands of glass, each of which provides a path for light rays that carry the data signal. Fiber-optic technology offers large bandwidth, very high security, and immunity to electrical interference. The glass-based transmission facilities also occupy far less space than other high-bandwidth media, which is a major advantage in crowded underground ducts. 2. Also called optical fibers or optical fiber bundles. An assemblage of transparent glass fibers all bundled together parallel to one another. The length of each fiber is much greater than its diameter. This bundle of fibers has the ability to transmit a picture from one of its surfaces to the other around curves and into otherwise inaccessible places with an extremely low loss of definition and light, by a process of total reflection. 3. The technique of conveying information in the form of light signals through a particular configuration of glass or plastic fibers. 4. A general term describing a light-wave or optical communications system. In such a system, electrical information is converted to light energy, transmitted to another location through optical fibers, and is there converted back into electrical information. 5. A method of communicating analog or digital signals through a noninductive/nonconductive dielectric medium such as glass- or plastic-core cables. The fiber-optic system consists of a light source and

*Fiber optics.*

light detector, cable-to-semiconductor connectors, and the fiber-optic cable. The transmitter converts the input signal to an analog- or digital-modulated light signal that is communicated through the fiber-optic cable to a light detector. The light detector converts the optical energy back into usable electric form. 6. The technology of guidance of optical power, including rays and waveguide modes of electromagnetic waves, along conductors of electromagnetic waves in the visible and near-visible region of the frequency spectrum, specifically when the optical energy is guided to another location through thin transparent strands. Techniques include conveying light or images through a particular configuration of glass or plastic fibers. Incoherent optical fibers will transmit light, as a pipe will transmit water, but not an image. Coherent optical fibers can transmit an image through perfectly aligned, small (10–12 micrometers) clad optical fibers. Specialty fiber optics combine coherent and incoherent aspects.

**fiber-optics bundles**—1. Assemblies of optical fibers. 2. Very fine transparent glass or plastic threads, each of which transmits light.

**fiber-optic scanner**—A scanner in which a fiber-optic assembly replaces a lens system.

**fiber-optics computer interconnection**—A means of connecting a computer with a terminal or another computer to transmit electrical signals via fiber-optics cable instead of wire.

**fiber-optics multiport coupler**—An optical unit, such as a scattering or diffusion solid "chamber" of optical material, that has at least one input and two outputs, or at least two inputs and one output, that can be used to couple various sources to various receivers. The ports are usually optical fibers. If there is only one input and one output port, it is simply a connector.

**fiber-optics probe**—A flexible probe made up of a bundle of fine glass fibers optically aligned to transmit an image, light, or both.

**fiber-optics scrambler**—1. Similar to a fiberscope except that the middle section of loose fiber is deliberately disoriented as much as possible, then potted and sawed. Each half is then capable of coding a picture, which can be decoded by the other half. 2. A device used for coding messages that has a fiber bundle that is aligned at both ends and scrambled in the middle. The resulting halves of the bundles serve as encoders or decoders and the message appears as a random scattering of black dots.

**fiber-optics splice**—A nonseparable junction joining one optical conductor to another.

**fiber-optics system**—A light source and light detector; transmitter and receiver; and fiber-optic cable with connectors. The transmitter converts the encoded

input signal to dc current that is converted to light energy by the light-emitting diode. This light energy is coupled from the LED into the fiber-optic cable with connectors and is then transmitted through the cable, which is connected to a light detector such as a photodiode (PIN diodes), phototransistor, or Darlington phototransistor. These devices detect the light energy and convert it to a current that may be amplified and decoded to faithfully reproduce the original input signal.

**fiber-optics terminus**—A device used to terminate an optical conductor that provides a means to locate and contain an optical conductor within a connector.

**fiber-optics transmission system**—Abbreviated FOTS. A transmission system utilizing small-diameter transparent fibers through which light is transmitted. Information is transferred by modulating the transmitted light. These modulated signals are detected by light-sensitive devices, such as photodetectors.

**fiber-optics waveguide**—A relatively long, thin strand of transparent substance, usually glass, capable of conducting an electromagnetic wave of optical wavelength (visible or near-visible region of the frequency spectrum) with some ability to confine longitudinally directed, or near-longitudinally directed, light waves to its interior by means of internal reflection.

**fiber scattering**—In an optical fiber, the coupling, or leaking, of light-wave power out of the core of the fiber by Rayleigh scattering or guide imperfections such as dielectric strain, compositional or physical discontinuities in the core or cladding, irregularities and extraneous inclusions in the core-cladding interface, curvature of the optical axis, or tapering. Scattering losses are measured in all directions as an integrated effect and expressed in decibels per kilometer.

**fiberscope**—Optical glass fibers, when systematically arranged in a bundle, transmit a full-color image that remains undisturbed when the bundle is bent. By mounting an objective lens on one end of the bundle, and an eyepiece at the other, the assembly becomes a flexible fiberscope that can be used to view objects that would be inaccessible for direct viewing.

**fibrillation**—A result of loss of synchronization of the heart muscle, causing the individual muscle fibers to contract in a random, uncoordinated sequence. As a result, the heart muscle merely quivers instead of pumping forcefully.

**fidelity**—1. The accuracy with which a system or portion of a system reproduces at its output the essential characteristics of the signal impressed on its input. 2. A measure of the exactness with which sound is duplicated or reproduced.

**field**—1. One of the two equal parts into which a frame of a television image is divided in interlaced scanning. With present U.S. standards, pictures are transmitted in two fields of 262.5 lines each, which are interlaced to form 30 complete frames, or images, per second. 2. That area or space in which a particular geophysical effect, such as gravity or magnetism, occurs and can be measured. 3. A group of characters in a computer that is treated as a single unit of information. 4. A region near an electric charge, a source of electromagnetic radiation, or a magnet in which components or materials may be affected. 5. That silicon area on a chip not used or occupied by active transistors. 6. A group of adjacent bits in a microinstruction. 7. A portion of a microprogram word that represents a group of bits dedicated to controlling a specific piece of hardware. 8. A subdivision of a record, usually consisting of a single item of information related to the rest of the record and serving a similar function in all records of that group. The smallest unit normally manipulated by a database management system.

**field application relay**—A device that automatically controls the application of the field excitation to an ac motor at some predetermined point in the slip cycle.

**field circuit breaker**—A device that functions to apply, or to remove, the field excitation of a machine.

**field control of speed**—The varying voltage applied to the field of a shunt-wound motor to control the motor's speed over the extended range.

**field density**—*See* magnetic induction.

**field-discharge protection**—A control function or device to limit the induced voltage in the field when the field current attempts to change suddenly.

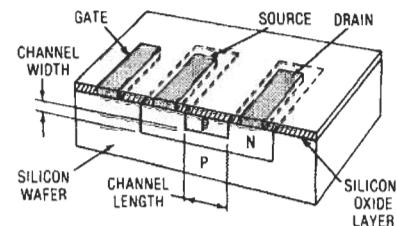
**field distortion**—Distortion between the north and south poles of a generator due to the counterelectromotive force in the armature winding.

**field-effect tetrode**—A semiconductor device consisting basically of a thin n region adjacent to a similarly thin p region. Two contacts are made to the n side and two to the p side so that currents can be passed through each thin region parallel to the single junction. The two currents remain separate because reverse bias is maintained on the junction. A current in either side affects the resistance of the other side and hence the current in the other side.

**field-effect transistor**—Abbreviated FET. 1. A transistor in which current carriers (holes or electrons) are injected at one terminal (the source) and pass to another (the drain) through a channel of semiconductor material whose resistivity depends mainly on the extent to which it is penetrated by a depletion region. The depletion region is produced by surrounding the channel with semiconductor material of the opposite conductivity and reverse-biasing the resulting pn junction from a control terminal (the gate). The depth of the depletion region depends on the magnitude of the reverse bias. Because the reverse-biased junction draws negligible current, the characteristics of the device are similar to those of a vacuum tube. 2. A transistor in which the current through a conducting channel is controlled by an electric field arising from a voltage applied between the gate and source terminals.

**field-effect tube**—A triode with its grid replaced by a nonintercepting control gate. A high positive voltage is applied to this gate in order to draw sufficient current from the cathode. The result is a strong concentration of the electric field at the gap between the gate and the cathode, producing an electron beam passing through the gate to the anode.

**field-effect varistor**—A passive, nonlinear, two-terminal semiconductor device that maintains a constant current over a wide range of voltage.



Field-effect transistor.

**field emission**—Also called cold emission. The liberation of electrons from a solid or liquid by application of a strong electric field at the surface.

**field-enhanced photoelectric emission**—Increased photoelectric emission resulting from the action of a strong electric field on the emitter.

**field-enhanced secondary emission**—Increased secondary emission resulting from the action of a strong electric field on the emitter.

**field forcing**—The effect of a control function or device that temporarily overexcites or underexcites the field of an electrical machine in order to increase the rate of change of flux.

**field-free emission current**—Also called zero-field emission. The electron current emitted by a cathode when the electric field at the surface of the cathode is zero.

**field frequency**—Also called field repetition rate. In television, the frame frequency multiplied by the number of fields contained in one frame. In the United States the field frequency is 60 per second, or twice the frame frequency.

**field intensity**—*See* field strength.

**field inversion**—Also called parasitic field turn-on. The creation of a channel between two nonassociated diffused beds in the field by voltages on conductors passing over.

**field loss relay**—*See* motor field-failure relay.

**field magnet**—An electromagnet or permanent magnet that produces a strong magnetic field in a speaker, microphone, phonograph pickup, generator, motor, or other electrical device.

**field-neutralizing coil**—A coil encircling the faceplate of a color picture tube. The current through it produces a magnetic field that offsets any effects of the earth's and other stray magnetic fields on the electron beams.

**field-neutralizing magnet**—Also called rim magnet. A permanent magnet mounted near the edge of the faceplate of a color picture tube to prevent stray magnetic fields from affecting the path of the electron beam.

**field of view**—1. The solid angle from which objects can be acceptably viewed, photographed, or otherwise detected. 2. The maximum angle of view that can be seen through a lens or optical instrument.

**field oxide**—That portion of the oxide on an MOS device that is the thickest when measured perpendicular to the bulk silicon, usually 12 K to 20 K A.

**field period**—The time required to transmit one television field. In the United States, it is  $\frac{1}{60}$  of a second.

**field pickup**—Also called a remote or nemo. A radio or television program originating outside the studio.

**field pole**—A structure, made of magnetic material, on which may be mounted a field coil.

**field relay**—A device that functions on a given or abnormally low value or failure of machine field current,

or on an excessive value of the reactive component of armature current in an ac machine, indicating abnormally low field excitation.

**field-repetition rate** — See field frequency.

**field resistor** — A component in which the resistance element is a thin layer of conductive material on an insulated form. The conductive material does not contain either binding or insulating material.

**field rheostat** — A variable resistance connected to the field coils of a motor or generator and used for varying the field current.

**field ring** — The part that supports the field of a dc or series-wound motor housing. The motor end shields are attached to the ends of the field ring.

**field scan** — In a television system the downward excursion of an electron beam across the face of a cathode-ray tube, resulting in the scanning of alternate lines.

**field selection** — In a computer, the isolation of a particular data field within one computer word without isolating the word.

**field sequential** — Pertaining to the association of individual primary colors with successive fields in a color television system (e.g., field-sequential pickup, display, system, transmission).

**field-sequential color television** — A color television system in which the individual primary colors (red, blue, and green) are produced in successive fields.

**field shield** — A process whereby a conducting layer covers an entire MOS chip (except at transistor terminals) between the doped substrate and interconnecting conductors to control field inversion problems.

**field-simultaneous system** — A color television system in which a succession of full-color images is produced rather than a succession of primary-color fields.

**field strength** — Also called field intensity. 1. The value of the vector at a point in the region occupied by a vector field. In radio, it is the effective value of the electric-field intensity in microvolts or millivolts per meter produced at a point by radio waves from a particular station. Unless otherwise specified, the measurement is assumed to be in the direction of maximum field intensity. 2. The amount of magnetic flux produced at a particular point by an electromagnet or permanent magnet. 3. The strength of radio waves at a distance from a transmitting antenna, usually expressed in microvolts per meter. This is not the same as the strength of a radio signal at the antenna terminals of a receiver. 4. The intensity of a signal emitted by an antenna. It is proportional to the current in the antenna.

**field-strength meter** — A calibrated measuring instrument for determining the strength of radiated energy (field strength) being received from a transmitter.

**field telephone** — A durable, portable telephone designed for use in the field.

**field weakening** — The introduction of a resistance in series with the shunt field of a motor to reduce the voltage and current and increase the motor speed.

**field wire** — A flexible insulated wire used in field telephone and telegraph systems.

**FIFO** — Acronym for first in, first out. 1. A special integrated circuit memory device that will accept parallel data and retransmit it on a first in, first out basis. 2. First in, first out method of storing and retrieving items from a stack, table, or list. Compare with *LIFO*. 3. A method of coordinating the sequential flow of data through a buffer.

**FIFO (first in, first out) buffer or shift register** — A shift register with an additional control section that permits input data to fall through to the first vacant stage so that if there is any data contained, it is available at the output even though all the stages are not

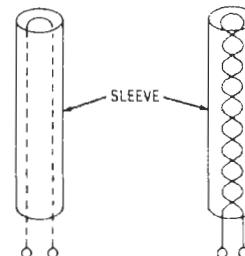
filled. In effect, it is a variable-length shift register whose length is always the same as the data stored therein.

**FIFO/LIFO** — Acronyms describing a method of data storage and retrieval. FIFO stands for first in, first out; LIFO for last in, first out. Both describe data input and output order.

**figure-eight microphone** — A microphone (usually a ribbon type) whose sensitivity is greatest to the front and rear, and weakest to both sides. See bidirectional microphone.

**figure of merit** — 1. The property or characteristic that makes a tube, coil, or other electronic device suitable for a particular application. It is a quality to look for in choosing a piece of equipment. 2. In a magnetic amplifier, the ratio of the power gain to the time constant. 3. For a thermoelectric material, the quotient of the square of the absolute Seebeck coefficient ( $\alpha$ ) divided by the product of the electrical resistivity ( $\rho$ ) and the thermal conductivity. 4. In a sample-and-hold circuit, the ratio of the available charging current during the sample mode to the leakage circuit during the hold mode.

**filament** — Also known as a filamentary cathode. 1. The cathode of a thermionic tube, usually a wire or ribbon, which is heated by passing a current through it. 2. In tubes employing a separate cathode, the heating element. 3. A slender thread of material, such as carbon or tungsten, that emits light when raised to a high temperature by an electric current (as in an incandescent light bulb).



*Filaments.*

**filamentary display** — A numerical or alphanumeric display whose segments are composed of individual incandescent-type filament wires, which emit white light when energized.

**filamentary transistor** — A conductivity-modulation transistor that is much longer than it is wide.

**filament battery** — The source of energy for heating the filament of a vacuum tube.

**filament circuit** — The complete circuit through which filament current flows.

**filament current** — The current supplied to a filament to heat it.

**filament emission** — The freeing of electrons from a filament in an electron tube as the result of the filament being heated by an electric current.

**filament power supply** — The source of power for the filament or heater of a vacuum tube.

**filament resistance** — The resistance (in ohms) of the filament of a vacuum tube or incandescent lamp.

**filament rheostat** — A variable resistance placed in series with the filament of a vacuum tube to regulate the filament current.

**filament sag** — The bending of a filament when it heats up and expands.

**filament saturation** — Also called temperature saturation. The condition whereby a further increase in filament voltage will no longer increase the plate current at a given value of plate voltage.

**filament transformer** — A transformer used exclusively to supply filament voltage and current for vacuum tubes.

**filament voltage** — The voltage value that must be applied to the filament of a vacuum tube to obtain the rated filament current.

**filament winding** — A secondary winding provided on a power transformer to furnish alternating filament voltage for one or more vacuum tubes.

**file** — 1. A collection of related records. For example, in inventory control, one line of an invoice containing data on the material, the quantity, and the price forms an item; a complete invoice forms a record; and the complete set of such records forms a file. 2. To insert an item into such a set. 3. A user-defined collection of information of variable length. 4. A list. Usually, a file is a list of instructions plus data and comments. 5. A collection of information consisting of records pertaining to a single subject. A file may be recorded on all or on part of a volume or on more than one volume. 6. A logical block of computer information, designated by name, and considered as a unit by a user. A file may be physically divided into records, blocks, or other units required by the memory device. 7. A collection of related information stored on a disk.

**filed coil** — A coil of insulated wire wound around an iron core. Current flowing in the coil produces a magnetic field.

**file gap** — On a data medium, an area intended to be used to mark the end of a file and, possibly, the start of another. A file gap frequently is used for other purposes, in particular for indicating the end or beginning of some other group of data.

**file layout** — 1. The organization and structure of data in a file, including the sequence and size of the components. 2. By extension, the description thereof.

**file maintenance** — The processing of a computer file in order to bring it up to date.

**file management** — An operating system facility for the manipulating of data files to and from secondary storage devices (usually disk files or magnetic tapes); it is used for building files, retrieving information from them, or modifying the information.

**file mark** — Also termed tape mark or end-of-file mark. A specially recorded block containing no data but acting as a data-block separator.

**file-protection device** — 1. A device by which the existence and integrity of a file are maintained. 2. A ring that must be in place in the hub of a reel before data can be recorded on the tape contained by the reel. A reel of tape not provided with a file-protection device can be read but not written.

**file section** — That part of a file which is recorded on any one volume. The file sections may not have sections of other files interspersed.

**file set** — A collection of one or more related files, recorded consecutively on a volume set.

**file transfer** — A procedure that calls for a communication link (typically over telephone lines) to be established between two or more PCs using modems. This connection allows data files to be transferred from one computer's storage device (usually a floppy or hard-disk drive) to the other's.

**File Transfer Protocol** — Abbreviated FTP. 1. The protocol used for copying files to and from remote computer systems on a network using TCP/IP, such as the Internet. 2. A very common method of moving files between two Internet sites. FTP is a special way to log in

to another Internet site for the purpose of retrieving and/or sending files. There are many Internet sites that have established publicly accessible repositories of material that can be obtained using FTP, by logging in using the account name "anonymous." These sites are called anonymous FTP servers. *See also* FTP.

**fill** — 1. The number of working lines in a particular cable or cable center. 2. The number of working lines as a percentage of the total pairs provided.

**filler** — 1. In mechanical recording, the inert material of a recording compound (as distinguished from the binder). 2. Nonconducting component cabled with insulation conductors to impart roundness, flexibility, tensile strength, or a combination of all three, to the cable.

**film** — Single or multiple layers or coatings of thin or thick material used to form various elements (resistors, capacitors, inductors) or interconnections and cross-overs (conductors, insulators). Thin films are deposited by vacuum evaporation or sputtering and/or plating. Thick films are deposited by screen printing.

**film badge** — A type of dosimeter consisting of a small piece of film sensitive to radiation, placed in a light-tight holder and carried by a person who works with radiation. When the film is developed, the amount of darkening can be measured to determine the total dose of ionizing radiation to which the badge has been subjected.

**film capacitor** — 1. A capacitor with a dielectric consisting of a plastic film. 2. A capacitor that is made by winding metal and dielectric (such as polyester, polycarbonate, polystyrene, polypropylene, or polysulfone) ribbons into a tubular shape. The metal electrodes can be separate metal foil, or can be vacuum-deposited onto the dielectric.

**film chain** — An arrangement of a film projector or projectors and a CCTV camera for transmitting moving pictures over a television system.

**film conductor** — 1. A conductor formed *in situ* on a substrate by depositing a conductive material by screening, plating, or evaporation techniques. 2. Electrically conductive material formed by deposition on a substrate.

**film integrated circuit** — Also called film microcircuit. 1. A circuit made up of elements that are films all formed in place upon an insulating substrate. To further define the nature of a film integrated circuit, additional modifiers may be prefixed. Examples: thin-film integrated circuit, thick-film integrated circuit. 2. Thin- or thick-film network forming an electrical interconnection of numerous devices.

**film microcircuit** — *See* film integrated circuit.

**film pickup** — A film projector combined with a television camera for telecasting scenes from a motion-picture film.

**film reader** — A computer input device that scans opaque and transparent patterns on photographic film and relays the corresponding information to the computer.

**film recorder** — An instrument designed to place nongraphic information, usually generated by a computer, onto photographic film. The information is generally encoded as a series of opaque and translucent spots, or light and dark spots.

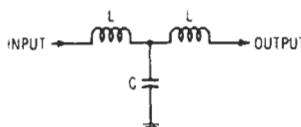
**film reproducer** — An instrument that reproduces a recording on film.

**film resistor** — 1. A fixed resistor whose resistance element is a very thin layer of conductive material on an insulated form. Some sort of mechanical protection is placed over this layer. 2. A resistor whose characteristics depend on film rather than bulk properties. 3. A device whose resistive material is a film on an insulator substrate; final resistance value may be determined by trimming.

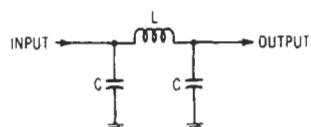
**film scanning** — 1. The process of converting movie film into corresponding electrical signals that can be

transmitted by a television system. 2. The process by which the light from the images of photographic film is encoded into electrical signals for video transmission.

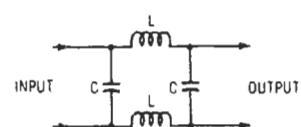
**filter**—Also called extractor or mask. 1. A selective network of resistors, inductors, or capacitors that offers comparatively little opposition to certain frequencies or to direct current, while blocking or attenuating other frequencies. *See also* wave filter. 2. A device or program that separates data, signals, or materials in accordance with specified criteria. 3. A machine word that specifies which parts of another machine word are to be operated on. 4. A circuit that attenuates signals above or below specific frequency without materially affecting signals in its passband. The action of a filter is usually defined by its slope (in decibels per octave; usually some multiple of 6 dB/octave) and by its turnover frequency. 5. Electrical device used to suppress undesirable electrical noise. 6. With respect to radiation, a device used to attenuate particular wavelengths or frequencies while passing others with relatively no change. 7. A circuit that passes signals above, below, or within a particular frequency band while rejecting all other signals. Active filters incorporate amplifier circuits, whereas passive filters are networks of capacitors, inductors, and resistors.



T section.



Pi section.



Ladder section.

### Filters, I.

**filter attenuation**—A loss of power through a filter as a result of absorption in resistive materials, of reflection, or of radiation. Usually expressed in decibels.

**filter attenuation band**—Also called a filter stop-band. A frequency band in which the attenuation constant is not zero if dissipation is neglected. In other words, a frequency band of attenuation.

**filter capacitor**—A capacitor used in a filter circuit. The term is usually reserved for electrolytic capacitors in a power-supply filter circuit.

**filter center**—In an aircraft control and warning system, a location at which information from observation posts is filtered for further dissemination to air-direction centers.

### filter — finger plethysmograph

**filter choke**—Normally, an iron-core coil that allows direct current to pass while opposing the passage of pulsating or alternating current.

**filter crystal or plate**—A quartz plate or crystal used in an electrical circuit designed to pass energy only at certain frequencies.

**filter discrimination**—The difference between the minimum insertion loss at any frequency in the attenuation band of a filter and the maximum insertion loss at any frequency in the transmission band of the filter. The loss is determined under the conditions of normal use of the filter.

**filtered radar data**—Radar data from which undesired returns have been removed by mapping.

**filter-impedance compensator**—An impedance compensator that is connected across the common terminals of electric-wave filters, when the latter are used in parallel, in order to compensate for the effects of the filters on each other.

**filter passband**—*See* filter transmission band.

**filter section**—Any of various simple networks that may be connected in cascade to form a filter. The simplest is the half section, consisting of a series impedance ( $Z$ ) followed by a shunt admittance ( $Y$ ). A full section is either a T-network in which the shunt arm is  $Y$  and the series arms are  $Z/2$ , or a pi network in which the series arm is  $Z$  and the shunt arms  $Y/2$ . Full sections, unlike half sections, have equal input and output impedances.

**filter slot**—A choke, in the form of a slot, designed to suppress unwanted modes in a waveguide.

**filter stopband**—*See* filter attenuation band.

**filter transmission band**—Also called filter passband. A frequency band in which the attenuation constant is zero if dissipation is neglected. In other words, a frequency band of free transmission.

**fin**—A metal disc or a thin, projecting metal strip attached to a semiconductor to dissipate heat.

**final actuation time**—The time of termination of the chatter of a relay following contact actuation.

**final amplifier**—The stage that feeds the antenna in a transmitter.

**final control element**—The part of a control system that actually changes the amount of energy or fuel to the process. For example, in an industrial oven the final control element could be a valve that controls the amount of fuel reaching the burner.

**final seal**—The hybrid microelectronic packaging step that encloses the circuit so that further internal processing cannot be performed without disassembly.

**final wrap**—The outer layer of insulation around a coil, covering the saddle and splice insulation.

**finder**—In a telephone switching system, a name applied to the switch or relay group that selects the path that the call is to follow through the system.

**fine-chrominance primary**—Also called the I signal. In the color television system presently standardized for broadcasting in the United States, the chrominance primary associated with the greater transmission bandwidth.

**fine-tuning control**—A receiver control that varies the frequency of the local oscillator over a small range to compensate for drift and permit fine adjustment to the carrier frequency of a station.

**finger plethysmograph**—An instrument for detecting and displaying changes in the volume of blood in the finger during the cardiac cycle. In some types, a light source and a photocell are placed on opposite sides of the finger; the volume of the blood in the finger determines the amount of light reaching the photocell. In another type, the finger is placed between two electrodes. The increased blood volume during each contraction of

**fingers** — the heart reduces the impedance of the finger, and the resulting change in the current between the electrodes is recorded or displayed on a cathode-ray tube.

**fingers** — Nonpreferred term for edge-board contact.

**finished blank** — A crystal product after completion of all processes. It may also include the electrodes adherent to the crystal blank.

**finishing** — The process of repeated hand lapping and electrical testing by which a finished crystal blank is brought up to specifications.

**finishing rate** — Expressed in amperes, the rate of charge to which the charging current of a battery is reduced near the end of the charge to prevent excessive gassing and temperature rise.

**finish lead** — The lead connected to the finish, or outer end, of a coil.

**finite** — Having fixed and definite limits.

**finite-element method** — A procedure for solving electromagnetic field problems by dividing the domain of interest into small, basic elements and by solving differential equations in each of those elements.

**finite-state machine** — A computer in which a set of inputs determines both the set of outputs and also the internal state of the computer.

**fins** — Radial sheets or discs of metal attached to metal parts of a power tube, power transistor, or other component for the purpose of dissipating heat.

**fin waveguide** — A waveguide in which a thin longitudinal metal fin is placed to increase the range of wavelengths over which the waveguide can transmit signals efficiently. The method usually is used with circular waveguides.

**FIPS** — Abbreviation for Federal Information Processing Standard. A standard approved for use by U.S. government agencies.

**fire** — 1. To change from a blocked condition, in which negligible current flows, to a saturated condition, in which heavy current flows. 2. The term used to describe the act of heating a thick-film circuit so that the resistors, conductors, capacitors, etc., will be transformed into their final form.

**fire-control equipment** — Equipment that takes in target indications from optical or radar devices and, after calculating the motion of the target and firing vehicle, properties of air, etc., puts out directions of bearing, elevation, and timing for aiming and firing the guns.

**fire-control radar** — Radar employed for directing gunfire against the targets it observes.

**fired tube (tr, atr, and pre-tr tubes)** — The condition of a tube while a radio-frequency glow discharge exists at the resonant gap, resonant window, or both.

**firewall** — 1. A combination of hardware and software that separates a local area network (LAN) into two or more parts for security purposes. 2. A method of partially or totally blocking access (from machines not on a LAN) or of filtering/monitoring incoming packets.

**firing** — 1. In any gas- or vapor-filled tube, the ionization of the gas and the start of current flow. 2. The excitation of a device during a brief pulse. 3. In a magnetic amplifier, the transition from the unsaturated to the saturated state of the saturable reactor during the conducting or gating alternation. 4. An adjective modifying phase or time, to designate when firing occurs.

**firing angle** — 1. The electrical angle of the plate-supply voltage at which ionization of a gaseous tube occurs. 2. In a magnetic amplifier, the point on a sine-wave control voltage at which the control ampere-turns are sufficient to saturate the core. This is the point at which the secondary winding (load) impedance drops to zero, and almost all of the supply voltage appears across the load.

**firing furnace** — Furnace used for the curing of multilayer ceramics for integrated electronics and for the firing of thick-film materials on substrates.

**firing point** — The point at which the gas or vapor in the tube ionizes and current begins to flow.

**firing potential** — The controlled potential at which conduction through a gas-filled tube begins.

**firing profile** — A graph of time versus temperature or, in a continuous thick-film furnace, of position versus temperature.

**firmware** — 1. A computer program or software stored permanently in PROM or ROM or semipermanently in EPROM. 2. Programs or instructions that are stored in read-only memories; firmware is analogous to software in a hardware form. These instructions are for internal processor functions only, and are transparent to the user. 3. The internal interconnections that permanently determine what functions a device or system can perform. Also called microprogram. 4. Sets of instructions cast into user-modifiable hardware. 5. A series of instructions in ROM (read-only memory). 6. Data stored in a nondestructive form such as hard-wired or in a ROM. 7. An extension to a computer's basic command repertoire to create microprograms for a user-oriented instruction set. This extension to the basic instruction set is done in ROM and not in software. The ROM converts the extended instructions to the basic instructions of the computer.

**first article** — A sample part or assembly manufactured prior to the start of production for the purpose of ensuring that the manufacturer is capable of manufacturing a product that will meet the requirements.

**first audio stage** — The first stage in an audio amplifier.

**first detector** — Now called the mixer. In a superheterodyne receiver, the stage in which the local-oscillator signal is combined with the modulated incoming radio-frequency signal to produce the modulated intermediate-frequency signal.

**first fit** — In a computer, an algorithm for memory allocation that searches the free list only long enough to find an unused memory block that is large enough to satisfy the requesting task.

**first Fresnel zone** — In optics and radio communications, the circular portion of a wave front intersecting the line between an emitter and a more distant point where the resultant disturbance is being observed. The center intersects the front with the direct ray, and the radius is such that the shortest path from the emitter through the periphery to the receiving point is one half-wave longer than the ray.

**first-generation computer** — A computer in which vacuum-tube components are used.

**first-in, first-out (FIFO) memory** — 1. A type of memory with separate input and output ports. The first data to enter the input port are the first to exit the output port. One use of FIFO memory is as a buffer between a terminal and a LAN in a network interface controller. 2. A data access mechanism that implements a queue. Data elements are always extracted from the data structure in the same order that they are entered (the first element in is the first element out).

**first selector** — The selector that immediately follows a line-finder in a switch train. It responds to the dial pulses that represent the first digit of the called telephone number.

**first-shot effect** — A term used relative to solid-state (electronic) timers using a resistor-capacitor (*RC*) single time-constant circuit. Due to the forming effect leakage found in electrolytic capacitors when stored, the first and sometimes second and third operations have longer time delays. The repeat accuracy specification does not include

this condition. Digital-type circuits do not exhibit this condition.

**fishbone antenna**—1. An antenna consisting of a series of coplanar elements arranged in collinear pairs and loosely coupled to a balanced transmission line. 2. Directional antenna in the form of a plane array of doublets arranged transversely along both sides of a transmission line.

**fishpaper**—A tough fiber used in sheet form for insulating transformer windings from the core, field coils from field poles, or conductors from the armature.

**fission**—Also called atomic fission or nuclear fission. The splitting of an atomic nucleus into two parts. Fission reactions occur only with heavy elements such as uranium and plutonium and are accompanied by large amounts of radioactivity and heat.

**fissionable**—Capable of undergoing fission.

**fission products**—The elements that result from atomic fission. They may consist of more than forty different radioactive elements, such as arsenic, silver, cadmium, iodine, barium, tin, cerium, and others.

**fissuring**—The cracking of dielectrics or conductors. Often dielectrics, if incorrectly processed, will crack in the presence of conductors because of stresses occurring during firing.

**FIT**—Failure in  $10^9$  device-hours.

**FITs**—The measure of a semiconductor's reliability is often expressed in failure units (FITs) the number of failures per  $10^9$  device-hours. For example, if 100 units operate for 1000 hours with one failure, the failure rate in FITs is  $(1/100) \times (10^9/1000)$  or  $10^4$  FITs. FITs are used as a measure of reliability because the units are particularly useful for expressing the low failure rates encountered in electronic devices. For example, it is much less cumbersome to work with a figure like 10 FITs rather than with 0.001%/1000 hours. FITs are also useful because they can be added when calculating the total failure rate for a system. FITs can also be used to calculate the mean time between failure, which is the reciprocal of the FIT rate times the total number of components in a system. For example, a system with 10,000 components with FIT rates of 100 would have a mean time between failure of  $10^9/(100)(10,000)$ , or 1000 hours.

**fitting**—An accessory, such as a locknut or bushing, to a wiring system. Its function is primarily mechanical rather than electrical.

**five-layer device**—A semiconductor, as a diac, triac, etc., in which there are four pn junctions.

**five-level code**—A telegraph code in which five impulses are utilized for describing a character. For asynchronous transmission, start and stop elements may be added. A common five-level code is the Baudot code.

**five-level start-stop operation**—Simplex mode of teletypewriter operation. Each code character consists of five electrical units. The distributor unit of the machine makes a positive start and stop for the transmission of each character.

**fix**—A position determined without reference to any former position.

**fixed bias**—A constant value of bias voltage.

**fixed capacitor**—A capacitor designed with a definite capacitance that cannot be adjusted.

**fixed-composition (carbon-composition) resistor**—Resistive element consisting of a carbon composition that is molded under extreme pressure, then enclosed in an insulating sleeve.

**fixed contact**—A contact that is permanently included in the insert material. It is permanently locked, cemented, or imbedded in the insert during molding.

**fixed crystal**—A crystal detector with a nondefinite contact position.

## fishbone antenna — fixed resistor

**fixed-cycle operation**—1. A type of computer performance whereby a fixed amount of time is allocated to an operation. 2. Synchronous or clock-type arrangement in a computer, in which events occur as functions of measured time.

**fixed decimal**—Calculator that is limited to established decimal category; can be preset for specified number of places in answer, or preset so that numbers are entered as they would be written.

**fixed decimal point**—Location of the decimal point in the display of a calculator chosen by a selector switch. For example, if the switch is set to position six on an eight-digit machine, the numbers between 99 and 0.001 can be used. In some machines no selector is provided, and a calculation such as 123/456 yields the answer 0.27 instead of 0.2697368.

**fixed echo**—A stationary echo indication on a radar PPI display, indicating a fixed target.

**fixed-frequency IFF**—A class of IFF (identification, friend or foe) equipment that responds immediately to every interrogation, thus permitting the response to be displayed on plan-position indicators.

**fixed-frequency transmitter**—A transmitter designed for operation on a single carrier frequency.

**fixed-instruction computer**—A computer having an instruction set that is fixed by the manufacturer. Users must design applications programs using this instruction set. Contrasted with microprogrammable computer.

**fixed-length record**—Pertaining to a file in which all records are constrained to be of the same predetermined length. (Opposite of variable-length record.)

**fixed logic**—Circuit logic computers or peripheral devices that cannot be changed through operation of external controls. Connections must be physically changed to rearrange the logic.

**fixed logic levels**—Digital data with high and low levels that are programmable or adjustable.

**fixed memory**—1. A nondestructive-readout computer memory that is alterable only by mechanical means. 2. A memory into which information normally can be written only once. The ROM is a fixed program memory. Programs are usually stored in fixed memories.

**fixed operation**—Radiocommunication conducted from the specific geographical land location shown on the station license.

**fixed point**—Pertaining to notation or a system of arithmetic in which all numeric quantities are expressed with a predetermined number of digits and the point is located implicitly at some predetermined position.

**fixed-point arithmetic**—1. Calculations in which the computing device is not concerned with the location of the point. An example is a slide-rule calculation, since the human operator must locate the decimal point. 2. A type of arithmetic in which all figures must remain within certain fixed limits. 3. Arithmetic in which the binary point that separates the integer and fractional portions of numerical expressions is either explicitly stated for all expressions or is fixed with respect to the first or last digit of each expression.

**fixed-point system**—A system of notation in which a number is represented by a single set of digits and the position of the radix point is not numerically expressed. See also floating-point system.

**fixed-program computer**—See wired-program computer.

**fixed resistor**—1. A resistor designed to introduce only a predetermined amount of resistance into an electrical circuit; it is not adjustable. 2. A basic, universal electronic component designed to impede the flow of electric current; classed according to the materials technology used to form the resistive element. Carbon, nickel

chromium, tin oxide, and various other alloys and bonded mixtures are commonly used for resistive elements that are molded, imprinted, or deposited. Most discrete resistors are leaded and coated to form compact, uniform units ready for assembly.

**fixed screen** — Application of a potential to a screen grid that is unaffected by other operating conditions within the tube.

**fixed service** — 1. Any service communicating by radio between fixed points, except broadcasting and special services. 2. A point-to-point radiocommunication service between specific fixed stations on the earth.

**fixed station** — 1. A station in the fixed service. (A fixed station may, as a secondary service, transmit to mobile stations on its normal frequencies.) 2. A permanent station that communicates with other fixed stations.

**fixed transmitter** — A transmitter operated from a permanent location.

**fixed-voltage winding** — The motor winding that is excited by a fixed voltage.

**fixed word length** — The condition in which a machine word always contains a fixed number of bits, characters, bytes, or digits.

**fixer network or system** — A combination of radio or radar direction-finding installations that, when operated in combination, can determine the position relative to the ground of an aircraft in flight.

**fixturing** — An assortment of electronic switches, wiring, black boxes, etc., to connect two systems, e.g., a test system and a board under test.

**fL** — Letter symbol for footlambert.

**flag** — 1. A large sheet of metal or fabric for shielding television camera lenses from light. 2. In a computer, an indication that a particular operation has been completed and may be skipped by the program. 3. A single flip-flop that indicates that a certain condition has arisen as, for example, during the course of an arithmetic or logical operation in a computer program. 4. Usually a flip-flop storing one bit that indicates some aspect of the status of the central processing unit. For example, a carry flag is set to 1 when an arithmetic operation produces a carry, and to 0 when the result is zero. These flags aid in interpreting the results of certain calculations. Others are sometimes provided to permit access by interrupt request lines; for example, if a CPU is engaged in the highest priority of calculation, it may set all status flags to zero, which, loosely translated, means "don't bother me now." If only some of these flags are set, then only certain interrupt lines will be able to get through, according to their priority. 5. A "permanent" status signal, normally stored in a flip-flop or a register of a computer to indicate a special condition. Typically, every microprocessor provides at least the following status flags: carry, zero, sign, overflow, half-carry. 6. A delimiting bit field used to separate portions of data. 7. In a computer, an indicator, usually a single binary bit, whose state is used to inform a later section of a program that a condition, identified with the flag and designated by the state of the flag, has occurred. A flag can be both software and hardware implemented. 8. Any of various types of indicators used for identification of a condition or event; for example, a character that signals the termination of a transmission.

**flag bit** — A processor memory bit, controlled through firmware, to signify a certain condition (e.g., battery low). A flag bit may be monitored by user-programmed instructions.

**flag lines** — Inputs to a microprocessor controlled by I/O devices and tested by branch instructions.

**flag terminal** — A type of solderless terminal in which the tongue projects from the side rather than the end of the terminal barrel.

**flame** — To send angry or critical messages to someone via e-mail or a newsgroup.

**flame-failure control** — A system that automatically stops the fuel supply to a furnace if the pilot burner accidentally goes out.

**flame microphone** — A microphone in which the action of sound waves on a flame changes the resistance between two electrodes in the flame.

**flameoff** — The procedure in which a wire is severed by passing a flame across the wire, thereby melting it. The procedure is used in gold wire thermocompression bonding to form a ball for making a ball bond.

**flameproof** — Said of insulated wire or other material that has been chemically treated so it will not aid the spread of flames.

**flameproof wire** — Wire having insulation that is chemically treated so that it will not support combustion.

**flame resistance** — The characteristic of a material that prevents it from flaming when the source of heat is removed.

**flame-resistant** — See flame-retardant.

**flame-retardant** — Also called flame-resistant. 1. Retarding ignition and the spread of flames, either inherently or because of special treatment. 2. Constructed or treated so as not to be able to convey flame.

**flammability** — Measure of a material's ability to support combustion.

**flammable** — Also called combustible. Term applied to material that readily ignites and burns when exposed to flames or elevated temperatures.

**flange** — 1. Also called waveguide flange. A fitting used at the end of a waveguide for making attachment to a microwave component or to another waveguide. 2. The side of a tape reel, which prevents the tape on the hub from slipping sideways off the "pie." 3. A projection extending from, or around the periphery of, a connector and provided with holes to permit mounting the connector to a panel or to another mating connector half.

**flange connector** — A mechanical joint employing plane flanges bolted together in a waveguide.

**flange coupling** — A connection utilizing flanges not in mechanical contact between two parts of a waveguide, yet introducing no discontinuity in the flow of energy along the guide.

**flange focus** — The distance from the mounting flange or reference surface of a lens to the focal plane for a subject at infinity.

**flanking effect** — The effect on filter characteristics of connecting additional filters in parallel.

**flap attenuator** — A form of waveguide attenuator in which a variable amount of loss is introduced by insertion of a sheet of resistive material, usually through a nonradiating slot.

**flare** — An enlarged and distorted radar-screen target indication due to excessive brightness.

**flare angle** — The continuous change in cross section of a waveguide.

**flare factor** — A number expressing the degree of outward curvature of a speaker horn.

**flash** — Sometimes called hit. Momentary interference to a television picture, lasting approximately one field or less and of sufficient magnitude to totally distort the picture information. In general, this term is used only when the impairment is so short that the basic impairment cannot be recognized.

**flashback voltage** — The inverse peak voltage at which ionization takes place in a gas tube.

**flasher** — 1. A device that is designed to automatically turn electric lamps on and off in a rapidly repeating sequence. The device may use a motor-driven mechanism,

a combination heater filament and bimetallic strip, to stop and start the current. 2. A control whereby the output to the load (normally a lamp) is turned on and off repeatedly at a given rate of operation or flashes per minute (fpm).

**flasher relay** — A self-interrupting relay.

**flashing** — The application of a high-frequency electromagnetic field to an electron tube through the envelope to flash its getter during evacuation.

**flashing of a dynamo** — The flashing or sparking that is likely to take place at the brushes of a commutator.

**flash lamp** — 1. A device in which a large amount of stored electrical energy is converted into light by means of a sudden electrical discharge. The flash is obtained by storing electrical energy in a capacitor and allowing the capacitor to discharge through the lamp. 2. A device or electronic circuitry that converts a large amount of stored electrical energy into light by means of a sudden electrical discharge. *See also* flash tube.

**flash magnetization** — Magnetization of a ferromagnetic object by an abrupt current impulse.

**flashover** — 1. A disruptive discharge through air, around or over the surface of insulation, or between parts of different potential or polarity produced by the application of voltage, wherein the breakdown path becomes sufficiently ionized to maintain an electric arc. 2. An electric discharge that occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

**flashover voltage** — 1. The highest value attained by any voltage impulse that caused a flashover. 2. The voltage at which insulation fails by discharge between electrodes across the insulation surface.

**flash plating** — The application of extremely thin deposits of a plating material for environmental protection or as a base for a subsequent layer of plating material.

**flashpoint of impregnate** — The temperature to which a liquid or solid impregnate must be heated before it gives off sufficient vapor to form a flammable mixture.

**flash pulsing** — Transmission of short bursts of radiation at irregular intervals by a mechanically controlled keyer.

**flash radiography** — A technique used in radiography to obtain an unblurred image of a moving object by the use of very short X-ray exposures, such as 1 microsecond, to record the image.

**flash spectroscopy** — The study and interpretation of the spectra of substances after they have absorbed the radiant energy emitted by a brief, intense light source.

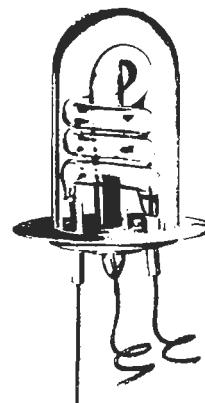
**flash test** — Also known as high-potting, high-pot, or short check. 1. A method of testing insulation by momentarily applying a voltage much higher than the working voltage. 2. Method of testing capacitors for shorts (or potential shorts) between electrodes by momentarily applying a voltage much higher than the rated working voltage.

**flash tube** — Also called electronic flash tube and photoflash tube. A gas-discharge tube for producing high-intensity, short-duration flashes of light. It consists of a glass tube bent in a U, a helix, or a combination of the two and filled with a rare gas. The tube has an anode, a cold cathode, and a trigger electrode. It is flashed by applying a high-voltage pulse to the trigger electrode. *See also* flash lamp.

**flash welding** — Welding in which an arc is first struck between the pieces to be welded. After the ends are thus heated, the weld is completed by bringing them together under pressure and cutting off the current.

**flat** — Having a slope of zero at all points, as a graph, curve, etc.

**flat back paper** — A flat kraft paper tape used in splicing electrical cable.



Flash tube.

**flatbed plotter** — 1. Plotter that draws an image on paper, glass, or film mounted on a flat table. 2. Type of plotter in which the paper is held flat against a table electrostatically.

**flatbed scanner** — An optical scanner with a flat surface that can copy a page into an electronic file.

**flat braid** — A woven braid, composed of tinned copper strands, that is rolled flat at the time of manufacture to a specific width depending on construction. It is generally used as a high-current conductor at low voltages.

**flat cable** — Also called flexible flat cable or flat conductor cable. 1. Any cable with two or more parallel round or flat conductors in the same plane encapsulated by an insulating material. 2. Any cable with two smooth or corrugated but essentially flat surfaces.

**flat-compounded generator** — A compound-wound generator in which the series field winding is adjusted so that the output voltage is virtually constant for currents between no load and full load.

**flat conductor** — 1. A conductor with a width-to-thickness ratio of arbitrarily 5 to 1 or greater. 2. A cable with a plurality of flat conductors. Flexible flat cable with conductors that have rectangular, rather than round, cross sections.

**flat fading** — That type of fading in which all components of the received radio signal fluctuate in the same proportion simultaneously.

**flat flexible cable** — *See* tape cable.

**flat frequency response** — The response of a system to a constant-amplitude function that varies in frequency is flat if the response remains within specified limits of amplitude, usually specified in decibels from a reference quantity.

**flat leakage power (tr and pre-tr tubes)** — The peak radio-frequency power transmitted through the tube after establishment of a steady-state radio-frequency discharge.

**flat line** — A radio-frequency transmission line or part of a line having a low standing wave ratio.

**flat pack** — 1. A flat, rectangular integrated circuit or hybrid circuit package with coplanar leads. 2. Semiconductor network encapsulated in a thin rectangular package, with the necessary connecting leads projecting from the edges of the unit. 3. A slab-shaped, very low profile package for electronic components. Often used when printed circuit boards must be stacked close together. 4. An integrated circuit package that has leads extending from the package in the same plane as the package so that leads can be spot welded to terminals on a substrate or soldered to a printed circuit board. The

small size and low profile of the flat pack contribute to high-density circuit packaging. 5. A small, flat IC package formed by sandwiching a hermetically sealed chip between two layers of metal or ceramic; the leads protrude from either two or all four of its edges.

**flat response** — Ability of a sound system to reproduce all tones (from the lowest to the highest) in their proper proportions. (For example, a specification of response within  $\pm 1$  dB from 30 to 15,000 Hz would be considered flat.)

**flat-square** — Refers to cathode-ray tubes that are both full-square and have relatively flat screen surfaces also.

**flat top** — The horizontal portion of an antenna.

**flat-top antenna** — An antenna having two or more lengths of wire parallel to each other and to the ground.

**flat-top response** — Response characteristic in which a definite band of frequencies is transmitted uniformly.

**flat-type armature** — Of a relay, an armature that rotates about an axis perpendicular to that of the core, with the pole face on a side surface of the core.

**flat-type relay** — A relay having a flat-type armature.

**flaw** — In a material, any discontinuity that would be harmful to proper functioning of the material.

**flaw detection** — The process of using sonic or ultrasonic waves to locate imperfections in a solid material. This is done by transmitting the waves through the material and listening for reflections or variations in transmission when they strike an imperfection in the material.

**F layer** — 1. An ionized layer in the F region, existing in the night hemisphere and in the weakly illuminated portion of the day hemisphere. 2. The layer of the ionosphere which causes most long-distance communication. It sits about 130 to 160 miles (210 to 260 km) above the earth.

**F<sub>1</sub> layer** — One of the regular ionospheric layers, having an average height of about 225 kilometers, which occurs during the daylight hours.

**F<sub>2</sub> layer** — The most useful of the ionospheric layers for radio-wave propagation. It is the most highly ionized and highest of the layers, having an average night height of 225 kilometers and a midday height of about 400 kilometers.

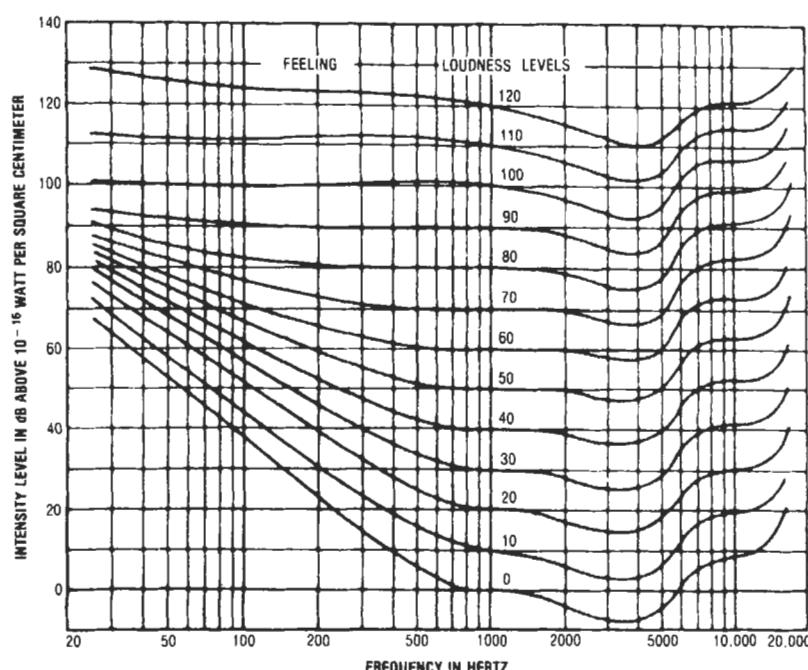
**Fleming's rule** — Also called the right-hand or left-hand rule. 1. If the thumb and the first and second fingers are extended at right angles to one another, with the thumb representing the direction of the wire motion, the first finger representing the direction of magnetic lines of force (from the north pole to the south pole), and the second finger representing the direction of the current, then the right hand will give the correct relationships for a conductor in the armature of a generator, and the left hand will give the correct relationships for a conductor in the armature of a motor. This rule is applied to the so-called conventional current flow, which is the opposite of electron flow. 2. A rule stating that if the fingers of the right hand are placed around a current-carrying wire so that the thumb points in the direction of the conventional current, the fingers will point in the direction of the magnetic field.

**Fleming valve** — An early name for a diode, or two-electrode thermionic vacuum tube used as a detector.

**Fletcher-Munson curves** — Also called equal-loudness contours. A group of sensitivity curves showing the characteristics of the human ear for different intensity levels between the threshold of hearing and the threshold of feeling. The reference frequency is 1000 Hz.

**Flewwelling circuit** — An early radio circuit in which one tube served as a detector, amplifier, and local oscillator.

**flexible coupling** — 1. A device for connecting two shafts end to end so that they can be rotated even though not exactly aligned. 2. Mechanical connection between two lengths of a waveguide normally lying in a straight line; designed to allow a limited angular movement between axes.



Fletcher-Munson curves.

**flexible disk**—A magnetic storage medium constructed of thin plastic. *See* floppy disk.

**flexible printed circuit**—A random arrangement of printed wiring and components utilizing flexible base materials with or without flexible cover layers.

**flexible printed wiring**—A random arrangement of printed wiring utilizing flexible base materials with or without flexible cover layers.

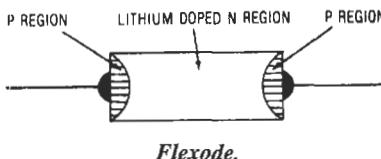
**flexible resistor**—A wirewound resistor that looks like a flexible lead. It is made by winding Nichrome or any other type of resistance wire around asbestos or other heat-resistant cord. The wire is then covered with braided insulation, which is color coded to indicate the resistor value.

**flexible shaft**—A flexible core made up of layers of wire that rotate inside a metal or rubber-covered flexible casing. The casing not only supports the core, but also acts as the bearing surface for the core.

**flexible substrate**—Thick- and thin-film circuits have generally been deposited on rigid substrates, but it is possible to deposit these circuits on some plastic substrates.

**flex life**—1. A measure of the resistance of a conductor or other device to failure due to fatigue from repeated bending. 2. The time of heat aging that an insulating material can withstand before failure when bent around a specific radius (used to evaluate thermal endurance).

**flexode**—A flexible diode containing a junction that may be altered at will from a pn junction in one direction, to no junction at all, to a pn junction in the opposite direction. Thus, the direction of easy current may be reversed without reversing the leads to the diode, and the resistance of the diode may be continuously varied from the back-resistance value to the forward-resistance value. It may be set to behave as a simple resistor, with the same value for both directions of current.



*Flexode.*

**Flexowriter**—A trade name for the typewriter that can provide input data to a computer or type outputs from the computer. (No longer used.)

**flexure failure**—A conductor failure due to repeated flexing that is indicated by an increase of resistance to a specified value for a specified time.

**flicker**—Also called jitter or wobble. 1. In television, the flickering produced in the picture when the field frequency is insufficient to completely synchronize the visual images. 2. In a regulated power supply, a phenomenon due primarily to sudden, minute changes of brief duration in the reference voltage or the input-stage junctions of the correction amplifier in the regulator. 3. Noise in an amplifier, of higher frequency than drift, but lower than power-line or chopper-drive frequency noise. 4. The sensation of image intermittence or of brightness or color variation. Flicker occurs when the frequency of the observed variation is less than the screen's flicker fusion frequency. 5. The fluctuation in apparent illumination that has a rate comparable to the reciprocal of the period of persistence in vision.

**flicker effect**—Small variations in the plate current of a thermionic vacuum tube, believed to be due to random emission of positive ions by the cathode.

**flicker noise**—Also called  $1/f$  noise. One of the sources of noise associated with solid-state devices such as mixers or diode detectors, the amplitude of which varies inversely with frequency. It has a random amplitude similar to shot and thermal noise but with a  $1/f$  spectral power density. This means that the noise increases at low frequencies and is associated with the level of direct current in the device.

**flicker photometer**—A device for measuring the intensity of a light source. Illumination from the light source being measured and a standard light source are observed alternately in rapid succession. When the standard source is equal to the other, the flickering disappears.

**flight control**—Real-time calculations for the control of a vehicle in flight; includes stabilization, fuel monitoring, cruise control, etc.

**flight path**—A planned course for an airborne vehicle.

**flight-path computer**—A computer that includes all the functions of a course-line computer and also controls the altitude of an aircraft in accordance with a desired plan of flight.

**flight-path deviation**—The difference between the flight path of an aircraft and the actual flight track, expressed in terms of either angular or linear measurement.

**flight-path deviation indicator**—An instrument that provides a visual indication of deviation from a flight path.

**flight track**—The three-dimensional path in space actually traced by a vehicle.

**Flinders bar**—A bar of soft iron placed near a compass to correct errors due to variation of the vertical component of the earth's magnetism in different parts of the world.

**flip chip**—1. An unencapsulated semiconductor device in which bead-type pads terminate on one face to permit flip (face-down) mounting of the device by contact of the leads to the required circuit interconnectors. 2. A mounting approach in which the chip (die) is inverted and connected directly to the substrate rather than using the more common wire bonding technique. Examples of this kind of flip-chip mounting are beam lead and solder bump. 3. A generic term describing a semiconductor device having all terminations on one side in the form of bump contacts. After the surface of the chip has been passivated or otherwise treated, it is flipped over for attaching to a matching substrate. 4. A semiconductor die that is fabricated so it can be bonded to the next higher assembly without the use of flywires. The termination points are typically raised pads or solder balls that are attached to the substrate metallization by ultrasonic scrubbing or thermocompression bonding. 5. A leadless monolithic structure, containing circuit elements, that is designed to electrically and mechanically interconnect to a hybrid circuit by means of an appropriate number of bumps, located on its face, which are covered with a conductive bonding agent.

**flip-chip bonding**—Method of interconnecting ICs in a circuit by bonding bumps, located on the IC chip's back surface, to the circuit's conducting paths.

**flip-chip mounting**—A method of mounting flip chips on thick- or thin-film circuits without the need for subsequent wire bonding.

**flip coil**—A small coil used for measuring a magnetic field. When connected to a ballistic galvanometer or other instrument, it gives an indication whenever the magnetic

field of the coil or its position in the field is suddenly reversed.

**flip-flop** — Also called bistable multivibrator, Eccles-Jordan circuit, or trigger circuit. 1. A two-stage multivibrator circuit having two stable states. In one state, the first stage is conducting and the second is cut off. In the other state, the second stage is conducting and the first stage is cut off. A trigger signal changes the circuit from one state to the other, and the next trigger signal changes it back to the first state. For counting and scaling purposes, a flip-flop can be used to deliver one output pulse for each two input pulses. 2. A similar bistable device with an input that allows it to act as a single-stage binary counter. 3. An electronic circuit having two static states and the ability to change from one state to the other on application of a signal in a special manner. 4. A type of digital circuit that can be in either of two states, depending both on the input received and on which state it was in when the input was received.

**flip-flop calculator** — Calculator that can display double its digital capacity in two steps by depressing a flip-flop key.

**flip-flop circuit** — An electronic circuit that has two conditions of permanent stability and a means for changing from one to the other in response to an external stimulus. *See also* Eccles-Jordan circuit.

**flip-flop equipment** — An electronic or electromechanical device that causes automatic alternation between two possible circuit paths.

**flip-flop multivibrator** — Also called start-stop multivibrator. A biased rectangular wave generator that operates for one cycle when a synchronizing trigger signal is applied.

**flipover cartridge** — A phonograph cartridge having separate needles for playing microgroove and standard records. It may be turned to bring the proper needle into playing position.

**flippies** — Floppy disks that flip over; two-sided diskettes.

**flippy** — A double-sided diskette.

**float** — 1. To be connected to no source of electrical potential. (Often used with respect to a particular point.) 2. To be maintained in a constant state of charge by being connected to a source of constant voltage, as a storage battery. 3. To operate a storage battery in parallel with a charger and a load at such a voltage that the charger supplies the load current and the battery supplies only transient peaks above the normal load.

**float-charging** — Charging a storage battery at about the same rate that it is being discharged by the load.

**floated battery** — A storage battery kept fully charged across the leads of a generator. The generator carries the normal load, and the battery assists during peaks.

**floating** — 1. Keeping a storage battery connected in parallel with an electric supply to serve as a standby in case of supply failure and to assist in handling peak loads. 2. The condition of a device or circuit that is not grounded and not tied to any established potential.

**floating address** — *See* symbolic address.

**floating battery** — A direct current supply from a constant-voltage source (generator or rectifier) paralleled with a storage battery. If the constant-voltage source is interrupted, the storage battery maintains power to the load. Minor variations in load current are supplied from the battery.

**floating-carrier modulation** — *See* controlled-carrier modulation.

**floating carrier system** — Method of radio transmission in which the percentage modulation is held constant by varying the amplitude of the carrier wave

to offset variations in the strength of the modulating wave.

**floating charge** — Continuous charging of a storage battery with a low current to keep the battery fully charged while idle or on light duty.

**floating decimal** — A calculator function that allows the user to calculate any decimal category. The decimal may or may not be present; if present, it automatically positions itself correctly in the answer.

**floating-decimal arithmetic** — *See* floating-point arithmetic.

**floating decimal point** — Calculator entry that may contain the decimal point in any position. The number and decimal point will be properly positioned automatically when displayed.

**floating gate** — A technique used for ultraviolet-erasable EPROMs, in which a silicon gate is isolated inside the silicon dioxide.

**floating grid** — A vacuum-type grid that is not connected to any circuit. It assumes a negative potential with respect to the cathode.

**floating ground** — A reference ground that is not earthed. A reference point or voltage in a circuit that is not tied to an actual external ground.

**floating in** — Decimal-point position need not be preset; numbers in a calculator are entered as they would be written.

**floating input** — 1. An isolated input circuit not connected to ground at any point (the maximum permissible voltage to ground is limited by electrical design parameters of the circuit involved). It is understood that in a floating-input circuit, both conductors are equally free from any reference potential, a qualification that limits the types of signal sources that can be operated floating. 2. *See* differential-input measurement.

**floating junction** — A semiconductor junction through which no net current flows.

**floating neutral** — A circuit in which the voltage to ground is free to vary with circuit conditions.

**floating out** — Decimal point in a calculator is automatically aligned in the answer.

**floating point** — 1. A method of representing a numeric value that contains a decimal point, i.e., not necessarily a whole number. 2. The representation of numbers in scientific notation, with the exponent and mantissa given separately, so as to be able to accommodate a very wide dynamic range. 3. Pertaining to a form of number representation in which quantities are expressed in terms of a bounded number (mantissa) and a scale factor (characteristic or exponent) consisting of a power of the number base. For example,  $127.6 = 0.1276 \times 10^3$ , where the bounds are 0 and 1.

**floating-point arithmetic** — 1. Computer handling of data in which the point is not always in the same position. Floating-point numbers are expressed in terms of digits and exponents. 2. In a digital computer, a form of arithmetic in which each number is represented by several significant digits, with an explicitly placed decimal point, multiplied by the base of the number system raised to a power, as for instance  $6.3542 \times 10^5$ . In computations of this kind the decimal point and exponent are adjusted automatically.

**floating-point calculation** — In a computer, a calculation taking into account the varying location of the decimal point (if base 10) or binary point (if base 2). The sign and coefficient of each number are specified separately.

**floating-point mathematics** — Calculations on data elements represented as a fixed-point or fractional component and an exponent; such calculations assure

**floating-point routine — flow soldering**

a specific degree of accuracy for values over a wide numerical range.

**floating-point routine**—Coded instructions in proper sequence to direct a computer to perform a calculation with floating-point operation.

**floating-point system**—A system of numbering in which an added set of digits is used to denote the location of the radix point. *See also* fixed-point system.

**floating-point unit**—In programming languages, a constant of type integer, real, double precision, or complex. Relates to a mathematical coprocessor.

**floating potential**—The dc voltage between an open-circuited terminal of a circuit and a reference point when a dc voltage is applied to the other circuit terminals as specified.

**floating zero**—In a machine-tool control system, the characteristic that allows the reference-point zero to be located readily anywhere along an axis of travel. Previously established reference points are eliminated from the control memory.

**float switch**—A switch actuated by a float on the surface of a liquid.

**float-zone crystal**—A crystal grown by passing a molten zone through a cylinder of material. No other material, with the possible exception of a gas, contacts the molten zone. When the crystal is grown in a vacuum, the term *vacuum float-zone crystal* is frequently used.

**flock**—Finely divided felt used on phonograph turntables, underneath microphone stands, or wherever a non-scratching surface is desired.

**F/logic**—A computer program developed by Bell Northern Research that can simulate large digital circuits with up to 32,000 gates. The program can simulate and detect faulty components, and trace and measure the circuit response. F/logic is a gate-level simulator, which means the simulator recognizes a circuit in terms of its constituent gate elements, such as NAND, NOR, and inverter gates. It is applicable in four areas of the design process: conceptual logic verification, completed design verification, fault simulation, and logic documentation.

**flood projection**—In facsimile transmission, an optical method in which all of the subject to be transmitted is illuminated and the scanning spot is defined by an aperture between the subject and the light-sensitive device.

**floor trap**—A trap, such as a trip wire switch or a mat switch, installed so as to detect the movement of a person across the floor space.

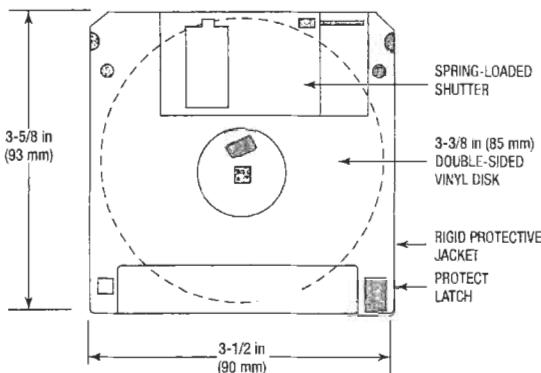
**floppy disk**—Also called a diskette. 1. A small, flexible disk carrying a magnetic medium in which digital data is stored for later retrieval and use. 2. A double-sided flexible vinyl disk that is coated with a magnetic oxide that serves as a memory medium for personal computers. Each side is organized in concentric circles called tracks, and each track is divided into sectors. The standard 3.5-in. diameter double-density disk is contained in a rigid square protective enclosure and has a formatted capacity of 1.44 Mbytes. The 5-1/4 inch and older 8-inch disks are now obsolete.

**flow**—1. The passage of electrons (a current) through a conductor or through the space between electrodes. 2. A general term to indicate a sequence of events.

**flow amplification**—The rate of change of the flow in a specified load impedance, connected to a device, with respect to the change in the flow applied to the controls of the device.

**flow amplifier**—A device that causes a change in output power following a change in control power of sufficient magnitude.

**flowchart**—Also called flow diagram. 1. A graphic presentation of the major steps of work in process with



*Floppy disk.*

accent on how the work flows through the process rather than on how the steps are done. 2. A graphical representation of the definition, analysis, or method of solution of a problem, particularly a problem to be solved on a computer. Symbols are used to represent operations, data flow, a process or sequence of decisions, and events. 3. A graphical representation used primarily to help in the development of a computer program by illustrating how a computer program logic is laid out, and to provide documentation for the program. 4. Symbolic representation of a program sequence, where boxes represent orders or computations and diamonds represent tests and decisions (branches). A flowchart is the recommended step between algorithm specification and program writing since it greatly facilitates understanding and debugging by breaking down the program into logical sequential modules.

**flowcharting**—A means of illustrating the steps required to solve a computer problem. It helps to clearly visualize each step in the solution of a problem and also provides a schematic diagram of the steps used. The shape of the symbol indicates its use.

**flowchart symbol**—A symbol used on a flowchart to represent data flow, equipment, or an operation.

**flow control**—1. A mechanism that allows a receiver to limit the amount of data a sender may transmit at any time. 2. The method used to regulate the rate of data exchange between the end users of a packet network in order to prevent system overloading. In general, the input is slowed down or stopped until the network handles the previous input.

**flow diagram**—Also called flowchart. A chart showing all the logical steps of a computer program. A program is coded by writing down the successive instructions that will cause the computer to perform the logical operations necessary for solving the problem, as represented on a flowchart.

**flow direction**—In flowcharting, the antecedent-to-successor relation between operations on a flowchart; it is indicated by arrows or other means.

**flowed wax**—A mechanical recording disc prepared by melting and flowing wax onto a metal base.

**flowline**—On a flowchart, a line that represents a connecting path between flowchart symbols, such as a line indicating transfer of data or control.

**flowmeter**—A device for measuring the rate of flow of liquids or gases.

**flow soldering**—Also called wave soldering. A method of soldering printed circuit boards by moving

them over a flowing wave of molten solder in a solder bath.

**fluctuating current** — A direct current that changes in value, but not at a steady rate.

**fluctuation noise** — Noise resulting from undesired fluctuations in quantity and/or velocity of electron (or hole) flow. *See* random noise; shot noise.

**fluctuation voltage** — Small voltage variations in a thermionic tube due to thermal agitation, shot effect, flicker effect, etc.

**fluid computer** — A digital computer constructed totally from fluid logic elements. All logic functions are carried out by interaction between jets of air or liquid, and the device contains no moving parts or electronic circuits.

**fluid damping** — Damping obtained through displacement of a viscous fluid and the accompanying dissipation of heat.

**fluidic** — Of or pertaining to devices, systems, assemblies, etc., utilizing fluidic components.

**fluidics** — 1. The branch of engineering and technology concerned with the design and production of logic elements, amplifiers, and the like, that depend for their operation on interactions between jets of fluid rather than on electrical phenomena. (While slower than electronic logic systems, fluid logic systems can operate in environments that would damage electronic systems.) 2. The technology wherein sensing, control, information processing, and/or actuation functions are performed solely through utilizing fluid dynamic phenomena.

**fluidized bed coating** — A method of applying a resin coating to an article. The heated article is immersed in a dense-phase aerated bed of powdered resin, and then is heated in an oven to obtain a smooth, pinhole-free coating.

**fluorescence** — The emission of light (or other electromagnetic radiation of longer wavelengths) by a substance as a result of the absorption of some other radiation of shorter wavelengths only as long as the stimulus producing it is maintained. Luminescence persists for less than about  $10^{-8}$  second after excitation is stopped.

**fluorescence spectroscopy** — The spectroscopic study of radiation emitted by the process of fluorescence.

**fluorescent** — Having the property of giving off light when activated by electronic bombardment or a source of radiant energy.

**fluorescent display** — A numerical or alphanumeric display whose segments are composed of fluorescent material that glows with a blue-green light when bombarded by electrons.

**fluorescent lamp** — 1. An electric discharge lamp in which a gas ionizes and produces radiation that activates the fluorescent material inside the glass tubing. The phosphors in the fluorescent material transform the radiant energy from the electric discharge into wavelengths giving more light (higher luminosity). 2. A low-pressure mercury electric-discharge lamp in which a fluorescing coating (phosphor) transforms some of the ultraviolet energy generated by the discharge into light.

**fluorescent light source** — A tube containing mercury vapor, lined with phosphor. When current is passed through the vapor, the strong ultraviolet emission excites the phosphor, which emits visible light. The ultraviolet itself cannot emerge because it is absorbed by the glass.

**fluorescent material** — A material that fluoresces readily when exposed to electron beams, X-rays, or other radiation.

**fluorescent screen** — A sheet of material coated with a fluorescent substance so as to emit visible light when struck by ionizing radiation such as X-rays or electron beams.

**fluorometer** — An instrument for measuring fluorescence.

**fluoroscope** — 1. An instrument with a fluorescent screen suitably mounted with respect to an X-ray tube, used for immediate indirect viewing of internal organs of the body, or internal structures in apparatus, or masses of metals, by means of X-rays. A fluorescent image (really a kind of X-ray shadow picture) is produced. 2. An X-ray device in which the image appears on a fluorescent screen rather than on a photographic film.

**fluoroscopy** — The use in diagnosis, testing, etc., of a fluorescent screen activated by X-rays.

**flush receptacle** — A receptacle recessed into a wall, with only the plate extending beyond the surface.

**flush-type instrument** — An instrument designed to be mounted with its face projecting only slightly from the front of the panel.

**flutter** — Also called wow and drift. 1. The frequency deviations produced by irregular motion of a turntable or tape transport during recording, duplication, or reproduction. The term *flutter* usually refers to relatively high cyclic deviations (for example, 10 Hz), and the term *wow* to relatively low ones (for example, a variation of once per turntable revolution). The term *drift* usually refers to a random rate close to 0 Hz. 2. In communications, (a) distortion due to variations in loss resulting from simultaneous transmission of a signal at another frequency, or (b) a similar effect due to phase distortion. 3. Rapidly repeated fluctuations in tape speed that introduce spurious burbling, quivering, or shimmering variations in the pitch of the reproduced sound. 4. A fast change in pitch (about 10 Hz) caused by a change in the speed of a turntable specified as a percentage of the test frequency (usually 3000 or 3150 Hz); figures below about 0.1 percent are good. 5. The audible effect of short-term recording speed fluctuations, occurring at a low audio or an infrasonic rate (0.5 to 200 Hz). This causes a frequency modulation of the program material, heard as a wavering or roughness of the sound. It is described as a percentage of rated speed; the smaller this percentage, the less audible the flutter. The percentage is generally combined with *wow*. It is often weighted (wrms) so that it corresponds to the average human hearing response. Flutter is particularly noticeable on piano or oboe, and may make the music sound watery or sour. 6. A rapid, extraneous variation in the pitch or frequency of a sound, usually caused by mechanical deviation in an element that should maintain constant speed. In tape recording, this may be caused by a faulty mechanism or by momentary sticking of the tape as it feeds through the transport and past the head.

**flutter bridge** — An instrument for measuring the irregularities in a constant-speed device such as a film, disc, or tape recorder.

**flutter echo** — 1. A rapid succession of reflected pulses resulting from a single initial pulse. 2. A multiple echo in which the reflections occur in rapid succession. If periodic and audible, it is referred to as a musical echo.

**flutter rate** — The number of times per second the flutter varies.

**flux** — 1. Number of particles crossing a unit area per unit time. The common unit of flux is particles/cm<sup>2</sup>/s. Integrated flux, after an exposure of time *T*, is equal to the total number of particles that have traversed a unit area during time *T*. 2. The number of photons that pass through a surface per unit time. Expressed in lumens or watts. 3. The lines of force that make up an electrostatic field. 4. The rate of energy flow passing to, from, or through a surface or other geometric entity. Radiant flux is expressed in watts; luminous flux is expressed in lumens. Flux is sometimes erroneously referred to as optical

power. 5. A substance used to promote or facilitate fusion, such as a material that removes oxides from surfaces to be joined by soldering, brazing, or welding. The flux also reduces surface tension of molten solder and metal to be soldered, and it covers the material being soldered to prevent reoxidation of the surface during the soldering operation. Rosin is widely used in electronics soldering. 6. The total amount of energy radiated in all directions per unit time from an electromagnetic source.

**flux changes per inch**—The number of polarity reversals possible in 1 inch (2.54 cm) of magnetic tape.

**flux concentration**—The intensity of radiation transmitted to a receiver.

**flux concentrator**—Any ferrous material attached to the sensor package to concentrate more of the available flux into the sensing area, thereby increasing the flux density at the chip.

**flux-cored solder**—Hollow-wire solder containing flux.

**flux density**—1. A measure of the strength of a wave; flux per unit area normal to the direction of the flux; number of photons passing through a surface per unit time per unit area. Expressed in watts/cm<sup>2</sup> or lumens/ft<sup>2</sup>. 2. The number of lines or maxwells per unit area in a section normal to the direction of the flux.

**fluxgate**—A magnetic azimuth-sensitive element of the fluxgate-compass system activated by the earth's magnetic field.

**fluxgate compass**—A gyrostabilized, remote-indicating compass and azimuth-control system used with automatic pilots.

**fluxgraph**—A machine that automatically plots on paper the magnetic field strength at various points in the vicinity of a coil.

**flux guide**—In induction heating, a magnetic material used for guiding the electromagnetic flux to the desired location or for confining it to definite regions.

**flux intensity**—Flux per unit solid angle.

**flux linkage**—1. Magnetic lines of force that link a coil of wire. Whenever the flux linkage changes, an emf is generated in the coil. 2. The product of a number of turns in an electrical circuit by the average value of flux linked with the circuit.

**fluxmeter**—An instrument used with a test coil for measuring magnetic flux. It consists usually of a moving-coil galvanometer in which the torsional control is either negligible or compensated.

**flyback**—Also called retrace. 1. The shorter of the two time intervals comprising a sawtooth wave. 2. As applied to a cathode-ray tube, the return of the spot to

## flux changes per inch – flying-spot scanner

its starting point after having reached the end of its trace. This portion of the wave is usually not seen because of blanking circuits or the shortage of time.

**flyback checker**—An instrument used to check flyback or other transformers or inductors for open windings or shorted turns.

**flyback diode**—See freewheeling diode.

**flyback power supply**—The power supply that generates the high dc voltage required by the second anode of a picture tube. This voltage is produced during the flyback period, the current in the horizontal-deflecting coils reversing and inducing a sharp pulse in the primary of the transformer supplying the deflection circuit. This pulse is stepped up by an autotransformer and rectified. After suitable filtering, it becomes a very high dc voltage.

**flyback tester**—An instrument that tests flyback transformers and sometimes also deflection yokes.

**flyback time**—The period during which the electron beam is returning from the end of a scanning line to begin the next line.

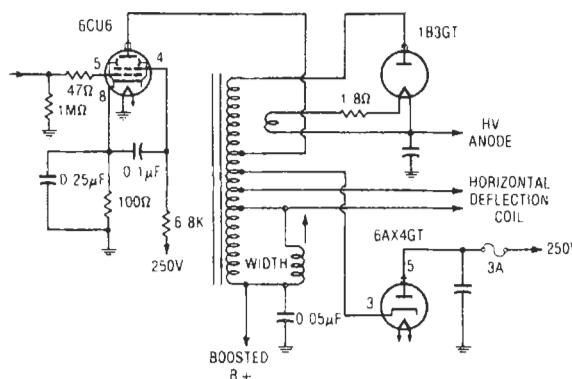
**flyback transformer**—Also called horizontal-output transformer. A transformer used in the horizontal-deflection circuit of a television receiver to provide the horizontal scanning and accelerating anode voltages for the cathode-ray tube. It also supplies the filament voltage for the high-voltage rectifier.

**flycutter**—An accessory used with a drill press to cut out large round holes in metal or wood.

**flying erase head**—An erase head in a camcorder that allows the user to edit while shooting and achieve perfectly clean splices between the edited segments. The flying erase head follows a path in its erasing process that matches that of the recording heads, completely eliminating the unerased blanks and rainbow streaking effect left by fixed erase heads.

**flying spot**—1. A small, rapidly moving spot of light, usually generated by a cathode-ray tube, used to scan an image field for television transmission. 2. The quick, mobile spot of light emitted by a source, generally a cathode-ray tube, to illuminate specific points of an area carrying light and dark regions according to a specific pattern.

**flying-spot scanner**—Also called light-spot scanner. 1. A television scanning device embodying a small beam that is moved over a scene or film and translates the highlights and shadows into electrical signals. 2. In optical character recognition, a device employing a moving spot of light to scan a sample space, the intensity of the transmitted or reflected light being sensed by a photoelectric transducer.



Flyback power supply.

**fly's-eye lens**—A multiple lens made up of hundreds of small, closely spaced lenses. It forms many images of the same subject and eliminates the need for step-and-repeat techniques in the fabrication of microelectronic circuits.

**flywheel diode**—*See* freewheeling diode.

**flywheel effect**—The maintaining of oscillations in a circuit in the intervals between pulses of excitation energy. The action is analogous to the rotation of a flywheel due to its stored mechanical energy.

**flywheel synchronization**—Automatic frequency control of a scanning system based on the average timing of the incoming sync signals rather than triggering of the scanning circuit by each pulse. It is used in high-sensitivity television receivers for fringe-area reception, in which noise pulses might otherwise trigger the sweep circuit prematurely.

**flywheel tuning**—A tuning-dial mechanism that uses a heavy flywheel on the control shaft for added momentum, to obtain a smoother tuning action.

**flywire**—A fine [0.001- to 0.003-inch (25- to 75- $\mu$ m) diameter] gold or aluminum wire used for circuit interconnection.

**FM**—Abbreviation for frequency modulation.

**FM/AM**—A system in which information subcarriers are frequency modulated and are used to amplitude modulate the carrier.

**FM/AM multiplier**—A multiplier in which a carrier is modulated so that its frequency deviation from the center value is proportional to one variable, and its amplitude is proportional to another variable. The modulated carrier is then consecutively demodulated for FM and for AM. The final output is proportional to the product of the two variables.

**FM broadcast band**—The band of frequencies extending from 88 to 108 MHz, which includes those assigned to noncommercial educational broadcasting.

**FM broadcast channel**—A band of frequencies 200 kHz wide and designated by its center frequency. Channels for FM broadcast stations begin at 88.1 MHz and continue in steps of 200 kHz through 107.9 MHz. The portion of the band from 88.1 to 91.9 MHz is reserved for educational broadcasts.

**FM broadcast station**—A station employing frequency modulation in the FM broadcast band and licensed primarily for the transmission of radio emissions intended to be received by the general public.

**FM discriminator**—A device that converts frequency variations to proportional variations in the amplitude of an electrical signal. Discriminators may be of several basic types, such as pulse averaging, Foster-Seeley, ratio detector, or phase-lock correlation detector.

**FM discriminator (subcarrier)**—The same as an FM discriminator except that it is used to convert subcarrier frequency variations into proportional voltage or current signals.

**FM Doppler**—Type of radar involving frequency modulation of both carrier and modulation on radial sweep.

**FM-FM**—Frequency modulation of a carrier by one or more subcarriers that are themselves frequency modulated by information.

**FM laser**—A conventional laser with a phase modulator inside its Fabry-Perot cavity. It is characterized by a lack of noise resulting from random phase fluctuation in the various modes.

**FM multiplex**—*See* FM stereo.

**FM noise level**—Residual frequency modulation of an aural transmitter as a result of disturbances in the frequency range between 50 and 15,000 Hz.

**FM noise/phase noise**—The short-term frequency variations in the output frequency that appear as energy at frequencies other than the carrier. It is usually expressed in terms of dBc or as an rms frequency deviation in a specified frequency removed from the carrier.

**FM/PM**—A system in which information subcarriers are frequency modulated and used to phase modulate the carrier.

**FM radar**—*See* frequency-modulated radar.

**FM receiver deviation sensitivity**—The smallest frequency deviation that results in a specified output power.

**FM recording (magnetic) tape**—A method of recording in which the input signal modulates a voltage-controlled oscillator, the output of which is delivered to the recording head.

**FM stereo**—Also called FM multiplex. 1. A means by which FM radio stations are able to transmit stereophonic program material to specially designed receivers and which is at the same time compatible with monophonic equipment. 2. FM broadcasting in which two channels of sound are transmitted, offering a signal similar to the stereo available from records and tapes. To hear FM stereo requires either a stereo FM tuner or a monophonic FM tuner fitted with an FM stereo adapter. The technical means for transmitting FM stereo is known as multiplexing.

**FM stereophonic broadcast**—The transmission of a stereophonic program by a single FM broadcast station utilizing the main channel and a subchannel to carry the signals required to produce the stereophonic effect.

**f-number**—In optical terminology, a number that describes a lens; ratio of focal length to lens diameter.

**FO**—Abbreviation for fiber optics.

**foam fluxing**—A commonly used wave-solder fluxing method in which flux foam is generated from a liquid flux by means of a porous diffuser, such as a hollow cylindrical stone. Low compressed air forced through the pores of the stone, immersed in the flux, generates fine bubbles of foam, which are guided to the surface by a chimney nozzle. *See also* brush fluxing; spray fluxing; wave fluxing.

**focal length**—1. Symbolized by *f*. The distance from the principal focus (focus of parallel rays of light) to the surface of a mirror or the optical center of a lens. 2. Of a lens, the distance from the focal point to the principal point of the lens.

**focal plane**—A plane (through the focal point) at right angles to the principal axis of a lens. That surface on which the best image is formed.

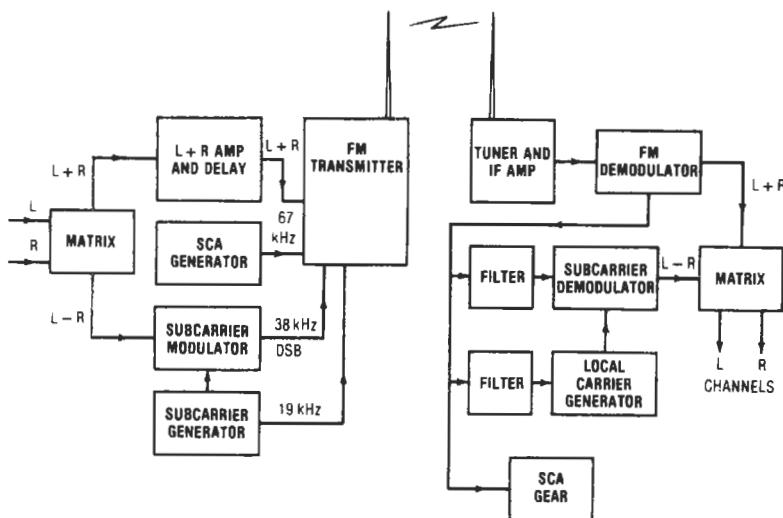
**focal point**—The point at which a lens or mirror will focus parallel incident radiation.

**focal distance-to-diameter ratio (F/D)**—The ratio of feedhorn distance to the center of an antenna divided by the diameter of the antenna.

**focometer**—An instrument for measuring the focal length of a lens or an optical system.

**focus**—1. The convergence of light rays or an electron beam at a selected point. 2. The sharp definition of a scanning beam in television receivers or optical systems. 3. The point at which light rays or an electron beam form a minimum-size spot. 4. The action of bringing light or electron beams to a fine spot.

**focus control**—1. On a television receiver, a potentiometer control used for fine focusing of the electron beam. The control varies the first-anode voltage of an electrostatic tube or the focus-coil current of a magnetic tube. 2. A manual adjustment for electrostatically bringing the electron beam of a vidicon or picture tube to a minimum-size spot, producing the sharpest image.



FM stereophonic broadcast system.

**focusing**—The process of controlling the convergence and divergence of an electron or light beam.

**focusing anode**—One of the electrodes used to focus the electron beam in a cathode-ray tube. As its potential changes, so does the electric field, thereby altering the path of the electrons.

**focusing coil**—The coil around the neck of a cathode-ray tube. It provides a magnetic field, parallel to the electron beam, for controlling the cross-sectional area of the beam on the screen.

**focusing electrode**—An electrode to which a potential is applied to control the cross-sectional area of the electron beam.

**focusing magnet**—A permanent magnet assembly that produces a magnetic field for focusing the electron beam in a cathode-ray tube.

**focus projection and scanning**—A method of magnetically focusing and electrostatically deflecting the electron beam in a hybrid vidicon. A transverse electrostatic field deflects the beam, and an axial magnetic field focuses the beam.

**foil**—1. A thin continuous sheet of metal, usually copper or aluminum, used as the conductor for printed circuits. Foils used for printed circuits are commonly 1 or 2 ounces per square foot ( $30$  or  $60$  g/cm $^2$ ); the thinner the foil, the lower the required etch time. Thinner foils also permit finer definition and spacing. 2. The thin metal shield in a shielded cable. It is equivalent to a long tubular capacitor that surrounds one or more signal wires. This electrostatic shield must be grounded at only one end of the cable by means of the drain wire. *See* shield. 3. A very thin sheet of metal, such as tin or aluminum. Used in the construction of fixed capacitors. 4. Thin metallic strips that are cemented to a protected surface (usually glass in a window or door), and connected to a closed electrical circuit. If the protected material is broken so as to break the foil, the circuit opens, initiating an alarm signal. Also called tape. A window, door, or other surface to which foil has been applied is said to be taped or foiled.

**foil connector**—An electrical terminal block used on the edge of a window to join interconnecting wire to window foil.

**foil electret**—A polymer plastic film about 1 mil (25  $\mu\text{m}$ ) thick with a very thin metal layer evaporated on

one surface and having permanent electrostatic polarization created by electron bombardment or by heating while exposed to a powerful electric field. Used to make electret microphones.

**foldback**—British term synonymous with talkback. A technique for protecting voltage regulators from short circuits. After a certain output-current level is reached, any further load on the regulator results in less, rather than more, current. *See* cue bus.

**foldback characteristic**—*See* current limiting (automatic).

**foldback current limiting**—1. An overload protection method whereby the output current of a power supply is decreased as the load approaches short circuit. Under output short circuit, the output current is, therefore, less than the rated output current. This technique minimizes internal power dissipation under overload conditions. 2. A protective circuit in a power supply that monitors the output current drain, and automatically reduces the output voltage to very low levels when the drain current exceeds a preset level. The output voltage is usually reduced to a level at which approximately 25 percent of the nominal current flows.

**foldback operation**—In a power supply, a technique similar to current limiting except that when the load demands too much current, the power supply reacts by reducing both its output current and output voltage.

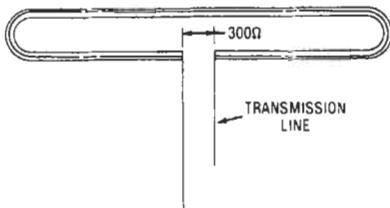
**folded cavity**—An arrangement used for producing a cumulative effect in a klystron repeater. This is done by making the incoming wave act in several places on the electron stream from the cathode.

**folded-dipole antenna**—An antenna comprising two parallel, closely spaced dipole antennas. Both are connected together at their ends, and one is fed at its center.

**folded heater**—A strand of bent, coated wire inserted into a cathode sleeve.

**folded horn**—1. An acoustic horn that is curled to permit more efficient use of the space it occupies. 2. A type of speaker enclosure employing a horn-shaped passageway for aiding the bass response.

**folding frequency**—The frequency that is one-half the sampling rate when samples are made continuously at equal intervals.



*Folded-dipole antenna.*

**foldover** — A distorted television picture that appears to overlap horizontally or vertically. It is due to nonlinear horizontal- or vertical-sweep circuits.

**follow current** — 1. That line current which tends to follow a lightning discharge through an arrester to ground. 2. The current through a lightning protector from a connected steady-state power source that flows during and following the discharge of a surge or transient current.

**follower** — A circuit in which the output of a high-gain amplifier is fed directly back to its negative input. The input signal is reproduced without polarity reversal.

**follower drive** — Also called slave drive. A drive in which the reference input and operation are direct functions of a master drive.

**follower with gain** — A follower in which only a part of the output voltage is fed back in series opposition to the input signal. Hence, closed-loop gain greater than unity is obtained over the rated range of operation.

**following blacks** — Also called edge effect, trailing reversal, or trailing blacks. A picture condition in which the edge following a white object is overshaded toward black (i.e., the object appears to have a trailing black border).

**following whites** — Also called edge effect, trailing reversal, or trailing whites. A picture condition in which the edge following a black or dark gray object is shaded toward white (i.e., the object appears to have a trailing white border).

**follow-on current** — The current from power sources that flows through a transient suppressor during and after discharge. Spark gaps, gas-discharge tubes, and SCR/thyristor crowbars offering a low impedance path to transient energy provide a low-impedance path for line current, as well. This follow-on current must be handled by the device until the follow-on voltage is removed.

**font** — 1. The characteristic style of a set of alphanumerics, e.g., gothic. 2. An alphabetic, numeric, or other graphic shape, i.e., 10-point Times Roman font, 1428E font, OCR (A) font, etc. 3. A family or assortment of characters of a given size and style. 4. A character set in a particular style and size of type, including all alphabet characters, numerics, punctuation marks, and special symbols. 5. A complete set of letter, numbers and symbols with a common design.

**footcandle** — Letter symbol: fc. The unit or measure of illumination in which the foot is taken as the unit of length. It is the illumination on a surface 1 square foot in area on which there is a uniformly distributed flux of 1 lumen, or the illumination produced on a surface all points of which are at a distance of 1 foot from a directionally uniform point source of 1 candela.

**foot control** — A foot-actuated start-stop switch, usually used for dictating and transcribing via tape.

**footlambert** — Letter symbol: fL. A unit of luminance (photometric brightness) equal to  $1/\pi$  candela per square foot or to the uniform luminance of a perfectly diffusing surface emitting or reflecting light at the rate

of 1 lumen per square foot or to the average luminance of any surface emitting or reflecting light at that rate. The average luminance of any reflecting surface in foot-lamberts is, therefore, the product of the illumination in footcandles by the luminous reflectance of the surface. Thus, a desk may be receiving 100 footcandles of illumination, but if it is a dark color it may be reflecting, say, 20 footlamberts. We "see" footlamberts, not footcandles. For a perfectly reflecting and perfectly diffusing surface, the number of lumens per square foot is equal to the number of footlamberts.

**foot-pound** — A unit of measurement equivalent to the work of raising one pound vertically a distance of 1 foot.

**footprint** — 1. The area covered by downlink signals transmitted from a satellite. 2. The space a device occupies on a desk or in a workplace. 3. The geographic area toward which a satellite downlink antenna directs its signal. The measure of strength of this footprint is the EIRP.

**foot rail** — A holdup alarm device, often used at cashiers' windows, in which a foot is placed under the rail, lifting it, to initiate an alarm signal.

**forbidden band** — The energy band lying between the conduction and valence bands. The energy difference across it determines whether a solid acts as a conductor, semiconductor, or insulator.

**forbidden combination** — A combination of bits or other representations that is invalid according to some criterion.

**forbidden-combination check** — A test, usually automatic, for the occurrence of a code expression that is not permissible. A self-checking code (or error-detecting code) uses code expressions such that errors result in a forbidden combination. A parity check uses a self-checking binary-digit code in which the total number of 1s (or 0s) in each permissible code expression is always even or always odd. A check may be made for either even parity or odd parity. A redundancy check makes use of a self-checking code that employs redundant digits called check digits.

**forbidden energy gap** — The energy range of a semiconductor between the bottom of the conduction band and the top of the valence band. Electrons cannot exist at energies within this range.

**force** — 1. Any physical action capable of moving a body or modifying its motion. 2. In computer programming, manual intervention that directs the computer to execute a jump instruction.

**force-balance transducer** — A transducer in which the output from the sensing member is amplified and fed back to an element that causes a force-summing member to return it to its rest position. The magnitude of the signal fed back determines the output of the divide, like the error signal in a servo signal.

**forced coding** — See minimum-access programming.

**force differential** — The difference between the operating force and the release force of a momentary contact switch.

**forced oscillation** — In a linear constant-parameter system, the response to an applied driving force, excluding the transient that results from energy at the time the driving force is applied.

**force factor (of an electromechanical or electroacoustic transducer)** — 1. The complex quotient of the force required to block the mechanical or acoustic system, divided by the corresponding current in the electrical system. 2. The complex quotient of the resultant open-circuit voltage in the electric system, divided by the velocity in the mechanical or acoustic system.

**force feedback — forty-five record**

**force feedback** — Sensing technique using electrical or hydraulic signals to control a robot end effector.

**force-summing device** — In a transducer, the element directly displaced by the applied stimulus.

**foreground processing** — The automatic execution of computer programs that have been designed to preempt the use of the computing facilities.

**fore pump** — An auxiliary vacuum pump used as the first stage in evacuating vacuum systems.

**foreshortened addressing** — A feature of control computers that makes it possible to use simpler instructions when addressing the computer; hence less of the available computer storage is used for this purpose.

**fork oscillator** — An oscillator in which a tuning fork is the frequency-determining element.

**fork tines** — The projecting ends of a tuning fork. When vibrated, they produce a constant frequency.

**form** — To apply a voltage to an electrolytic capacitor, semiconductor, or other component as part of a manufacturing process, in order to cause a desired change in its characteristics.

**formal logic** — The study of the structure and form of a valid argument without regard to the meaning of the terms in the argument.

**formant** — 1. The particular frequency region in which the energy of a vowel sound is concentrated most strongly. 2. In an organ, an electrical circuit whose purpose is to alter the tone quality of sound amplified by it. A formant filter is applied to the entire output from a manual, rather than to individual tones.

**formant filter** — A waveshaping network used in an organ to modify the signal from the tone generator so it will assume the waveshape of the desired tone.

**formants** — Resonances in the frequency spectra of voiced speech. Formants appear as bands in a spectrographic display of voiced speech. Formants help to distinguish one sound from another.

**formant synthesis** — 1. A technique for modeling the natural resonances of the vocal tract. For recognizable speech, at least three formants should be used for each voice utterance. Voiced sounds are generated from an impulse source that is modulated in amplitude to control intensity. The resulting signal is passed through two levels of filtering. The first is a time-varying filter composed of cascaded resonators that correspond to the source-spectrum and mouth-radiation characteristics of the speech waveform. Unvoiced sounds, generated as white noise, are passed through a variable-pole-zero filter. The second filter used for voiced sounds can be reused for the unvoiced sounds. The coefficients for these filters are stored in ROM. An approximate number of memory bits required for a second of speech is 400. 2. A parameter-encoding technique that models speech information by tracking the formants of the frequency spectrum.

**format** — 1. In a computer, a specified grouping of data to facilitate storage and movement of the data in the system. A given format may include control codes, record marks, block marks, and tape marks in a prearranged sequence. The format tells the operator or the system how the transfer, processing, and printing of data are to be controlled. The term *format* also describes the layout of characters on printed copy, which is directly related to the data format. 2. A model for a microinstruction consisting of fields that contain constants, variables, and don't cares. 3. A message or data structure that allows identification of specific control codes or data by their position during processing. 4. The orderly structured arrangement of data elements (bits, characters, bytes, and/or files) to form a larger entity, such as a list, table, record, file, or dictionary. 5. A contraction meaning the *form* of material, designating the predetermined arrangement of text/data

for output. 6. The layout, presentation, or arrangement of data on a screen, file, or paper. 7. A specified arrangement of data that permits identification of control and information content. 8. To prepare a disk for reading, writing, and accepting files.

**formatted diskette** — 1. A computer disk that has been initialized with DOS. 2. A diskette on which track and sector control information has been written.

**formatted display** — Standardized data arrangement to make data entry faster and more organized.

**formatter** — See buffer.

**formatting** — 1. Preparing a diskette for use so that the operating system can write information on it. The formatting process erases any previous information on the diskette. 2. The arranging in a predefined order of code characters within a record. 3. The division of tracks into sections to make it easier to retrieve and update data. In each sector, the block of data is preceded by an identifying header. Gaps are inserted between sectors and between the header and data block within each sector to allow time for control logic functions.

**form factor** — 1. Shape (diameter/length) of a coil. 2. Ratio of the effective value of a symmetrical alternating quantity to its half-period average value. 3. A figure of merit that indicates how much the current departs from pure dc or from a continuous, nonpulsating current. Unity represents pure dc. Values greater than 1 indicate an increasing departure from pure dc. A departure from unity form factor increases the heating effect in a motor and reduces brush life.

**Formica** — Trade name for a phenolic compound having good insulating qualities.

**forming** — The application of voltage to an electrolytic capacitor, electrolytic rectifier, or semiconductor device to produce a desired permanent change in electrical characteristics as a part of the manufacturing process.

**formula translation** — See FORTRAN.

**form-wound coil** — An armature coil that is formed or shaped over a fixture before being placed on the armature of a motor or generator. Any coil wound on a fixture or dummy form.

**FORTRAN** — 1. Acronym for formula translation. A procedure-oriented computer language designed to be used with problems expressible in algebraic notation. There are several forms: FORTRAN II, FORTRAN IV, etc. 2. A computer-programming language designed mainly for scientific problems. 3. A higher-level programming language designed for programming scientific-type problems.

**fortuitous conductor** — Any conductor that may provide an unintended path for intelligible signals; for example, water pipe, wire or cable, metal structural members, and so forth.

**fortuitous telegraph distortion** — 1. Distortion other than bias or characteristic. It occurs when a signal pulse departs from the average combined effects of bias and characteristic distortion for one occurrence. Since fortuitous distortion varies from one signal to another, it must be measured by a process of elimination over a long period. It is expressed in a percentage of unit pulse. 2. Distortion of telegraph signals that does not follow any pattern and is not predictable.

**forty-five/forty-five** — Also called the Westrex system. A system of disc recording in which signals originating from two microphones are impressed on each side of a groove. The two sides are cut 45° from the surface of the record.

**forty-five record** — A 7-inch (17.8-cm) record with a 1½-inch (3.8-cm) center hole. It is recorded at 45 rpm and played at the same speed. (No longer in use.)

**forty-four-type repeater**—Type of telephone repeater used in a four-wire system. It employs two amplifiers and no hybrid arrangements.

**forward**—In or of the direction in which a nonlinear element, like a pn junction, conducts most easily.

**forward-acting regulator**—A transmission regulator that makes an adjustment without affecting the quantity that caused the adjustment.

**forward-backward counter**—A counter having both an add and subtract input and thus capable of counting in either an increasing or a decreasing direction.

**forward bias**—1. A voltage applied across a rectifying junction with a polarity that provides a low-resistance conducting path. By contrast, reverse bias causes the junction to block normal current. 2. An external voltage applied in the conducting direction of a pn junction. The positive terminal is connected to the p-type region, and the negative terminal to the n-type region.

**forward-biased second breakdown**—A local thermal runaway phenomenon in a semiconductor characterized by high local temperature and uneven current density. It is strongly a function of breakdown voltage and is affected by the structure used.

**forward coupler**—A directional coupler used for sampling incident power.

**forward current**—1. The current that flows across a semiconductor junction when a forward-bias voltage is applied. 2. Of a diode, the current through a diode in the forward direction.

**forward dc resistance**—Of a diode, the quotient of forward voltage across a diode and the corresponding forward current.

**forward direction**—1. The direction of easy current flow through a semiconductor device when a given voltage within the ratings of the device is applied. In a conventional rectifier or diode, the forward direction is from anode to cathode when the anode is at a positive voltage with respect to the cathode. 2. Of a pn junction or a semiconductor diode, the direction of the unidirectional current in which the junction or diode has the lower resistance. 3. Of a tunnel diode, the direction of current within the diode for which the characteristic includes negative differential conductance.

**forward error correction**—Abbreviated FEC. A technique for improving the accuracy of data transmission. Excess bits are included in the outgoing data stream so that error correction algorithms can be applied upon reception.

**forward gate current**—The current into the gate terminal of a field-effect transistor with a forward gate-to-source voltage applied. The gate current corresponding to the forward gate voltage.

**forward gate-to-source breakdown voltage**—The breakdown voltage between the gate and source terminals of an insulated-gate field-effect transistor with a forward gate-to-source voltage applied and all other terminals short-circuited to the source terminal.

**forward gate voltage**—The negative gate-to-anode voltage for n-gate thyristors. The positive gate-to-cathode voltage for p-gate thyristors.

**forward path**—In a feedback control loop, the transmission path from the loop-actuating to the loop-output signal.

**forward propagation by ionospheric scatter**—A radiocommunication technique using the scattering phenomenon exhibited by electromagnetic waves in the 30- to 100-megahertz region when passing through the ionosphere at an elevation of about 85 kilometers.

**forward propagation by tropospheric scatter**—A method of communication by means of ultrahigh-frequency FM radio. It provides reliable

multichannel telephone, teletype, and data transmission without line-of-sight restrictions or the necessity of using wire or cables.

**forward recovery time**—1. In a semiconductor diode, the time required for the current or voltage to arrive at a specified condition after instantaneous switching from zero or a specified reverse voltage to a specified forward voltage. 2. The time required for the current or voltage to recover to a specified value after instantaneous switching of a semiconductor from zero or a specified reverse voltage to a specified forward bias condition.

**forward resistance**—The resistance measured at a specified forward voltage drop or forward current in a rectifier.

**forward scatter**—1. Propagation of electromagnetic waves at frequencies above the maximum usable high frequency through use of the scattering of a small portion of the transmitted energy when the signal passes from a nonionized medium into a layer of the ionosphere. 2. A term referring collectively to very-high-frequency forward propagation by ionospheric scatter and ultrahigh-frequency forward propagation by tropospheric scatter communication techniques.

**forward scattering**—The reflected radiation of energy from a target away from the illuminating radar.

**forward short-circuit current amplification factor**—In a transistor, the ratio of incremental values of output to input current when the output circuit is ac short-circuited.

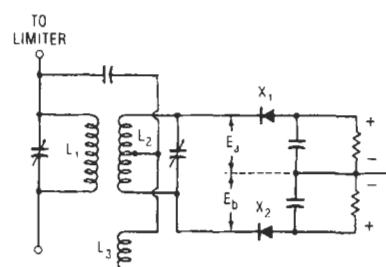
**forward-transfer function**—In a feedback control loop, the transfer function of the forward path.

**forward voltage**—1. Voltage of the polarity that produces the larger current. 2. The voltage drop across a device after breaking over into conduction at some specified current. 3. Of a diode, the voltage across the terminals that results from the current in the forward direction. 4. Of a thyristor, a positive anode voltage.

**forward voltage drop**—The resultant voltage drop when current flows through a rectifier in the forward direction.

**forward wave**—In a traveling-wave tube, a wave with a group velocity in the same direction the electron stream moves.

**Foster-Seeley discriminator**—A type of frequency discriminator that converts a frequency-modulated signal into an audio signal. It requires a limiter to prevent random amplitude variations of the FM signal from appearing in its output.



Foster-Seeley discriminator.

**Foster's reactance theorem**—The driving-point impedance of a finite two-terminal network composed of pure reactances is a reactance that is an odd rational function of frequency and that is completely determined, except for a constant factor, by assigning the resonant and

antiresonant frequencies. In other words, the driving-point impedance consists of segments going from minus infinity to plus infinity (except that at zero, or infinite, frequency, a segment may start or stop at zero impedance). The frequencies at which the impedance is infinite are termed poles, and those at which it is zero are termed zeros.

**FOTS** — See fiber-optics transmission system.

**Foucault currents** — See eddy currents.

**four-address code** — An artificial language for describing or expressing the instructions carried out by a digital computer. In automatically sequenced computers, the instruction code is used for describing or expressing sequences of instructions. Each instruction word then contains a part specifying the operation to be performed, plus one or more addresses that identify a particular location in storage.

**four-channel sound** — See quadraphonic.

**four-frequency duplex telegraphy** — A method of frequency-shift telegraphy in which a separate frequency is used to represent each of the four possible signal combinations corresponding to two telegraph channels.

**four-horn feed** — A cluster of four rectangular horn antennas used as the radiating and receiving elements of parabolic or lens-type radar antennas. The four segments of the horn assembly define the four quadrants of information for direction to target sensing. Used on monopulse-type radar systems such as the AN/FPS-16.

**Fourier analysis** — 1. The process of analyzing a complex wave by separating it into a plurality of component waves, each of a particular frequency, amplitude, and phase displacement. 2. The representation of arbitrary functions as the superposition of sinusoidal functions, whereby the representations themselves are referred to as Fourier series or Fourier integers.

**Fourier series** — A mathematical analysis that permits any complex waveform to be resolved into a fundamental, plus a finite number of terms involving its harmonics.

**Fourier transform** — 1. A mathematical relationship that provides a connection between information in the frequency domain and the time domain. The Fourier transform of correlation functions yields the power spectra. 2. A mathematical operation that decomposes a time-varying signal into its complex frequency components (amplitude and the phase, or real and imaginary components). 3. Any of the various methods of decomposing a signal into a set of coefficients of orthogonal waveforms (trigonometric functions). 4. Mathematical operation used to derive the frequency domain description of a distribution. An efficient digital implementation is the fast Fourier transform, or FFT. The inverse Fourier transform returns a frequency domain description to the original distribution. The digital inverse form is known as the IFFT.

**four-layer diode** — 1. A semiconductor diode that has three junctions, with connections made only to the two outer layers that form the junctions. A Schottky diode is an example. 2. A pnpn two-terminal thyristor exhibiting a negative resistance characteristic in one direction. It has two stable states: an off state in which it displays a high series resistance, and an on state in which the series resistance is quite low. Switching time for the four-layer diode is in the nanosecond region. A very high ratio of hold current to switching makes it ideal for oscillator application.

**four-layer transistor** — A junction transistor that has four conductivity regions, but only three terminals. A thyristor is an example.

**four-level laser** — A type of laser that differs from a three-level type in that it has a terminal (lower level) for the laser transition that itself is an excited state of the system rather than ground level. Ordinarily, less energy is

required to obtain the necessary population inversion in a four-level laser because the terminal level may be almost empty initially.

**four-level system** — A laser involving four electronic energy levels. The ground state (level 1) is pumped to level 4, from which the excited electrons make a downward transition to the upper laser level 3 (or metastable level 3). Then, stimulated transition to the lower laser level 2 occurs, followed by rapid decay to the ground state. The four-level system has the advantage that the pump level and ground state are isolated from the laser action.

**four-pole network** — See two-terminal-pair network.

**four-quadrant multiplier** — In analog computers, a multiplier in which operation is not restricted with regard to the signs of the input variables.

**four-track** — A quarter-track tape format in which the width of the tape is recorded in four parallel magnetic tracks, separated by narrow unrecorded guard bands.

**four-track recorder** — See track configuration.

**four-track recording** — Also called quarter-track.

On quarter-inch-wide tape, the arrangement by which four different channels of sound may be recorded on adjacent tracks. These may be recorded as four separate and distinct tracks (monophonic), or two related (stereo) pairs of tracks. By convention, tracks 1 and 3 are recorded in the forward direction of a given reel, and tracks 2 and 4 are recorded in the reverse direction.

**four-track tape** — Also known as quarter-track. Tape on which four separate sound paths are recorded. The use of four tracks permits stereo in both directions of tape movement, or alternately, monophonic recording across four times the length of a given tape.

**four-track tape recording format** — Either of two professional tape recording formats (four-track, half-track, or four-track quarter track) in which four channels (tracks) can be recorded in the same direction.

**four-wire circuit** — 1. A two-way circuit with two paths. Each path transmits the electric waves in one direction only. The transmission paths may or may not employ four wires. 2. A full-duplex communications channel in which transmission occurs over one pair of wires and reception occurs over a separate pair.

**four-wire line** — A two-way transmission circuit using separate paths for the two directions of transmission. For voice-frequency transmission, this requires two pairs (four wires).

**four-wire modem** — A modem, using two pairs of wires, capable of simultaneous data transmission in both directions (i.e., full-duplex modem).

**four-wire repeater** — A telephone repeater used in a four-wire circuit. It has two amplifiers; one amplifies the telephone currents in one side of the four-wire circuit, and the other in the other side.

**four-wire resistance** — Resistance measurement method that compensates for the resistance in the measurement leads as well as those in the meter's input terminals (and anywhere else in the measurement circuit, such as junctions).

**four-wire terminating set** — A hybrid arrangement involving termination of four-wire circuits on a two-wire basis for interconnection with two-wire circuits.

**fox message** — A diagnostic test message that includes all the alphanumerics on a teletypewriter, as well as most of the function characteristics such as space, figure shift, letter shift, etc. It is: THE QUICK BROWN FOX JUMPED OVER A LAZY DOG'S BACK 1234567890--SENDING. The sending station's identification is inserted in the three space blanks that precede the word "sending."

**fox test**—*See* fox message.

**FPGA**—Abbreviation for field-programmable gate array. An array of gates on a chip whose interconnections can be arranged electronically by the user.

**FPLA**—Abbreviation for field-programmable logic array. A PLA that can be programmed by the user. FPLAs are used in particular to implement the control section of bit-slice processors.

**fractal**—1. A form of computer-generated art-making process that creates complex, repetitive, mathematically based geometric shapes and patterns that resemble those found in nature. 2. An object (or set of points, curves, or patterns) that exhibits increasing detail with increasing magnification. In computer graphics applications, a technique for attaining a degree of complexity analogous to that in nature from a handful of data points.

**fractional arithmetic units**—Arithmetic units in a computer that is operated with the decimal point at the extreme left so that all numbers have a value less than 1.

**fractional frequency offset**—*See* frequency offset.

**fractional-horsepower motor**—Any motor having a continuous rating of less than 1 horsepower.

**fragmentation**—1. Condition in which a mass memory has many separate holes (available spaces) and needs compacting. 2. In a computer, the division of a contiguous storage area such as a main memory or secondary storage in a way that causes areas to be wasted. 3. The existence of small increments of unused space throughout disk storage. The uneven distribution of data on a disk that occurs whenever files on a disk are deleted and new files are added.

**Frahm frequency meter**—A meter that measures the frequency of an alternating current. It consists of a row of steel reeds, each with a different natural frequency. All are excited by an electromagnet fed with the current to be measured. The reed that vibrates is the one with a frequency corresponding most nearly to that of the current.

**frame**—1. In television, the total area occupied by the picture. In the United States, each frame contains 525 horizontal scanning lines, and 30 complete frames are shown per second. 2. One cycle of a recurring number of pulses. 3. In pulse-amplitude modulation and pulse-duration modulation, one complete commutator revolution or sweep. In pulse-code modulation, a recurring group of words that includes a single synchronizing signal. 4. The array of binary digits across the width of magnetic or paper tape. 5. The time period needed to transmit either bits or bytes of data along with the parity and other control information. 6. To center an image or place it in any part of the TV screen desired. Also applies to stills. 7. A single image of the connected multiple images on motion-picture film. 8. The size of the copy produced by a facsimile system. 9. In a computer, a logical block of consecutive addresses or lines within a structure such as a record or a file. 10. The total area occupied by a television image that is scanned, equivalent to one frame of moving-picture film.

**frame buffer**—Hardware to hold a bit-map picture, especially when hooked up to a computer so that a user may add effects one by one and see the result.

**frame capture**—A method of acquiring images displayed on a computer monitor into memory, so that they can be imported into an application program, manipulated, and printed.

**frame frequency**—1. The number of times per second the picture area is completely scanned (30 per second in the United States television system). 2. In a computer, the number of frames per unit time. 3. In

telemetry, the number of times per second that a frame of pulses is sent or received.

**frame grabber**—An electronic circuit in a computer used to capture a still video image for storage or processing.

**frame grid**—The grid of a vacuum tube consisting of a rigid welded frame on which tungsten wire is wound under tension, resulting in a firm precision structure that can be positioned accurately. It also allows the use of much finer grid wire, which reduces electron interception and power dissipation in the grid.

**frame-grounding circuit**—A conductor that is electrically bonded to the machine frame and/or to any conduction parts that are normally exposed to operating personnel. This circuit may further be connected to external grounds as may be required by applicable Underwriters code.

**frame of reference**—A set of points, lines, or planes used for defining space coordinates.

**frame pulse synchronization**—Synchronization of the local-channel rate oscillator by comparison and phase lock with the separate frame-synchronizing pulses.

**framer**—A device for adjusting facsimile equipment so that the recorded elemental area bears the same relationship to the record sheet as the corresponding transmitted elemental area bears to the subject copy as the line progresses.

**frame rate**—*See* frame frequency.

**frame roll**—A momentary roll, or flip-flop, of a television picture.

**frame synchronization signal**—In pulse-amplitude modulation, a coded pulse or interval to indicate the start of the commutation frame period. In pulse-code modulation, any signal used to identify a frame of data.

**frame-synchronizing pulse**—A recurrent signal that establishes each frame.

**frame-synchronizing pulse separator**—A circuit for separating frame-synchronizing pulses or intervals from commutated signals.

**framing**—1. Adjusting the picture to a desired position in the direction of line progression. 2. The process of selecting the bit groupings representing one or more characters from a continuous stream of bits.

**framing bits**—Also called sync bits. Non-information-carrying bits used to make possible the separation of characters in a bit stream.

**framing control**—More often called centering control. A knob (or knobs) for centering and adjusting the height and width of a television picture.

**framing magnet**—*See* centering magnet.

**Franklin antenna**—A base-fed vertical antenna that is several wavelengths high and that gives broadside radiation as a result of the elimination of phase reversals by means of loading coils or wire folds.

**Franklin oscillator**—A two-terminal feedback oscillator using two tubes or transistors and having sufficient loop gain to permit extremely loose coupling to the resonant circuit.

**Fraunhofer region**—The region in which the energy from an antenna proceeds essentially as though coming from a source located in the vicinity of the antenna.

**fraying**—The unraveling of a fibrous braid.

**free-carrier absorption**—The phenomenon whereby an electron within a band absorbs radiation by transferring from a low-energy level to an empty high-energy level.

**free-carrier photoconductivity**—Photoconductivity that may be extended as far as the microwave region, due to the absorption of photons by electrons.

**free electrons** — Electrons that are not bound to a particular atom, but circulate among the atoms of a substance.

**free energy** — The available energy in a thermodynamic system.

**free field** — 1. Theoretically, a field (wave or potential) that is free from boundaries in a homogeneous, isotropic medium. In practice, a field in which the effects of the boundaries are negligible over the region of interest. 2. A property of information-processing recording media that permits recording of information without regard to a preassigned or fixed field; e.g., information-retrieval-devices information may be dispersed in the record in a sequence or location.

**free-field emission** — Electron emission that occurs when the electric field at the surface of an emitter is zero.

**free grid** — A grid electrode that is left unconnected in a vacuum tube. Its potential exerts a control over the plate current.

**free impedance** — Also called normal impedance. The input impedance of a transducer when the load impedance is zero.

**free list** — A list of computer memory locations that are currently unused and may be allocated by the memory manager to requesting tasks. Free lists are usually organized as linked lists of memory blocks, in which each block contains the size of the block and a pointer to the next block in the list.

**free magnetic pole** — A magnetic pole so far from an opposite pole that it is free from the effect of the other pole.

**free motional impedance** — The complex remainder after the blocked impedance of a transducer has been subtracted from the free impedance.

**free net** — A net in which any station may communicate with any other station in the same net without first obtaining permission from the control station.

**free oscillations** — Commonly referred to as shock-excited oscillations. Oscillations that continue in a circuit or system after the applied force has been removed. The frequency of the oscillations is determined by the parameters of the system or circuit.

**free-point tube tester** — A tester instrument that permits transferring a tube from a circuit to a test panel at which either voltage or current measurement for any electrode of the tube is readily made by plugging a meter into appropriate jacks. Connections to the receiver are made by means of a cord and plug inserted into the socket from which the tube was removed.

**free position** — The initial position of the actuator of a momentary-contact switch when there is no external force (other than gravity) applied on the actuator, and the switch is in the specified position.

**free progressive wave** — Also called free wave. A wave free from boundary effects in a medium. In other words, there are no reflections from nearby surfaces. A free wave can only be approximated in practice.

**free radicals** — Atoms, ionized fragments of atoms, or molecules that combine and release enormous amounts of energy.

**free reel** — The reel that supplies the magnetic tape on a recorder.

**free-rotor gyro** — A gyro whose rotor is supported by a gas-lubricated spherical bearing.

**free routing** — A method of traffic handling in which a message is sent toward its destination over any available channel without dependence on a predetermined routing doctrine.

**free-running frequency** — The frequency at which a normally synchronized oscillator operates in the absence of a synchronizing signal. See center frequency.

**free-running local synchronizer oscillator** — A free-running oscillator circuit in the decommutator normally triggered by separated channel synchronizing pulses. It supplies substitute pulses for missing channel pulses.

**free-running multivibrator** — A multivibrator that oscillates without triggering pulses. See astable multivibrator (free-running).

**free-running sweep** — A sweep operating without synchronizing pulses.

**free sound field** — A field in a medium free from discontinuities or boundaries. In practice it is a field in which the boundaries cause negligible effects over the region of interest.

**free space** — 1. Empty space, or space with no free electrons or ions. It has approximately the electrical constants of air. 2. Having to do with a condition in which the radiation pattern of an antenna is not affected by surrounding objects such as the earth, buildings, vegetation, etc. 3. The amount of unused space available on a hard disk or other device. DOS chkdsk or another utility determines free space.

**free-space field intensity** — The radio-field intensity that would exist at a point in a uniform medium in the absence of waves reflected from the earth or other objects.

**free-space loss** — 1. The theoretical radiation loss that would occur in radio transmission if all variable factors were disregarded. 2. The theoretical transmission loss between two isotropic radio antennas dependent only on distance and frequency, with all variable factors eliminated.

**free-space propagation** — Electromagnetic radiation over a straight-line path in a vacuum or ideal atmosphere, sufficiently removed from all objects that affect the wave in any way.

**free-space radar equation** — The equation for determining the characteristic of a radar signal propagated between the radar set and a reflecting target in free space.

**free-space radiation pattern** — The radiation pattern of an antenna in free space, where there is nothing to reflect, refract, or absorb the radiated waves.

**free-space transmission** — Electromagnetic radiation over a straight line in a vacuum or ideal atmosphere sufficiently removed from all objects that affect the wave.

**free-space wave** — That portion of a radio wave which travels in a direct path between transmitting and receiving antennas, without reflections or refractions.

**free speed** — The angular speed of an energized motor under no-load conditions. See also angular velocity.

**freeware** — A computer file that is made available to the public free of charge from the author.

**free wave** — See free progressive wave.

**freewheeling circuit** — A motor arrangement in which the field is shunted by a half-wave rectifier that discharges the energy stored in the field during the negative half-cycles.

**freewheeling diode** — Also called damper diode, flyback diode, feedback diode, and flywheel diode. A fast recovery rectifier connected across an inductive load so it conducts current proportional to the energy stored in the inductance. This current flows when no power is supplied to the load and continues until all energy stored in the inductor has been removed or until energy is again supplied to the inductance from the power source.

**freeze-out** — A short-time denial of a telephone circuit to a subscriber by a speech-interpolation system.

**F region** — The region of the ionosphere above 100 miles (160 km).

**freq** — Abbreviation for frequency.

**frequency**—1. Symbolized by  $f$ . The number of recurrences of a periodic phenomenon in a unit of time. Electrical frequency is specified as so many hertz. Radio frequencies are normally expressed in kilohertz at and below 30,000 kilohertz and in megahertz above this frequency. 2. The number of complete cycles in 1 second of alternating current, voltage, or electromagnetic or sound pressure waves. 3. Number of alternations or repetitions per second in any recurring action. In the case of alternating current and other forms of wave motion, it is expressed in hertz. 4. With reference to electromagnetic radiation, the number of crests of waves that pass a fixed point in a given unit of time, in light or other wave motion.

**frequency agile**—The ability of a satellite TV receiver to select or tune all channels (transponders) from a satellite. Receivers not frequency agile are dedicated to a single channel, and are most often used in the CATV industry. Frequency agility can be via continuously variable tuning or discrete-step (channel selection) tuning.

**frequency agility**—The rapid and continual shifting of a radar frequency to avoid jamming by the enemy, reduce mutual interference with friendly sources, enhance echoes from targets, or provide necessary patterns of ECM (electronic countermeasures) or ECCM (electronic counter-countermeasures) radiation.

**frequency allocation**—1. The assignment of available frequencies in the radio spectrum to specific stations, for specific purposes. This is done to yield maximum utilization of frequencies with minimum interference between stations. Allocations in the United States are made by the Federal Communications Commission. 2. A band of radio frequencies identified by an upper and lower frequency limit ear-marked for use by one or more of the 38 terrestrial and space radiocommunication services defined by the International Telecommunication Union under specified conditions.

**frequency allotment**—The designation of portions of an allocated frequency band to individual countries or geographical areas for a particular radiocommunication service; for a satellite service, specific orbital positions may also be allotted to individual countries.

**frequency assignment**—Authorization given by a nation's government for a station or operator in that country to use a specific radio frequency channel under specified conditions.

**frequency authorization**—The document of power that legalizes the assignment of a frequency or a frequency band.

**frequency-azimuth-intensity**—Pertaining to a type of radar display in which frequency, azimuth, and strobe intensity are correlated.

**frequency band**—A continuous and specific range of frequencies. A range of frequencies between a lower and an upper limit.

**frequency band of emission**—The frequency band required for a specific type of transmission and speed of signaling.

**frequency bias**—A constant frequency purposely added to the frequency of a signal.

**frequency changer**—See frequency converter.

**frequency-change signaling**—A telegraph signaling method in which one or more particular frequencies correspond to each desired signaling condition of a telegraph code. The transition from one set of frequencies to the other may be either a continuous or a discontinuous change in frequency or in phase.

**frequency-changing circuit**—A circuit comprising an oscillator and a mixer and delivering an output at one or more frequencies other than the input frequency.

**frequency channel**—A continuous portion of the appropriate frequency spectrum for a specified class of emission.

**frequency compensation**—1. The technique of modifying an electronic circuit or device for the purpose of improving or broadening the linearity of its response with respect to frequency. 2. The compensation required in feedback amplifiers to ensure stability and prevent unwanted oscillations.

**frequency constant**—The number relating the natural vibration frequency of a piezoid (finished crystal blank) to its linear dimension.

**frequency conversion**—1. The process of converting a signal to some other frequency by combining it with another frequency. 2. Of a heterodyne receiving system, converting the carrier frequency of a received signal from its original value to the intermediate-frequency (IF) value in a superheterodyne receiver.

**frequency converter**—Also called frequency changer. A circuit, device, or machine that changes an alternating current from one frequency to another, with or without a change in voltage or number of phases. In a superheterodyne receiver, the oscillator and mixer first-detector stages together serve as a frequency converter.

**frequency correction**—Compensation, by means of an attenuation equalizer, for unequal transmission of various frequencies in a line.

**frequency counter**—An instrument in which frequency is measured by counting the number of cycles (pulses) occurring during a precisely established time interval.

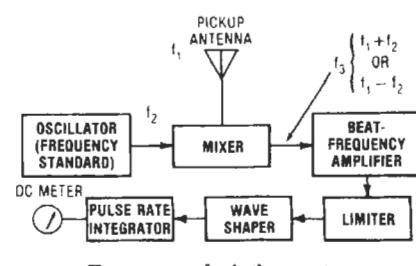
**frequency cutoff**—The frequency at which the current gain of a transistor drops 3 dB below the low-frequency gain.

**frequency demodulation**—Removal of the intelligence from a modulated carrier.

**frequency departure**—The amount a carrier or center frequency deviates from its assigned value.

**frequency deviation**—1. In frequency modulation, the peak difference between the instantaneous frequency of the modulated wave and its carrier frequency. 2. A measure of the output frequency excursion around the carrier caused by modulating the oscillator's tuning input, which produces a frequency-modulated output signal. 3. The measure of the percentage modulation of a frequency-modulated wave. It is the peak difference between the instantaneous frequency of a frequency-modulated wave and the carrier frequency.

**frequency-deviation meter**—An instrument that indicates the number of hertz a transmitter has drifted from its assigned carrier frequency.



Frequency-deviation meter.

**frequency discrimination**—A term applied to the operation of selecting a desired frequency or frequencies from a spectrum of frequencies.

**frequency discriminator — frequency-modulated carrier-current telephony**

**frequency discriminator**—A circuit that converts a frequency-modulated signal into an audio signal.

**frequency distortion**—1. The distortion that results when all frequencies in a complex wave are not amplified or attenuated equally. 2. The unequal amplification of all frequencies over the passband of an amplifier. 3. Distortion in which there is change in the relative magnitudes of the different frequency components of a complex wave, provided that the change is not caused by nonlinear distortion. *See also* frequency response.

**frequency distribution**—The number of occurrences of particular values plotted against those values.

**frequency diversity**—*See* frequency-diversity reception.

**frequency-diversity reception**—Also called frequency diversity. The form of diversity reception that utilizes transmission at different frequencies.

**frequency divider**—1. A device delivering an output voltage that is at an integral submultiple or proper fraction of the input frequency. 2. A counter that has a gating structure added that provides an output pulse after a specified number of input pulses are received.

**frequency-division data link**—A data link in which frequency-division techniques are used for channel spacing.

**frequency-division multiplexer**—Abbreviated FDM. 1. A device or process for transmitting two or more signals over a different frequency band. 2. A multiplex system in which the total transmission bandwidth is divided into narrower bands, each used for a single, separate channel.

**frequency-division multiplexing**—Abbreviated FDM. 1. Taking the frequency spectrum of one leased line and subdividing it into a series of low-frequency bands, each of which will transmit the data of an associated low-speed device. 2. The multiplexing technique that assigns to each signal a specific set of frequencies (called a channel) within the larger block of frequencies available on the main transmission path in much the same way that many radio stations broadcast at the same time but can be separately received. 3. The transmission of two or more signals over a common path by using a different frequency band for each signal. 4. Multiplexing by splitting the bandwidth into some number of low-speed channels or subbands. 5. A technique in which a data line's bandwidth is divided into different frequency subchannels. It permits several terminals to share the same line. 6. A technique in which an analog communication channel's bandwidth is divided into frequency subchannels to permit several circuits to share the same channel.

**frequency domain**—A way of looking at waveforms in terms of the frequency components of the waveforms. An analysis in the frequency domain of a simple sine wave would be described as a pure sine wave of a single frequency. An analysis of the square wave would show that the square wave could be described as a sum of sine waves of different frequencies and magnitudes. In fact any waveform, no matter how complex, may be described as a sum of sine waves in the frequency domain.

**frequency doubler**—An electronic stage having a resonant output circuit tuned to the second harmonic of

the input frequency. The output signal will then have twice the frequency of the input signal.

**frequency-doubling transponder**—A transponder that doubles the frequency of the interrogating signal before retransmission.

**frequency drift**—Any undesired change in the frequency of an oscillator, transmitter, or receiver.

**frequency-exchange signaling**—The method in which the change from one signaling condition to another is accompanied by a decay in amplitude of one or more frequencies and by a build-up in amplitude of one or more other frequencies.

**frequency frogging**—The interchanging of the frequency allocations of carrier channels to prevent singing, reduce crosstalk, and correct for line slope. It is accomplished by having the modulation in a repeater translate a low-frequency group to a high-frequency group and vice versa.

**frequency hopping**—Carrier-frequency shifting in discrete increments in a pattern dictated by a code sequence. The transmitter jumps from frequency to frequency within some predetermined set; the order of frequency hops is determined by a code sequence that, in turn, is detected and followed by the receiver.

**frequency indicator**—A device that shows when two alternating currents have the same phase or frequency.

**frequency influence**—In a measuring instrument other than a frequency meter, the change, expressed as a percentage of the full-scale value, in the indicated value as a result of a departure of the measured quantity from a specified reference frequency.

**frequency interlace**—1. In television, the relationship of intermeshing between the frequency spectrum of an essentially periodic interfering signal and the spectrum of harmonics of the scanning frequencies. Such a relationship minimizes the visibility of the interfering pattern by altering its appearance on successive scans. 2. The method by which color and black-and-white sideband signals are interwoven within the same channel bandwidth.

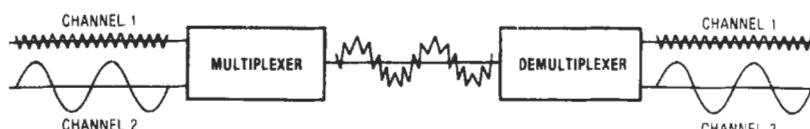
**frequency keying**—A method of keying in which the carrier frequency is shifted between two predetermined frequencies.

**frequency-measuring equipment**—Equipment for indicating or measuring the frequency or pulse-repetition rate of an electrical signal.

**frequency meter**—1. An instrument for measuring the frequency of an alternating current. 2. Instrument for measuring the repetition rate of a recurring phenomenon, as the cycles per second of a sinusoidal waveform. 3. An instrument that measures the number of periods per unit of time of a signal in hertz.

**frequency-modulated broadcast band**—The band of frequencies from 88 to 108 megahertz. It is divided into 100 channels, each 200 kilohertz in width, and set aside for frequency-modulated broadcasting. *See* FM broadcast channel.

**frequency-modulated carrier-current telephony**—A form of telephony in which a frequency-modulated carrier signal is transmitted over power lines or other wires.



*Frequency-division multiplex.*

**frequency-modulated cyclotron**—A cyclotron in which the frequency of the accelerating electric field is modulated in order to hold the positively charged particles in synchronism with the accelerating field despite their much greater mass at very high speeds.

**frequency-modulated jamming**—A jamming technique in which an rf signal of constant amplitude is varied in frequency about a center value to produce a signal that covers a band of frequencies.

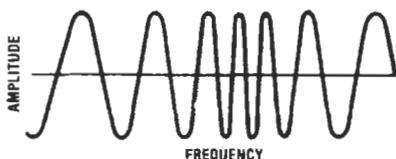
**frequency-modulated output**—A transducer output that is obtained in the form of a deviation from a center frequency, where the deviation is proportional to the applied stimulus.

**frequency-modulated radar**—Also called FM radar. A form of radar in which the radiated wave is frequency modulated. The range is measured by beating the returning wave with the one being radiated.

**frequency-modulated transmitter**—A transmitter in which the frequency of the wave is modulated.

**frequency-modulated wave**—A carrier wave whose frequency is varied by an amount proportionate to the amplitude of the modulated signal.

**frequency modulation**—Abbreviated FM. 1. Modulation of a sine-wave carrier so that its instantaneous frequency differs from the carrier frequency by an amount proportionate to the instantaneous amplitude of the modulating wave. Combinations of phase and frequency modulation also are commonly referred to as frequency modulation. See also frequency-modulated wave. 2. One of three ways of modifying a sine-wave signal to make it carry information. The sine wave, or carrier, has its frequency modified in accordance with the information to be transmitted. The frequency function of the modulated wave may be continuous or discontinuous. In the latter case, two or more partial frequencies may correspond to one significant condition. 3. A method of transmitting digital information on an analog line by the carrier frequency.



Frequency modulation.

**frequency-modulation deviation**—The peak difference between the instantaneous frequency of a modulated wave and the carrier or reference frequency.

**frequency-modulation frequency modulation**—A system in which frequency-modulated subcarriers are used to frequency modulate a second carrier.

**frequency-modulation phase modulation**—A system in which frequency-modulated subcarriers are used to phase modulate a second carrier.

**frequency monitor**—An instrument for indicating the amount a frequency deviates from its assigned value.

**frequency multiplex**—A technique for the transmission of two or more signals over a common path. Each signal is characterized by a distinctive reference frequency or band of frequencies.

**frequency multiplier**—A device for delivering an output wave whose frequency is a multiple of the input frequency (e.g., frequency doublers and triplers).

**frequency offset**—1. The amount by which a frequency lies above or below a reference frequency. For example, if a frequency measures 1.000 001 MHz when compared against a reference frequency of 1.000 000 MHz, then its fractional frequency offset is 1 Hz/MHz, or 1 part in  $10^6$ . 2. Analog-line frequency change, an impairment encountered on a communication line.

**frequency-offset transponder**—A transponder that changes the interrogating signal frequency by a fixed amount before retransmission.

**frequency output (transducer)**—An output in the form of frequency that is a function of the applied measurand (e.g., angular speed and flow rate).

**frequency overlap**—That part of the frequency band which is shared as a result of interleaving.

**frequency-prediction chart**—A graph that shows the maximum usable frequency, optimum working frequency, and lowest usable frequency between two specific points for various times throughout a 24-hour period.

**frequency pulling**—A change in oscillator frequency due to a change in the load impedance.

**frequency pushing**—A source-frequency change caused by a change in electron flow within the source oscillator.

**frequency range**—1. In a transmission system, those frequencies at which the system is able to transmit power without attenuating it more than an arbitrary amount. 2. In a receiver, the frequency band over which the receiver is designed to operate, covering those frequencies the receiver will readily accept and amplify. 3. A designated portion of the frequency spectrum.

**frequency record**—A recording of various known frequencies at known amplitudes, usually for testing purposes.

**frequency regulator**—A regulator that maintains the frequency of the frequency-generating equipment at a predetermined value or varies it according to a predetermined plan.

**frequency relay**—A relay that functions at a predetermined value of frequency. It may be an overfrequency or underfrequency relay, or a combination of both.

**frequency response**—1. A measure of how effectively a circuit or device transmits the different frequencies applied to it. 2. The portion of the frequency spectrum that can be sensed by a device within specified limits of amplitude error. 3. A graphical characteristic showing relative signal levels at different frequencies with respect to a given reference level. A flat frequency response is one that has a uniform level at all frequencies within a given bandwidth. 4. A measure of the ability of a device to take into account, follow, or act upon a rapidly varying condition, e.g., as applied to amplifiers. 5. The measure of any component's ability to pass signals of different frequency without affecting their relative strengths. This is shown as a graph, or curve, that assumes input signals equally strong at all frequencies and plots their output intensities against a decibel scale. The ideal curve is a straight line. Frequency response may also be stated as a frequency range but with specified decibel limits indicating the maximum deviations from flat response. For instance, 30 to 20,000 Hz  $\pm 2$  dB means the component will not change the relative intensities of any frequencies within that range by more than 2 dB above or 2 dB below the ideal 0 dB (volume unchanged) point. 6. The range of frequencies over which an amplifier responds within defined limits of amplification (or signal output). 7. The range or band of frequencies to which a unit of electronic equipment will offer essentially the same characteristics.

**frequency-response analysis**—The use of alternating or pulsating signals to excite a control system so

that the response of the system to different frequencies can be ascertained to permit analysis of its operating characteristics.

**frequency-response analyzer**—An instrument that analyzes the output amplitude of a signal waveform passing through a circuit over a specified band of frequencies.

**frequency-response characteristic**—The amount by which the gain or loss of a device varies with the frequency.

**frequency-response curve**—A graphical representation of the way a circuit responds to different frequencies within its operating range.

**frequency-response equalization**—Also called equalization or corrective equalization. The effect of all frequency-discrimination means employed in a transmission system to obtain the desired overall frequency response.

**frequency reuse**—A method that allows two different TV channels to be broadcast simultaneously on the same transponder by vertically polarizing one channel and horizontally polarizing the other. Another method of frequency reuse is to space satellites about 4° apart. A TVRO pointed at one satellite will not detect any signal from the other satellite, even if it is operating at the same frequency.

**frequency run**—A series of tests for determining the frequency-response characteristics of a transmission line, circuit, or device.

**frequency-scan antenna**—A radar antenna, similar to a phased-array antenna, in which scanning in one dimension is accomplished through frequency variation.

**frequency scanning**—A technique in which the output frequency is made to vary over a desired range at a specified rate.

**frequency selectivity**—The degree to which a transducer is capable of differentiating between the desired signal and signals or interference at other frequencies.

**frequency-sensitive relay**—A relay that operates only when energized with voltage, current, or power within specific frequency limits. A resonant reed relay is one example of this type.

**frequency-separation multiplier**—A multiplying device in which each variable is split into low-frequency and high-frequency parts that are multiplied separately to obtain results that are added to give the required product. The system makes possible high accuracy and broad bandwidth.

**frequency separator**—The circuit that separates the horizontal-scanning from the vertical-scanning synchronizing pulses in a television receiver.

**frequency shift**—1. Pertaining to radio-teletypewriter operation in which the mark and space signals are transmitted as different frequencies. 2. A change in the frequency of a radio transmitter or oscillator. 3. Pertaining to a modulation system in which one radio frequency represents picture black and another represents picture white; frequencies between the two limits represent shades of gray. 4. The frequency difference in a frequency-shift modulation system.

**frequency-shift converter**—A device that limits the amplitude of the received frequency-shift signal and then changes it to an amplitude-modulated signal.

**frequency-shifted keyed filter**—Abbreviated FSK filter. A highly selective bandpass filter that passes two closely spaced FSK frequencies corresponding to binary 0s and 1s, while rejecting voice; this allows transmission of digital data over voice-frequency channels.

**frequency-shift indicator**—In automatic code transmission, a device that designates marks and spaces

by shifting the carrier back and forth between two frequencies instead of keying it on and off.

**frequency-shift keying**—Abbreviated FSK. 1. A form of frequency modulation in which the modulating wave shifts the output frequency between predetermined values and the output wave has no phase discontinuity. 2. A method of modulating a carrier frequency. A binary 1 shifts the frequency above the center carrier frequency; a binary 0 shifts the frequency below the center carrier frequency. 3. A frequency-modulation method in which the frequency is made to vary at the significant instants as follows: (a) by smooth transitions—the modulated wave and the change in frequency are continuous at the significant instants; (b) by abrupt transitions—the modulated wave is continuous, but the frequency is discontinuous at the significant instants. 4. A form of frequency modulation in which the carrier frequency is made to vary or change in frequency precisely when a change in the state of a transmitted signal occurs. 5. A modulation scheme that shifts between two frequencies to represent a 1 or 0 state of data transmission.

**frequency-shift telegraphy**—Telegraphy by frequency modulation in which the telegraph signal shifts the frequency of the carrier between predetermined values. There is phase continuity during the shift from one frequency to the other.

**frequency-shift transmission**—A method of transmitting the mark and space elements of a telegraph code by shifting the carrier frequency slightly, usually about 800 Hz.

**frequency-slope modulation**—A method of modulation in which the carrier is swept periodically over the entire band. Modulation of the carrier with a communications signal changes the system bandwidth without affecting the uniform distribution of energy over the band. Thus, the desired information can be recovered from any part of the system bandwidth, and portions of the band that have interference can be filtered out without loss of desired information.

**frequency spectrum**—The entire range of frequencies of electromagnetic radiations.

**frequency splitting**—One condition of magnetron operation in which rapid alternation occurs from one mode of operation to another. This results in a similar rapid change in oscillatory frequency and consequent loss of power at the desired frequency.

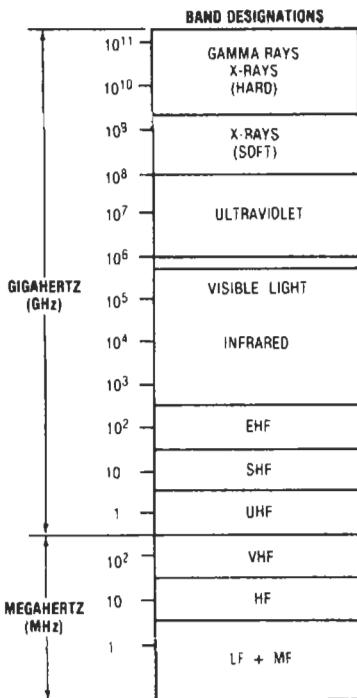
**frequency stability**—The ability of electronic equipment to maintain the desired operating frequency.

**frequency stabilization**—The controlling of the center or carrier frequency so that it does not differ more than a prescribed amount from the reference frequency.

**frequency standard**—A stable low-frequency oscillator used for frequency calibration. It can generate a fundamental frequency of 50 to 100 kilohertz with a high degree of accuracy. Harmonics of this fundamental are then used as reference points for checking throughout the radio spectrum at 50- or 100-kilohertz intervals.

**frequency swing**—The instantaneous departure of the emitted wave from the center frequency when its frequency is modulated.

**frequency synthesizer**—1. A frequency source of high accuracy generally characterized by the fact that the output frequency is composed of two components. The frequency steps, mostly decadic, are derived from the crystal-stabilized frequency standard and the variable frequency of a free-running oscillator, which fills in between these steps. The simplest method of frequency synthesis is to derive standard frequencies from a crystal-controlled frequency by harmonic generation and frequency division. 2. A circuit capable of producing a multitude of



Frequency spectrum.

output frequencies from a single input frequency. 3. An rf source that can provide, by external command, any discrete and precise frequency within its range and resolution. The output signal is stabilized to a fixed frequency reference, which may be internal or external to the synthesizer. Primary applications include automatic test equipment, electronic warfare, and communications systems. 4. A system utilizing the phase-locked loop (PLL) principle in conjunction with a programmable digital frequency divider to generate any of a number of discrete frequencies. (May replace a number of crystals or other timing elements with only one timing element.)

**frequency-time-intensity** — Pertaining to a type of radar display in which frequency, time, and strobe intensity are correlated.

**frequency tolerance** — 1. The maximum permissible deviation with respect to the reference frequency of the corresponding characteristic frequency of an emission. Expressed in percent or in hertz. 2. The extent to which the carrier frequency of a transmitter may be permitted to depart from the frequency assigned.

**frequency translation** — The transfer *en bloc* of signals occupying a definite frequency band, such as a channel or group of channels, from one position in the frequency spectrum to another in such a way that the arithmetic frequency difference of the signals within the band is unaltered.

**frequency tripler** — An amplifier whose output circuit is resonant to the third harmonic of the input signal. The output frequency is three times the input frequency.

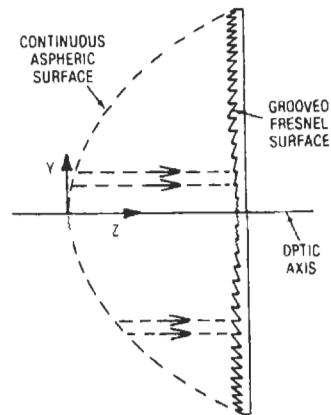
**frequency-type telemeter** — A telemeter that employs the frequency of a periodically recurring electric signal as the translating means.

**frequency-wavelength relation** — For radio waves, the frequency in hertz is equal to approximately 300,000,000 divided by the wavelength in meters. The wavelength in meters is equal to approximately

300,000,000 divided by the frequency in hertz, or 300 divided by the frequency in megahertz.

**Fresnel** — A little-used unit of frequency equal to 10<sup>12</sup> hertz.

**Fresnel lens** — 1. A lens similar in action to a plano-convex lens but made thinner and lighter because of the presence of steps on the convex side. Often the flat side has a rough surface to diffuse the light slightly and thereby smooth the light beams. 2. A lens resembling a structure that is cut into narrow rings and flattened out. If the steps are narrow, the surface of each step is generally made conical and not spherical. Fresnel lenses can be large glass structures, as in lighthouses, floodlights, or traffic signals, or a thin molded plastic plate with fine steps.



Fresnel lens.

**Fresnel loss** — See surface reflection.

**Fresnel number** — The square of the radius of a lens aperture divided by the product of the focal length and the wavelength. It provides a measure of the importance of diffraction in the image formed by the lens: a small Fresnel number indicates greater diffraction effects.

**Fresnel reflection losses** — Losses that are incurred at the optical conductor interface due to refractive index differences.

**Fresnel reflections** — Losses due to reflections at the input and output ends of an optical fiber caused by differences in the reflective indexes of the fiber core and the immersion medium.

**Fresnel region** — 1. The region adjacent to the region in which the field of an antenna is focused (that is, just outside the Fraunhofer region). 2. The region between an antenna and the beginning of the Fraunhofer region.

**Fresnel zone** — 1. An area selected in the aperture of a radiating system so that radiation from all parts of the system reaches some point at which it is desired at a common phase within 180°. 2. A circular zone about the direct path between a transmitter and a receiver at each radius such that the distance from a point on this circle to the receiving point has a path length that is some multiple of a half-wavelength longer than the direct path.

**fretting** — A condition whereby mated surfaces of a connector move slightly and continually expose fresh metal. The exposed metal oxidizes and builds up until electrical continuity of the system is broken.

**frictional electricity** — Electric charges produced by rubbing one material against another.

**frictional error**—Applied to pickups, the difference in values measured in percent of full scale before and after tapping, with the measurand constant.

**frictional loss**—The loss of energy due to friction between moving parts.

**frictional machine**—Also called a static machine. A device for producing frictional electricity.

**friction effects**—The difference in resistance or output between readings obtained prior to and immediately after tapping an instrument while applying a constant stimulus. Particularly applicable to potentiometric transducers.

**friction error**—A change in a reading originally taken in the absence of vibration that occurs after a transducer is tapped or dithered to remove internal friction.

**friction-free calibration (transducer)**—Calibration under conditions minimizing the effect of static friction often obtained by dithering.

**friction tape**—A fibrous or plastic tape impregnated with a sticky, moisture-resistant compound that provides a protective covering or insulation.

**friendly environment**—A software environment in which all software is adequately tested; therefore, one task will not interfere with or cause errors in the execution of another task.

**friendly terminal**—A terminal that is relatively easy and comfortable to use and whose features are designed with the needs of their operator in mind.

**fringe**—A unit of linear measurement equal to half the wavelength of thallium green light (approximately 0.01 mil or 0.25 μm). It is used in measuring the depth of diffusion in silicon.

**fringe area**—The area just beyond the limits of the reliable service area of a television transmitter. Signals are weak and erratic, requiring the use of high-gain directional receiving antennas and sensitive receivers for satisfactory reception.

**fringe effect**—The extension of the flux in a field beyond the edges of a gap, as electric flux at the edges of the plates of a capacitor or magnetic flux at the edges of an air gap in a magnetic circuit.

**fringe howl**—A squeal or howl heard when some circuit in a receiver is on the verge of oscillation.

**frit**—1. Metallic powders fused in a glass binder. 2. To melt and fuse together, as a set of electrical contacts that are subject to repeated discharges. 3. Glass composition ground up into a fine powder form and used in thick-film compositions as the portion of the composition that melts upon firing to give adhesion to the substrate and hold the composition together. 4. In fiber optics, finely ground glass used to join glass to metal or other glasses. Also called solder glass, it may or may not devitrify during temperature cycles. 5. A term used interchangeably with "glass," as in frit- or glass-sealed packages such as CERDIP and CERPACK.

**fritting**—A type of contact erosion in which an electrical discharge makes a hole through the contact film and produces molten matter that is drawn through the hole by electrostatic forces and then solidifies and forms a conducting bridge.

**frogging**—At an intermediate carrier repeater, changing low-group frequencies on the input to high-group frequencies on the output, and vice versa, as a means of reducing crosstalk.

**frogging repeater**—A carrier repeater that has provisions for frequency frogging to make possible the use of a single multipair voice cable without excessive crosstalk.

**Frolich high-temperature breakdown theory**—A thermal mechanism for breakdown in which electrons rather than ions carry the current. The necessary

## frictional error — front-to-rear ratio

number of conduction electrons is produced by thermal excitation of the electrons in impurity and imperfection levels.

**Frolich low-temperature breakdown theory**—Also called the high-energy criterion. Similar to the Von Hippel theory, except that an electron energy distribution is assumed. Only a few electrons on the high-energy tail of the distribution must gain the necessary critical energy.

**front contact**—A movable relay contact that closes a circuit when the associated device is operated.

**front end**—1. The section of a tuner or receiver that is used to select the desired station from either the AM, FM, or TV band, and to convert the rf signal to intermediate frequency. To do its job properly, a front end requires a high-gain, low-noise rf stage, a mixer, and an oscillator. The degree to which a desired station can be received without interference and without adding noise is expressed by sensitivity and signal-to-noise ratio. 2. An auxiliary computer system that performs network-control operations, releasing the host computer system to process data. 3. In a process control system, the input end at which raw signals are converted to digital information for further processing.

**front-end overload**—Distortion or interference caused by an FM tuner's inability to handle strong signals from a nearby transmitter. Front-end overload can cause a station to appear at more than one place on the dial.

**front-end processor**—In a computer, a processor in charge of interfacing with a user or a process. May perform preprocessing (translations) and file handling. The main processor performs interpretation, execution, or number crunching.

**front-end rejection**—A dB expression of the relative ability of a receiver network to reject signals outside the tuned bandwidth.

**front porch**—In the composite television signal, that portion of the synchronizing signal (at the blanking or black level) preceding the horizontal-sync pulse at the end of each active horizontal line. The standard EIA signal is 1.27 microseconds in duration.

**front projection**—A system of picture enlargement using an opaque reflective screen. The projector and viewers are on the same side of the screen.

**front-surface mirror**—An optical mirror on which the reflecting surface is applied to the front of the mirror instead of the back.

**front-to-back ratio**—Also called front-to-rear ratio. 1. The ratio of power gain between the front and rear of a directional antenna. 2. Ratio of signal strength transmitted in a forward direction to that transmitted in a backward direction. For receiving antennas, the ratio of received-signal strength when the source is in the front of the antenna to the received-signal strength when the antenna is rotated 180°. 3. The ratio between a cardioid microphone's sensitivity to sounds arriving from the front and from the rear, a measure of its directivity. 4. On a printed circuit board, the location of the printed pattern on one side relative to the printed pattern on the opposite side. 5. A measure of the directivity of an antenna that is based on the difference between the strengths of signals received from the antenna front and those received from the back. The difference usually is expressed in decibels (dB). For example, a front-to-back ratio of 40 dB indicates that the power of signals received from the antenna front will be 10,000 times greater than those received from the back. Generally, the higher the rating in dB, the greater the directivity of the antenna.

**front-to-back registration**—On a printed circuit board, the location of the printed pattern on one side relative to the printed pattern on the opposite side.

**front-to-rear ratio**—See front-to-back ratio.

**fruit** — See fruit pulse.

**fruit pulse** — Also called fruit. Radar beacon system video display of a synchronous beacon return that results when several interrogator stations are located within the same general area. Each interrogator receives its own synchronous reply as well as many synchronous replies resulting from interrogation of the airborne transponders by other ground stations.

**F-scan** — See F-display.

**F-scope** — See F-display.

**FSK** — See frequency-shift keying.

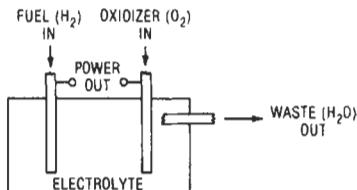
**FSK filter** — See frequency-shift keyed filter.

**FSS** — Abbreviation for fixed-satellite service. A radiocommunication service between earth stations at given fixed positions via one or more satellites.

**f-stop** — Also called f-number and f-system. Refers to the speed or ability of a lens to pass light. It is calculated by dividing the focal length of the lens by its diameter.

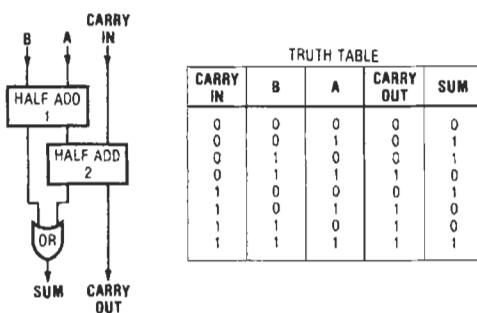
**FTP** — Abbreviation for File Transfer Protocol. 1. A way to download remote files over the Internet. See File Transfer Protocol. 2. A protocol used for the transfer of data files consisting of one or more segments.

**fuel cell** — An electrochemical generator in which the chemical energy from the reaction of air (oxygen) and a conventional fuel is converted directly into electricity. A fuel cell differs from a battery in that it uses hydrocarbons (or some derivative such as hydrogen) for fuel, and it operates continuously as long as fuel and air are available.



*Fuel cell.*

**full adder** — A circuit that provides an output equal to the sum of three binary-digit inputs (two digits to be added and a carry digit from a previous stage). Sum and carry outputs are provided.



*Full adder.*

**full-differential input** — Input configuration of an analog amplifier in which neither input is connected directly to ground or to other channels. This configuration has better noise immunity than a single-ended input.

**full duplex** — Abbreviated FDX. 1. A method of operation of a communication circuit in which each end can simultaneously transmit and receive. When used on a radio circuit, duplex operation requires two frequencies. 2. A data circuit that is capable of both sending and receiving data simultaneously. 3. A mode of data transmission that is the equivalent of two paths — one in each direction simultaneously. 4. Simultaneous two-way transmission.

**full-duplex operation** — 1. Simultaneous operation in opposite directions in a telegraph system. 2. A method of operation that provides simultaneous two-way communications between two points.

**full excursion** — The application of a measurand, in a controlled manner, over the entire range of a transducer.

**full/full duplex** — A protocol for a multidrop line that permits transmission from a master location to a slave site; the master location can also simultaneously receive a transmission from another slave site on that line.

**fullhouse** — A multichannel radio control system for model airplanes in which all controls work to allow the model to fly a complete flight pattern.

**full load** — The greatest load a piece of equipment is designed to carry under specified conditions.

**full-period allocated circuit** — A communication link (allocated circuit) assigned exclusively for the use of previously defined users at two or more terminal points.

**full-pitch winding** — A type of armature winding in which the number of slots between the sides of the coil equals the pole-pitch measure in the slots.

**full-range speaker unit** — See dual cone.

**full scale** — The total interval over which an instrument is intended to be operated. Also, the output from a transducer when the maximum rated stimulus is applied to the input.

**full-scale cycle** — The complete range of an instrument, from minimum reading to full scale and back to minimum reading.

**full-scale error** — The difference between the actual voltage or current that produces full-scale deflection of an electrical indicating instrument and the rated full-scale input of the instrument.

**full-scale output** — The algebraic difference in electrical output between the maximum and minimum values of measurand over which an instrument is calibrated. When the sensitivity slope is given by any other line than the end-point sensitivity, full scale expresses the algebraic difference, for the span of the instrument, which is calculated from the slope of the straight line from which nonlinearity is determined.

**full-scale range** — The continuum of input values (and resultant readings) over which a meter has been designed to function before exceeding the maximum scale or digital reading (or before entering the overrange region in digital meters providing overranging).

**full-scale sensitivity** — See full-scale output.

**full-scale value** — The largest value of applied electrical energy that can be indicated on a meter scale. When zero is between the ends of the scale, the full-scale value is the arithmetic sum of the values of the applied electrical quantity corresponding to the two ends of the scale. On a suppressed meter, the full-scale value is the largest value of applied electrical input less the smallest value of applied electrical energy input.

**full-scale value of an instrument** — The largest actuating electrical quantity that can be indicated on the scale; or, for an instrument having its zero between the ends of the scale, the sum of the values of the actuating electrical quantity corresponding to the two ends.

**full subtractor**—A device that can obtain the difference of two input bits, subtract a borrow from these two bits, and provide difference and borrow outputs.

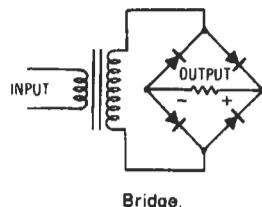
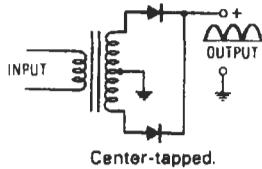
**full-track recording**—1. Defines the track width as essentially equal to the tape width. Applies to inch-wide (or less) tape only. 2. A recorded signal occupying the full width of a 1/4-inch (6.35-mm) tape. 3. Recording monophonically on one track whose width is essentially the same as the tape's. *See track configuration.*

**full-track tape recording**—A professional tape recording standard in which one track occupies the entire width of a 1/4-inch (6.35-mm) wide recording tape.

**full-voltage starting**—*See across-the-line starting.*

**full-wave rectification**—The process of inverting the negative half-cycle of current of an alternating input so that it flows in the same direction as the positive half-cycle. A way to accomplish this is to use four diodes placed in a bridge configuration.

**full-wave rectifier**—A circuit, electron tube, or other device that uses both positive and negative alternations in an alternating current to produce direct current.



**Full-wave rectifier.**

**full-wave rectifier tube**—A tube containing two sets of rectifying elements to provide full-wave rectification.

**full-wave vibrator**—A vibrator having an armature that moves back and forth between two fixed contacts, so as to change the direction of the direct current flow through a transformer at regular intervals and thereby permit voltage step-up by the transformer. Used in battery-operated power supplies for mobile and marine radio equipment.

**function**—1. A quantity of value that depends on the value of one or more other quantities. 2. A specific purpose of an entity, or its characteristic action. 3. A means of referring to a type or sequence of calculations within an arithmetic statement. 4. An integral unit of computational work (add, subtract, sine, cosine, read, write). It cannot be subdivided further without destroying its nature—it is at its optimum granularity.

**functional block**—Also called molecular electronic circuit. A more or less homogeneous combination of several solid-state materials to perform a desired circuit function. The quartz crystal is often represented as a natural expression of the functional block combination of resistance, capacitance, and inductance.

**functional board tester**—A tester that verifies the correct logical operation of a logic board by applying test patterns at the board-edge connector. The output responses usually are monitored at the connector, although some test points may be used.

**functional design**—The specification of the working relations between the parts of a system in terms of their characteristic action.

**functional device**—*See integrated circuit.*

**functional diagram**—A diagram showing the functional relationships among the parts of a system.

**functional electronic block**—A fabricated device serving a complete electronic function, such as amplification, without other individual components or conducting wires except those required for input, power, and output.

**functional insulation**—The insulation necessary for the proper functioning of a device and for basic protection against electrical shock hazard.

**functional interface**—An interface between the operating characteristics of equipment such as electrical power and signal characteristics, signal timing, and environmental coupling.

**functional language**—A programming language that uses exclusively expressions to be evaluated.

**functional parts**—Discrete items defined by functional characteristics and dimensions that are not repairable with the use of spare parts (e.g., resistors, capacitors, diodes, potted transformers, permanently sealed batteries, etc.).

**functional testing**—Testing to determine whether the device under test reacts correctly to inputs, qualitatively.

**functional tests**—The application of functional input vectors and the corresponding responses that assure proper operation of a digital IC.

**functional trimming**—Trimming of a circuit element (usually resistors) on an operating circuit to set a voltage or current on the output.

**function characteristic**—The relationship between the output ratio and the shaft position of a precision potentiometer.

**function codes**—Codes that appear in tape or cards to operate machine functions, such as carriage returns, space, shift, skip, tabulate, etc.

**function digit**—A coded instruction used in a computer for setting a branch order to link subroutines into the main program.

**function generator**—1. A device capable of generating one or more desired waveforms. 2. An electrical network that can be adjusted to make its output voltage (or current) a desired function of time. Used in conjunction with analog computers. 3. A character, conic, or vector generator in a display controller. Some display controllers have additional function generators, such as sweep generators for displaying television-type pictures on the display screen. 4. A signal source that can produce a variety of output waveshapes that, if completely free from distortion, would represent a readily definable mathematical relationship between the time base and the output voltage. Thus, square, triangle, sawtooth, and equivalent waveshapes constitute the basic outputs of a function generator. If the instrument incorporates adequate signal-modifying circuitry, it can alter triangle or square waveforms to closely approximate sine-haversine and havertriangle or haversquare outputs. With circuitry for amplitude hold, internal gating, slope control, dc offset, signal inversion, and horizontal and limit control, it becomes simple to produce trapezoids, forward or backward skewed sines, or almost any other combination or variation of internally generated waveforms derived from basic mathematical functions.

**functioning time**—In a relay, the time that elapses between energization and operation or between deenergization and release.

**functioning value**—In a relay, the value of applied voltage, current, or power at which operation or release occurs.

**function keyboard**—An input device for an interactive display terminal that consists of various function keys.

**function keys**—1. Data entry devices usually programmed to initiate or terminate a particular function or process in the graphic system. Function keys may or may not generate interrupts when depressed and/or released. Some systems will generate an interrupt upon depression and release, some just on depression, and others do not generate any interrupt but rather set a bit in a register. The latter type of function key must have the register periodically read by the host computer to determine when a key is depressed. The register bit is cleared when the key is released. Function keys may be mounted on the alphanumeric keyboard or on a separate box on the console. 2. Keys on a keyboard or a control panel that, when depressed, activate a particular machine function. The functional operation can usually be programmed or defined dynamically. 3. Keys on a keyboard that cause an operation, such as LETTERS, FIGURES, CARRIAGE RETURN, and LINE FEED, but not the printing of a character.

**function switch**—1. A network of systems having a number of inputs and outputs. When signals representing information expressed in a certain code are applied to the inputs, the output signals will represent the input information in a different code. 2. In adapters or control units, the switch that determines whether the system plays as a monophonic or stereophonic unit; it may parallel the speakers or cut out one or the other, switch amplifiers from one speaker to the other, reverse channels, etc.

**function table**—1. A table of values for a mathematical function. 2. A hardware device or a computer program that translates one representation of information into another. 3. A routine by means of which a dependent variable is derived from the values of independent variables. 4. A subroutine that can be used either to decode multiple inputs into a single output or to encode a single input into multiple outputs.

**function test**—A check for correct logical operation of the device. Basically, a function test is a device truth table verification.

**function unit**—A device that can store a functional relationship and release it continuously or sporadically.

**fundamental**—*See* fundamental frequency.

**fundamental component**—The fundamental frequency component in the harmonic analysis of a wave.

**fundamental frequency**—1. The principal component of a wave; i.e., the component with the lowest frequency or greatest amplitude. It is usually taken as a reference. 2. The lowest frequency component of a complex sound or electrical signal.

**fundamental group**—In wire communications, a group of trunks by means of which each local or trunk switching center is connected to a trunk switching center of higher rank on which it "homes." The term also applies to groups that interconnect zone centers.

**fundamental harmonic**—The harmonic component with the lowest frequency.

**fundamental mode**—1. Of vibration, the mode having the lowest natural frequency. 2. The waveguide mode that has the lowest critical frequency. *See* dominant mode.

**fundamental piezoelectric crystal unit**—A unit designed to use the lowest resonant frequency for a particular mode of vibration.

**fundamental tone**—1. In a periodic wave, the component corresponding to the fundamental frequency. 2. In a complex tone, the component tone of lowest pitch.

**fundamental units**—Units arbitrarily selected as the basis of an absolute system of units.

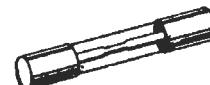
**fundamental wavelength**—The wavelength corresponding to the fundamental frequency. In an antenna, the lowest resonant frequency of the antenna alone, without inductance or capacitance.

**fungusproof**—To chemically treat a material, component, or unit to prevent the growth of fungus spores.

**furcation coupling**—The mixing of signals from several separate optical fibers by passing them through a common single fiber rod, thus obtaining a signal containing all the components of the several signals. The mixing of several colors can take place in this manner.

**furnace soldering**—Soldering by placing clamped and fluxed assemblies, on which solder has been positioned, in a furnace or oven.

**fuse**—1. A protective device, usually a short piece of wire but sometimes a chemical compound, that melts and breaks the circuit when the current exceeds the rated value. 2. To equip with a fuse. 3. A device used for protection against excessive currents. Consists of a short length of fusible metal wire or strip that melts when the current through it exceeds the rated amount for a definite time. Placed in series with the circuit it is to protect. 4. A replaceable protective device that will break the current when the current exceeds the capacity of the fuse.



Glass-tube.



Clear-window.



Grasshopper.

Fuses.

**fuse alarm**—A circuit that produces a visual and/or audible signal to indicate a blown fuse.

**fuse block**—An insulating base on which fuse clips or other contacts for holding fuses are mounted.

**fuse box**—An enclosed box containing fuse blocks and fuses.

**fuse clips**—Contacts on the fuse support for connecting the fuse holder into the circuit.

**fuse cutout**—An assembly consisting of a fuse support and a fuse holder that may or may not include the fuse link.

**fused arrays of fibers**—Optical fibers fused together to form solid, vacuum-tight assemblies in the form of slabs or rods. Disks or rectangular shapes having ground and polished surfaces perpendicular to the fiber lengths will transmit image information from one surface to the other. Rods of this type, either straight or tapered, will transmit images from one end of the rod to the other.

**fused coating**—A metallic coating (usually tin or solder alloy) that has been melted and solidified, forming a metallurgical bond to the base material.

**fused conductors**—Individual strands of heavy tinned copper wire stranded together and then bonded together by induction heating.

**fused disconnect**—Generally an air-break switch with a fusing unit in the blade. Used for opening and closing high-voltage circuits.

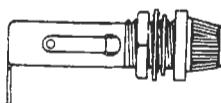
**fused junction**—See alloy junction.

**fused quartz**—1. A glasslike insulating material having exceptional resistance to the action of heat and acid. 2. Crystal quartz that is melted at a white heat and cooled to form an amorphous glass. It is not birefringent, and the refractive index is much lower than that of crystal quartz. Fused quartz of optical quality can be prepared by suitable techniques.

**fused semiconductor**—The junction formed by recrystallization on a base crystal from a liquid phase of one or more components and the semiconductor.

**fuse filler**—Material placed within the fuse tube to aid circuit interruption.

**fuse holder**—A device for supporting a fuse and providing connections for its terminals.



*Fuse holder.*

**fuse link**—In a fuse, the current-carrying portion, which melts when the current exceeds a predetermined value.

**Fusestat**—Trade name for a time-delay fuse similar to a Fusetron. It has a sized base requiring a permanent socket adapter, which prevents insertion of a fuse or Fusetron of an incorrect rating.

**fuse terminal block**—A block designed for cartridge fuses. Some are fitted with a neon or incandescent fuse failure indicator and may be mixed with feedthrough models on the same standard assembly vail.

**Fusetron**—Trade name for a screw-plug time-delay fuse that permits up to 50-percent overload for short periods without blowing.

**fuse tube**—The insulated tube enclosing a fuse link.

**fuse unit**—An assembly consisting of a fuse link mounted in a fuse holder, which contains parts and materials essential to the operation of the fuse link.

**fuse wire**—A wire made from an alloy that melts at a relatively low temperature.

**fusible line**—The current-carrying portion of a fuse, which is designed to melt when the rated current is exceeded for a specified length of time. Some fuses are made so that the fusible line can be replaced.

**fusible link**—A type of programmable read-only memory integrated circuit in which circuits form bit patterns by being “blasted” open (by a destructive current) or left closed (intact).

**fusible-link diode-matrix integrated circuit memory**—A programmable read-only memory (PROM) in which shorting fusible links are blown by applying overcurrent to configure a diode matrix with the proper program.

**fusible-link readout memory**—A large semiconductor array of prediffused cells interconnected by a fixed metallization pattern that can be tailored to a particular need simply by burning out selected interconnections.

**fusible resistor**—A resistor designed to protect a circuit against overload by opening when the current drain exceeds the design limits.

**fusible wire**—A wire used in fire-alarm circuits. It is made of an alloy with a low melting point.

**fusing**—1. The melting of a metallic coating (usually electrodeposited) followed by solidification. 2. Melting and cooling two or more powder materials together so that they bond together in a homogeneous mass.

**fusion**—1. Also called atomic fusion or nuclear fusion. The melting of atomic nuclei, under extreme heat (millions of degrees), to form a heavier nucleus. The fusion of two nuclei of light atoms is accompanied by a tremendous release of energy. 2. Melting, usually as the result of interaction of two or more materials.

**fusion welding**—Welding technique used to join metals by melting and fusing them at high temperatures using an electric arc or combustible gases.

**fuzz**—Also called fuzz tone. An intentional distortion of the natural tone of an electric guitar.

**fuzz box**—A special-effects device, usually used with electric guitars, which creates a great amount of harmonic distortion. The lack of clarity that results is called fuzz. A typical fuzz box operates by overdriving a preamplifier and then attenuating the preamplifier output so the output signal level is not necessarily higher than the output level.

**fuzz tone**—See fuzz.

**fuzzy computer**—A specially designed computer that uses fuzzy logic. Fuzzy logic computers are designed for artificial intelligence applications.

**fuzzy logic**—1. A branch of logic that uses degrees of membership in sets rather than a strict true/false membership. 2. A kind of logic using graded or qualified statements rather than ones that are strictly true or false. The results of fuzzy reasoning are not as definite as those derived by strict logic, but they cover a larger field of discourse. 3. A method of handling imprecision or uncertainty that attaches various measures of credibility to propositions. A form of logic used in some expert systems and other artificial intelligence applications.

**fuzzy sets**—Sets that do not have a crisply defined membership, but rather allow objects to have grades of membership from 0 to 1.

**fV**—Letter symbol for femtovolt ( $10^{-15}$  volt).

# G

**g**—Also called G force. Symbol for the acceleration of a free-falling body due to the earth's gravitational pull. Equal to 32.17 feet per second per second.

**G**—1. Symbol for conductance, a grid of a vacuum tube, a generator, or ground. 2. Letter symbol for giga ( $10^9$ ). 3. Abbreviation for the gate of a field-effect transistor.

**g-a**—Abbreviation for ground-to-air. Communication with airborne objects from the ground.

**GaAs FET**—*See* gallium arsenide field-effect transistor.

**GA coil**—A coil wound with air spaces between its turns and layers to reduce the capacitance.

**gage**—Also spelled gauge. 1. An instrument or means for measuring or testing. By extension, the term is often used synonymously with *transducer*. 2. A system for specifying wire size. The American wire gage (AWG), also known as Brown & Sharpe gage, is used for copper. An increase of three gage numbers doubles area and weight, and halves dc resistance.

**gage pressure**—1. A differential pressure measurement using the ambient pressure as a reference. 2. A pressure in excess of a standard atmosphere at sea level (i.e., 14.7 pounds per square inch or  $1.033 \times 10^4 \text{ kg/m}^2$ ).

**gage pressure transducer**—A pressure transducer that uses ambient pressure as the reference pressure. The sensing element is normally vented to the ambient pressure.

**gain**—Also called transmission gain. 1. Any increase in power when a signal is transmitted from one point to another. Usually expressed in decibels. Widely used for denoting transducer gain. 2. The ratios of voltage, power, or current with respect to a standard or previous reading. 3. Any increase in the strength of an electrical signal, as takes place in an amplifier. Gain is measured in terms of decibels or number of times of amplification; for example, 6 dB (a gain of 2) increases an input voltage to an output twice as large. 4. The change in source-drain current per unit change in gate voltage. Thus, higher gain gives faster devices. 5. The degree to which a signal's amplitude is increased. The amount of amplification realized when a signal passes through an amplifier or repeater, normally measured in decibels. 6. The ratio of output power to the input power for a system or component. 7. Change in signal level due to processing functions that increase the magnitude of the signal. Examples include signal amplification in a radar receiver; processing gain in the processor; and antenna gain, a result of the directivity of the pattern.

**gain-bandwidth product**—1. The product of the closed-loop gain of an operational amplifier and its corresponding closed-loop bandwidth. This product is often constant in operational amplifiers. 2. The product of the gain of an active device and a specified bandwidth. For an avalanche photodiode, the gain-bandwidth product

is the gain times the frequency of measurement when the device is biased for maximum obtainable gain.

**gain block**—A single stage of gain or a cascaded series of gain stages.

**gain control**—A device for varying the gain of a system or component.

**gain function**—A transfer function that relates either a pair of voltages or a pair of currents.

**gain margin**—The amount of gain change of an operational amplifier at  $180^\circ$  phase-shift angle frequency that would produce instability.

**gain nonlinearity**—The degree to which gain of an amplifier or instrument varies over the range of permissible input levels for a given gain setting, generally expressed as a percentage of deviation from the desired gain.

**gain-sensitivity control**—*See* differential gain control.

**gain stability**—The extent to which the sensitivity of an instrument remains constant with time. (The property reported in specifications should be instability, which is the maximum change in sensitivity from the initial value over a stated period of time under stated conditions.)

**gain-time control**—*See* sensitivity-time control.

**galactic noise**—All noise that originates in space as a result of radiation of celestial bodies other than the sun.

**galena**—A bluish-gray, crystalline form of lead sulfide often used as the crystal in a variable-crystal detector.

**gallium arsenide field-effect transistor**—Abbreviated GaAs FET. A field-effect transistor with a reverse-biased Schottky-barrier gate fabricated on a gallium arsenide substrate. Roughly equivalent to a silicon MOSFET, GaAs FETs are depletion-mode devices. Because charge carriers reach approximately twice the velocity as in silicon, for a given geometry a given gain can be reached at about twice the frequency. Also called GaAs MESFET, for metal epitaxial semiconductor FET.

**gallium arsenide (GaAs) injection laser**—A laser system consisting of a planar pn junction within a single crystal of gallium arsenide. The pair of parallel, semireflective end faces produces a Fabry-Perot resonant cavity, whereas the other faces are sawed to suppress all except the modes that propagate between the end faces. The lasing occurs in the modes that have the maximum optical gain and the least optical loss.

**galloping ghost**—*See* proportional control, 2.

**galvanic**—1. An early term for current resulting from chemical action, as distinguished from electrostatic phenomena. 2. Describing any substance from which, or through which, direct current occurs as a result of chemical action.

**galvanic anode**—A source of emf for cathodic protection provided by a metal less noble than the one

to be protected (i.e., magnesium, zinc, or aluminum as used for cathodic protection of steel).

**galvanic cell**—An electrolytic cell capable of producing electric energy by electrochemical action.

**galvanic corrosion**—Accelerated electrochemical corrosion produced when one metal is in electrical contact with another more noble metal, both being in the same corroding medium, or electrolyte, with a current between them. (Corrosion of this type usually results in a higher rate of solution of the less noble metal and protection of the more noble metal.)

**galvanic current**—An electrobiological term for unidirectional current such as ordinary direct current.

**galvanic series**—A list of metals and alloys arranged in the order of their relative potentials (ability to go into solution) in a given environment. The table of potentials is arranged with the anodic, or least noble, metals at one end and the cathodic, or more noble metals, at the other. (For marine use, the potentials listed are related to a seawater environment.)

#### *Galvanic Series*

(Anodic)	
Magnesium	
Zinc	
Cadmium	
Steel or iron	
Cast iron	
Chromium iron (active)	
Lead-tin solders	
Lead	
Tin	
Nickel	
Brasses	
Copper	
Bronzes	
Copper-nickel alloys	
<i>Monel</i>	
Silver	
Graphite	
Gold	
Platinum	
(Cathodic)	

**galvanizing**—The coating of steel with zinc to retard corrosion.

**galvanoluminescence**—The emission of radiant energy produced by the passage of an electrical current through an appropriate electrolyte in which an electrode made of certain metals such as aluminum or tantalum has been immersed.

**galvanometer**—1. An instrument for measuring an electric current. This is done by measuring the mechanical motion produced by the electromagnetic or electrodynamical forces set up by the current. 2. An instrument for detecting or measuring a small electric current by movements of a magnetic needle of a coil in a magnetic field. 3. An instrument used to measure the presence, amount cf, and direction of an electric current.

**galvanometer constant**—The factor by which a certain function of a galvanometer reading must be multiplied to obtain the current in ordinary units.

**galvanometer lamp**—The lamp that illuminates a movable mirror of the galvanometer in some spectrophotometers. The angle at which the light is reflected to the galvanometer scale depends on the amount of current through the galvanometer coil.

#### **galvanic cell — ganged**

**galvanometer recorder (for photographic recording)**—A combination of a mirror and coil suspended in a magnetic field. A signal voltage, applied to the coil, causes a light beam from the mirror to be reflected across a slit in front of a moving photographic film.

**galvanometer shunt**—A resistor connected in parallel with a galvanometer to increase the range of the instrument. The resistor limits the current to a known fraction and thus prevents excessive current from damaging the galvanometer.

**galvanometric controller**—A temperature indicator that has been converted to a temperature controller. The indicator operates directly off the sensor's input signal. The controller portion detects the mechanical position of the pointer and varies the output to keep the pointer at the desired temperature.

**game controller**—Joysticklike device that plugs into a computer and make it easier to play games.

**game paddle**—A game controller that moves an object in one of two directions.

**game port**—Interface on an adapter card used to connect a game peripheral and the computer.

**game theory**—A branch of mathematics that aims to analyze various problems of conflict by abstracting common strategic features for study in theoretical models termed games because they are patterned on actual games such as bridge and poker.

**gamma**—1. A unit of magnetic intensity, equal to  $10^{-5}$  oersted. 2. A number indicating the degree of contrast in a photograph, facsimile reproduction, or received television picture. This quantity is the exponent of that power law which is used to approximate the curve of output magnitude versus input magnitude over the region of interest.

**gamma correction**—Introduction of a nonlinear output-input characteristic for the purpose of changing the effective value of gamma.

**gamma ferric oxide**—The magnetic constituent of practically all present-day tapes, in the form of a dispersion of fine acicular particles within the coating.

**gamma radiation**—A highly penetrating electromagnetic disturbance (photons) that emanates from the nucleus of an atom. This type of radiation travels in waveform much like X-rays or light, but it has a shorter wavelength of approximately 1 angstrom or  $10^{-7}$  millimeter.

**gamma radiography**—Radiography using the emission of gamma rays to form an image of the structure penetrated by the radiation.

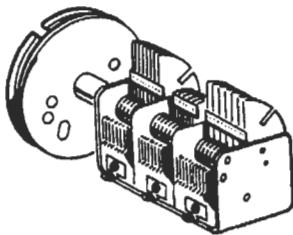
**gamma rays**—1. The emission from certain radioactive substances. They are electromagnetic radiations similar to X-rays, but with a shorter wavelength from about  $10^{-12}$  to  $10^{-9}$  centimeter. 2. The spontaneous emission of electromagnetic radiation by the nucleus of certain radioactive elements during their quantum transition between two energy levels.

**gang**—To mechanically couple two or more variable capacitors, switches, potentiometers, or other components together so they can be operated from a single control knob.

**gang capacitor**—Also called gang tuning capacitor. Two or more variable tuning capacitors mounted on the same shaft and controlled by a single knob, but each capacitor tuning a different circuit. Thus, more than one circuit can be tuned simultaneously by a single control.

**gang control**—Simultaneous control of several similar pieces of apparatus with one adjustment knob or other control.

**ganged**—Describing a group of devices, such as variable capacitors or resistors, that are coupled mechanically so that all are adjusted simultaneously from one control.



Gang capacitor.

**ganged tuning**—Simultaneous tuning of two or more circuits with a single mechanical control.

**gang punch**—To punch information that is identical or constant into all of a group of punch cards.

**gang switch**—A number of switches mechanically coupled for simultaneous operation, but electrically connected to different circuits. In one common form, two or more rotary switches are mounted on the same shaft and operated by a single control.

**gang tuning capacitor**—See gang capacitor.

**gap**—1. In a magnetic circuit, the portion that does not contain ferromagnetic material (i.e., an air space). 2. The space between two electrodes in a spark gap. 3. The tiny space between the pole pieces of a record or playback head, across which the magnetic fields appear (when the tape is running) for transduction into alternating electrical signals. 4. A space between radar-antenna radiation lobes where the field strength is low, resulting in incomplete radar coverage. 5. A space in which the radiation fails to meet minimum coverage requirements, either because the space is not covered or because the minimum specified overlap is not obtained. 6. An interval of space or time used to indicate automatically the end of a word, record, or file of data on a tape. 7. Space between two records or two blocks of information on a magnetic memory that is usually set to predetermined value, such as all zeros. It allows rewriting blocks in slightly expanded or reduced format, due to speed variations of the drive.

**gap arrester**—A type of lightning arrester comprising a number of air gaps in series between metal cylinders or cones.

**gap coding**—1. A means for inserting periods of no transmission in a system in which transmission is normally continuous. The spacing and duration of the periods of silence from the code are variable. 2. Subdividing the response of a transponder into long and short groups of pulses (analogous to Morse code) for purposes of recognition.

**gap depth**—The dimension of the gap in a recording head, measured perpendicular to the surface of the head.

**gap factor**—In a tube that employs electron-accelerating gaps (a traveling-wave tube), the ratio of the maximum energy gained (expressed in volts) to the maximum gap voltage.

**gap filler**—1. A lightweight radar set used to fill in gaps in the coverage pattern of an early-warning radar net. 2. An auxiliary radar antenna used to fill in gaps in the pattern of the main radar antenna.

**gap filling**—Electrical or mechanical rearrangement of an antenna array, or the use of a supplementary array, to produce lobes where gaps previously occurred.

**gap insulation**—Insulation wound in a gap.

**gap length**—The dimension of the gap of a recording head, measured from one pole face to the other. In longitudinal recording, the gap length is the dimension of the gap in the direction of tape travel.

**gap loss**—1. The loss in output attributable to the finite gap length of the reproduce head. The loss increases as the wavelength decreases, amounting to approximately 4 dB when the wavelength is equal to twice the gap length, and subsequently increases rapidly toward the complete extinction of output when the wavelength is approximately equal to 1.15 times the gap length. 2. In fiber optics, a power loss caused by deviation from optimum spacing between the elements to the fiber junction, fiber-to-fiber junction, or fiber-to-element junction. Gap loss is expressed in decibels.

**gap motor**—A spark-gap drive motor.

**gap scatter**—In a computer, the deviation from true vertical alignment of the gaps of the magnetic readout heads for the several parallel tracks. The mechanical misalignment of a head's read/write gaps in the direction of tape travel.

**gap width**—The dimension of the gap, measured in the direction parallel to the head surface and pole faces. The gap width of the record head governs the track width. The gap widths of reproduce heads are sometimes made appreciably less than those of the record heads to minimize tracking errors.

**garbage**—1. In a computer, a slang term for unwanted and meaningless information carried along in storage. Sometimes called hash. 2. Undecipherable or meaningless sequences of characters produced in computer output or retained within storage. 3. An informal term for corrupted data.

**garbage collection**—Technique for collecting empty spaces in a mass memory and then compacting them.

**garbage in, garbage out**—See GIGO.

**garble**—Faulty transmission, reception, or encoding that renders the message incorrect or unreadable.

**garnet maser**—See ferromagnetic amplifier.

**garter spring**—In facsimile, the spring fastened around the drum to hold the record sheet or copy in place.

**gas**—One of the three states of matter. An aeriform fluid having neither independent shape nor volume, but tending to spread out and occupy the entire enclosure in which it is placed. Gases are formed by heating a liquid above its boiling point.

**gas amplification**—Ratio of the charge collected to the charge liberated by the initial ionizing of the gas in a radiation counter.

**gas-amplification factor**—Ratio of radiant or luminous sensitivities with and without ionization of the gas in a gas phototube.

**gas cell**—A cell whose action is dependent on the absorption of gases by the electrodes.

**gas cleanup**—The tendency of many gas-filled tubes to lose their gas pressure and hence become inoperable. This occurs when the ions of gas are driven at high velocity into the metal parts or the glass envelope of the tube, where they form stable compounds and are lost as far as the tube is concerned.

**gas current**—1. The current in the grid circuit of a vacuum tube when the gas ions within the tube are attracted by the grid. 2. A flow of positive ions to an electrode, the ions having been produced as a result of gas ionization by an electron current between other electrodes. 3. The positive-ion current created in an electron tube as the result of the collisions between electrons and residual gas molecules.

**gas detector**—An instrument used to indicate the concentration of harmful gases in the air.

**gas diode**—A tube having a hot cathode and an anode in an envelope containing a small amount of an inert gas or vapor. When the anode is made sufficiently positive, the electrons flowing to it collide with gas atoms

and ionize them. As a result, the anode current is much greater than that for a comparable vacuum diode.

**gas-discharge device**—A device utilizing the conduction of electricity in a gas due to movements of electrons and ions produced by collision.

**gas-discharge display**—A device containing an inert gas that gives off orange light when a high voltage is applied to break down (ionize) the gas. Gas-discharge displays have a seven-segment format.

**gas-discharge laser**—See gas laser.

**gas-electric drive**—A self-contained power-conversion system comprising an electric generator driven by a gasoline engine. The generator in turn supplies power to the driving motor or motors.

**gaseous discharge**—The state of a gas or mixture of gases in which a conduction current can be maintained by ionization. The ionization results from collisions between electrons and atoms or molecules of the gas, the energy being furnished by an external source such as an electric field.

**gaseous electronics**—The field of study involving the conduction of electricity through gases and a study of all atomic-scale collision phenomena.

**gaseous tube**—An electronic tube into which a small amount of gas or vapor is introduced after the tube has been evacuated. Ionization of the gas molecules during operation of the tube affects its operating characteristics.

**gaseous-tube generator**—A power source comprising a gas-filled electron-tube oscillator and a power supply, plus associated controls.

**gas-filled cable**—A coaxial or other type of cable containing gas under pressure, which serves as insulation and prevents moisture from entering.

**gas-filled lamp**—A tungsten-filament lamp containing nitrogen or an inert gas such as argon.

**gas-filled radiation-counter tube**—A gas tube used for the detection of radiation. It operates on the principle that radiation will ionize a gas.

**gas-filled tube rectifier**—A rectifier tube in which a unidirectional flow of electrons from a heated electrode ionizes the inert gas within the tube. In this way, rectification is accomplished.

**gas focusing**—Also called ionic focusing. The use of an inert gas to focus the electron beam in a cathode-ray tube. Beam electrons ionize the gas molecules, forming a core of positive ions along the beam path that tends to attract beam electrons, making the beam more compact.

**gasket**—A device used to retain fluids under pressure or seal out foreign matter. Also a static seal to reduce electromagnetic interference or susceptibility.

**gasket-sealed relay**—A relay in an enclosure sealed with a gasket.

**gas laser**—Also called gas-discharge laser. A laser in which the active medium is a discharge in gas, vapor, or mixture within a glass or quartz tube that has a Brewster window at each end. This gas can be excited by a high-frequency oscillator or by a direct current between electrodes inside the tube to pump the medium so as to obtain a population inversion.

**gas magnification**—The increase in current through a phototube due to ionization of the gas within the tube.

**gas maser**—A maser in which the microwave electromagnetic radiation interacts with the molecules of a gas such as ammonia. Use is limited chiefly to highly stable oscillator applications, as in atomic clocks.

**gas noise**—Electrical noise produced by erratic motion of gas molecules in gas or partially evacuated vacuum tubes.

**gas-phase laser**—A continuous-wave device for general experimental work with coherent light. It employs

## gas-discharge device — gate

a resonator made up of a fused-silica plasma tube 60 cm long having internal, multilayer, dielectric-coated confocal reflectors of optical-grade fused silica.

**gas photocell**—A photoemissive cell having an inert gas added to its envelope. Subsequent ionization of the gas increases the responsivity of the photocell.

**gas phototube**—A phototube into which a quantity of gas has been introduced, usually to increase its sensitivity.

**gas ratio**—The ratio of the ion current in a tube to the electron current that produces it.

**gassiness**—The presence of unwanted gas in a vacuum tube, usually in relatively small amounts. It is caused by leakage from outside the tube or by evolution from its inside walls or elements.

**gassing**—1. Evolution of a gas from one or more electrodes during electrolysis. 2. The production of gas in a storage battery when the charging current is continued after the battery has been completely charged.

**gassy**—Having operating characteristics that are impaired as a result of an excessive amount of gas inside its envelope, as a vacuum tube.

**gassy tube**—See soft tube.

**gas-tight connection**—A contact or joint that prevents contaminant gases from reaching the contact area.

**gaston**—A modulator that produces a random-noise modulation signal from a gas tube. It may be attached to any standard aircraft communications transmitter to provide a counterjamming modulation.

**gas tube**—1. A partially evacuated electron tube containing a small amount of gas. Ionization of the gas molecules is responsible for the current. 2. An electron tube whose current is affected by the pressure on the gas or vapor contained in the tube.

**gas-tube relaxation oscillator**—A relaxation oscillator in which the abrupt discharge is provided by the breakdown of the gas in the tube.

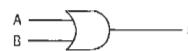
**gas X-ray tube**—An X-ray tube in which electron emission from the cathode is produced by bombarding it with positive ions.

**gate**—1. A circuit having two or more inputs and one output, the output depending upon the combination of logic signals at the inputs. There are four gates, called



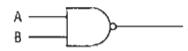
A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

AND



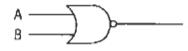
A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

OR



A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

NAND



A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

NOR

AND, OR, NAND, and NOR. The definitions assume positive logic is used. In computer work, a gate is often called an AND circuit. 2. A signal used to trigger the passage of other signals through a circuit. 3. One of the electrodes of a field-effect transistor; it is analogous to the base of a transistor or the grid of a vacuum tube. Symbol: G. 4. An output element of a cryotron. 5. A circuit in which one signal (usually a square wave) switches another signal on or off. 6. To control the passage of a pulse or signal. 7. Voltage-actuated control terminal of an MOS transistor. 8. A circuit that admits and amplifies or passes a signal only when a gating (triggering) pulse is present. 9. A digital logic element usually with one output and several inputs, where the output is a function of a combination of the inputs. 10. A single logic function, such as NAND, NOR, AND, OR, XOR, or NOT.

**gate array**—1. A geometric pattern of basic gates contained in one chip. It is possible to interconnect the gates during manufacture to form a complex function that may be used as a standard production. 2. A cellular arrangement of logic elements with a custom interconnection. Arrays offer complexities of several hundred to more than 2000 gates, performance that equals or betters that of standard TTL or ECL, and as little as 12-week turnaround from design to prototype. 3. Also called a semicustom large-scale integrated or very large-scale integrated circuit (VLSI). A matrix of unconnected transistors and resistors that become a dedicated array only after they are interconnected by one or more masking and interconnection steps. The term *gate array* is a holdover from the days when functional logical cells, equivalent to small- and medium-scale integrated circuits, were made by first forming equivalent gates. 4. Cells of transistors stacked in columns and separated by conductive channels. The cells are selectively connected to the channels in the final stages of manufacturing to provide logic functions. Like PLAs, gate arrays are less space efficient and more expensive than dedicated circuits. 5. A semicustom IC consisting of a regular arrangement of gates that are interconnected through one or more layers of metal to provide custom functions. Generally, gate arrays are preprocessed up to the first interconnect level so they can be quickly processed with final metal to meet a customer's specified logic function.

**gate circuit**—A circuit that passes a signal only when a gating pulse is present.

**gate-controlled switch**—Also called gate turn-off switch. A three-junction, three-terminal, solid-state device constructed very much like a silicon-controlled rectifier except that it has a turn-off ability, which is controlled by a negative current pulse applied to the gate.

**gate-controlled turn-off time**—1. The time interval during which a thyristor is switching from the on state to the off state as a result of the application of a gate trigger pulse. The interval is usually measured from the 10-percent point on the gate pulse to the instant at which the principal voltage has increased to 90 percent of the off-state voltage. 2. The time interval during which a thyristor is switching from the off state to the on state as a result of the application of a gate trigger pulse. The interval is usually measured from the 10-percent point on the gate pulse to the instant at which the principal voltage has dropped to 10 percent of its initial value. The turn-on time is the sum of the delay time and the rise time.

**gate-controlled turn-on time**—The time interval between the 10-percent rise of the gate pulse and the 90-percent rise of the principal current pulse during switching of a thyristor from the off state to the on state.

**gate current**—Instantaneous current flowing between the gate and cathode of a silicon-controlled rectifier.

**gate current for firing**—Gate current required to fire a silicon-controlled rectifier when the anode is at a fixed dc voltage with respect to the cathode and with the device at stated temperature conditions.

**gated-beam detector**—A single-stage FM detector using a gated-beam tube.

**gated-beam tube**—A five-element tube in which the electrons flow in a beam between the cathode and plate. A small increase in voltage on the limiter grid will cut off the plate current, and further increases will have a negligible effect on it.

**gated buffer**—A low-impedance inverting driver circuit that may be used as a line driver for pulse differentiation or in multivibrators.

**gated flip-flop**—A flip-flop that has a steering circuit that prevents both flip-flop outputs from becoming 0 at the same time. Alternating-current input pulses must be used to prevent the flip-flop from oscillating. This situation can arise if both input lines are made high simultaneously.

**gated sweep**—Sweep in which the duration as well as the starting time is controlled to exclude undesired echoes from the indicator screen.

**gated transistor**—A transistor in which a gate electrode covers the emitter and collector junctions. This allows the application of an electric field at the surface of the base region.

**gate electrode**—A control electrode to which trigger pulses are applied.

**gate equivalent circuit**—A basic unit for describing relative digital circuit complexity. The number of gate equivalent circuits is that number of individual logic gates that would have to be interconnected to perform the same function.

**gate generator**—A circuit or device used to produce one or more gate pulses.

**gate impedance**—The impedance of a gate winding in a magnetic amplifier.

**gate multivibrator**—A rectangular-wave generator designed to produce a single positive or negative gate voltage upon being triggered and then to become inactive until the arrival of the following trigger pulse.

**gate nontrigger current**—The highest gate current that will not cause a thyristor to switch from the off state to the on state.

**gate nontrigger voltage**—The maximum gate voltage that will not cause a thyristor to switch from the off state to the on state.

**gate power dissipation**—The power dissipated between the gate and cathode terminals of a silicon-controlled rectifier.

**gate-producing multivibrator**—A rectangular-wave generator that produces a single positive or negative gate voltage only when triggered by a pulse.

**gate pulse**—A pulse that enables a gate circuit to pass a signal. The gate pulse generally has a longer duration than the signal to ensure time coincidence.

**gate region**—Of a field-effect transistor, a region associated with the gate electrode in which the electric field due to the control voltage is effective.

**gate resistance**—The dc resistance between gate and source terminals of a field-effect transistor at specified gate voltage with drain short-circuited to the source.

**gate signal**—That signal generated by some form of delay circuit required in connection with beam switching, automatic following, the application of AGC to a selected echo, and many other purposes.

**gate terminal**—1. The terminal in a field-effect transistor electrically connected to the electrode associated with the region in which the electric field, due to the

control voltage, is effective. 2. A terminal to or from which only control current, usually called the gate current, flows.

**gate-to-source leakage current** — A current through gate and source terminals of a field-effect transistor at specified drain circuit conditions.

**gate trigger current** — In a controlled rectifier, the minimum gate current, for a given anode-to-cathode voltage, required to switch the rectifier from the off state to the on state.

**gate trigger voltage** — In a controlled rectifier, the gate voltage that produces the gate trigger current.

**gate tube** — A tube that does not operate unless two signal voltages, derived from two independent circuits, are applied simultaneously to two separate electrodes.

**gate turn-off current** — In a controlled rectifier, the minimum gate current, for a given collector current in the on state, required to cause the rectifier to switch off. Not all thyristors can be turned off by the gate.

**gate turn-off switch** — See gate-controlled switch.

**gate turn-off voltage** — The gate voltage required to produce the gate turn-off current in a thyristor. Not all thyristors can be turned off by the gate.

**gate voltage** — 1. The voltage across the gate-winding terminals of a magnetic amplifier. 2. The instantaneous voltage between gate and cathode of a silicon-controlled rectifier with anode opening. 3. The voltage between a gate terminal and a specified main terminal.

**gateway** — 1. A link, or bridge, from one type of communication network to another. 2. A machine or set of machines used to relay packets from one network to another network. *See also* router. 3. Equipment used to connect network architectures that use different protocols by providing protocol translation. 4. A link from one computer system to a different computer system. Some gateways are the Internet and Stocklink.

**gateway station** — An earth station that provides mobile units with access to the public telephone network.

**gate winding** — The reactor winding that produces the gating action in a magnetic amplifier.

**gating** — 1. Selecting those portions of a wave that exist during certain intervals or that have certain magnitudes. 2. Applying a rectangular voltage to the grid or cathode of a cathode-ray tube, to sensitize it during the sweep time only. 3. Application of a specific waveform to perform electronic switching. *See also* blanking.

**gating circuit** — A circuit that operates as a selective switch and allows conduction only during selected time intervals or when the signal magnitude is within specified limits.

**gating pulse** — A pulse that modifies the operation of a gate circuit.

**gage** — *See* gage.

**gage pressure** — *See* gage pressure.

**gauss** — 1. The centimeter-gram-second electromagnetic unit of magnetic induction. One gauss represents one line of flux (one maxwell) per square centimeter. Letter symbol: G.

**Gaussian distribution** — Also called normal distribution. A density function of a population that is bell-shaped and symmetrical and that is completely defined by two independent parameters: the mean and the standard deviation.

**Gaussian elimination** — A method for solving systems of linear equations based on manipulation of the matrix representing those equations.

**Gaussian function** — A mathematical function used in designing a filter to pass a step function with zero overshoot and minimum rise time (similar to a Bessel-function filter).

**Gaussian noise** — 1. Unwanted electrical disturbances or perturbations described by a probability density function that follows a normal law of statistics. This normal distribution is the well-known symmetrical bell-shaped density function of a population that is completely defined by two independent parameters, viz., the mean and the standard deviation. The Gaussian (normal) amplitude distribution is of fundamental significance in statistical theory, describing numerous natural phenomena. The central-limit theorem of statistics states, in essence, that the sum of a number of independent random variables approaches the Gaussian distribution as the number of said variables increases, regardless of the distribution of the individual variables. A significant facet of Gaussian random noise is that it exceeds its positive root-mean-square amplitude and attains twice that value for 16 and 20 percent of the time, respectively. 2. A random-noise signal whose frequency components have a Gaussian distribution centered on a specified frequency. 3. Noise whose amplitude is characterized by the Gaussian distribution, e.g., white noise, ambient noise, and hiss.

**Gaussian random vibration** — *See* random vibration.

**Gaussian waveform** — In pulse-compression systems, a waveform that produces very low transmitted side lobes.

**gaussmeter** — An instrument that provides direct readings of magnetic field density (flux density) by virtue of the interaction with an internal magnetic field.

**Gauss's theorem** — The summation of the normal component of the electric displacement over any closed surface is equal to the electric charge within the surface.

**GB** — Abbreviation for gigabyte, one billion bytes.

**GCA** — Abbreviation for ground-controlled approach.

**GCI** — Abbreviation for ground-controlled interception.

**GCS** — Abbreviation for gate-controlled switch.

**GCT or Gct** — Abbreviation for Greenwich civil time.

**G-display** — Also called G-scan or G-scope. In radar, a rectangular display in which a target appears as a laterally centralized blip on which wings appear to grow as the target approaches. Horizontal and vertical aiming errors are indicated by horizontal and vertical displacement of the blip.

**gear** — An element shaped like a toothed wheel that engages one or more similar wheels. The energy transmitted can be stepped up or down by making the driven gears of different sizes.

**geared synchro system** — A system in which the transmitting and receiving synchros turn at a higher speed than the input and output shafts. Geared systems are generally used when a high degree of accuracy is required.

**gearmotor** — A train of gears and a motor used for reducing or increasing the speed of the driven object.

**Geiger counter** — Also called Geiger-Mueller or G-M counter. 1. A radiation detector that uses a Geiger-Mueller counter tube, an amplifier, and an indicating device. The tube consists of a thin-walled gas-filled metal cylinder with a projecting electrode. Nuclear particles enter a window in the metal cylinder and temporarily ionize the gas, causing a brief pulse discharge. These pulses, which appear at the projecting electrode, are amplified and indicated visibly or audibly. 2. Gas-chamber-type radiation counter in which the chamber operates in avalanche region for high amplification and sensitivity.

**Geiger-Mueller counter** — *See* Geiger counter.

**Geiger-Mueller counter tube** — A radiation-counter tube designed to operate in the Geiger-Mueller region.

**Geiger-Mueller region**—Also called Geiger region. The voltage interval in which the pulse size is independent of the number of primary ions produced in the initial ionizing event.

**Geiger-Mueller threshold**—Also called Geiger threshold. The lowest voltage at which all pulses produced in the tube by any ionizing event are of the same size regardless of the size of the primary ionizing event. This threshold is that start of the Geiger region in which the counting rate does not substantially change with applied voltage.

**Geiger region**—See Geiger-Mueller region.

**Geiger threshold**—See Geiger-Mueller threshold.

**Geissler tube**—A gas-filled dual-electrode discharge tube that glows when electric current passes through the gas.

**gel**—A material composed of a solid held in a liquid.

**genemotor**—A type of dynamotor having two armature windings. One winding serves as the driving motor and operates from the vehicle battery. The other winding functions as a high-voltage dc generator for operation of mobile equipment.

**general address**—Group of characters included in the heading of a message to cause routing of the message to all addresses included in the general address category.

**general background lighting**—Overall lighting level in a room or area, exclusive of local lighting.

**general class license**—A license issued by the FCC to amateur radio operators who are able to send and receive code at the rate of 13 words per minute and who are familiar with general radio theory and practice. Holder enjoys all authorized amateur privileges except those reserved for higher license classes.

**generalized network**—A set of elements, commonly called nodes, that are interconnected in some way. In some cases it is sufficient to assign some meaning to the nodes and interconnections for the network to have some useful purpose. For example, a PERT network is simply a planning model of a complex set of tasks to be performed. Each node represents the completion of a task. The interconnecting lines represent precursor and successor relationships among tasks. Such models are commonly used to determine the critical path—the most complex sequence of events that will complete the task.

**general light**—The total light or light level in a room or area, including all sources.

**general-purpose computer**—A computer designed to solve a wide variety of problems, the exact nature of which may have been unknown before the computer was designed.

**general-purpose digital computer**—A digital computer designed to solve a large variety of problems; that is, a computer that can be adapted to a large class of applications (as opposed to a computer designed specifically to control a manufacturing process). A typical general-purpose digital computer consists of four subsystems: (1) input/output, which permits communication with the outside world; (2) memory, which stores data

and instructions; (3) central processing unit (CPU), or arithmetic unit, which performs the arithmetic and data processing operations; and (4) control, which ties all of the subsystems together so that they operate in a fully automated way.

**general-purpose interface bus**—See GPIB.

**general-purpose motor**—A motor of 200 hp or less and 450 rpm or more, rated for continuous operation, having standard ratings, and suitable for use without restriction to a particular application.

**general-purpose relay**—A term that covers a wide variety of electromechanical relays that typically are of the common coil-and-armature type, the most common styles having the ability to switch either ac or dc with dc ratings from 2 to 10 amperes. These relays are usually employed in switching power and can be found in business machines, process controls, fractional-horsepower motor controls, and many other applications. They may be plug-in, bracket, stud, or screw mounted. Plug-in choices are square, octal, miniature, and multiple-pin. A relay that is adaptable to a variety of applications.

**general rate**—The amount of time taken by the creation of electron-hole pairs in a semiconductor.

**general register**—One of a specified number of internal addressable registers in a CPU that can be used for temporary storage, as an accumulator, an index register, a stack pointer, or for any other general-purpose function.

**general routine**—A computer routine designed to solve a general class of problems, but when appropriate parametric values are supplied, it specializes in a specific problem.

**generated noise**—In potentiometric transducers, the noise that is attributable to causes such as the generation of emf when dissimilar metals are rubbed against each other, or the emf resulting from the thermocouple effects at points where dissimilar metals are joined.

**generating electric field meter**—Also called a gradient meter. A device for measuring the potential gradient at the surface of a conductor. A flat conductor is alternately exposed and then shielded from the electric field to be measured. The resultant current in the conductor is then rectified and used as the measure.

**generating magnetometer**—Also called earth inductor. A magnetometer that measures a magnetic field by the amount of emf generated in a coil rotated in the field.

**generating station**—An installation that produces electric energy from chemical, mechanical, hydraulic, or some other form of energy.

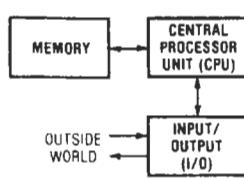
**generating voltmeter**—Also called a rotary voltmeter. A device that measures voltage. A capacitor is connected across the voltage, and its capacitance is varied cyclically. The resultant current in the capacitor is then rectified and used as a measure.

**generation**—The number of dubbing steps between a master recording and a given copy of the master. Thus, a second-generation dub is a copy of a copy of the original master.

**generation data group**—A collection of successive data sets that are historically related.

**generation rate**—The time rate of creation of electron-hole pairs in a semiconductor.

**generator**—Symbolized G. Also called dynamo. 1. A machine that converts the mechanical energy of a spinning rotor into electrical energy. 2. An electronic device that converts dc voltage to alternating current of the desired frequency and waveshape. 3. Any device that generates electricity. 4. In computer operation, a routine for producing specific routines from specific input parameters and skeletal coding. 5. A machine that



General-purpose digital computer.

converts mechanical energy into electric energy. In its commonest form, a large number of conductors are mounted on an armature that is rotated in a magnetic field produced by field coils. 6. A vacuum-tube oscillator or any other nonrotating device that generates an alternating voltage at a desired frequency when energized with dc power or low-frequency ac power. Such generators are used to produce large amounts of rf power, such as for high-frequency heating and ultrasonic cleaning. 7. A circuit that generates a desired repetitive or nonrepetitive waveform, such as a pulse generator.

**generator efficiency** — 1. In a generator, the ratio between the power required to drive the generator and the output power obtained from it. 2. In a thermoelectric couple, the ratio of the electrical power output to the thermal power input. It is an idealized efficiency assuming perfect thermal insulation of the thermoelectric arms.

**generator field control** — Regulation of the output voltage of a generator by control of the voltage that excites the field winding of the generator.

**generator lock** — See genlock.

**generator voltage regulator** — A regulator that maintains or varies the voltage of a synchronous generator, capacitor motor, or direct-current generator at or within a predetermined value.

**generic package** — A collection of software items from which more than one installation-dependent specific package may be generated by a software manufacturing process. Generic packages may be in source-code form (generic source package) or in object-code form (generic object package).

**genlock** — Abbreviation for generator lock. Also abbreviated GENLOCK. 1. When two composite video signals are mixed, or one is fed as input to another, their vertical, horizontal and subcarrier signals must be synchronized exactly or with a fixed offset. Genlock is achieved by means of locking the originating signal with the second with a digital or analog phase-locked loop circuit. 2. A process of sync generator locking, that makes it possible for two sync generators to run at the same frequency and phase. Used in video processing.

**geodesic** — The shortest line between two points on a given surface.

**geometric distortion** — In television, any geometric dissimilarity between the original scene and the reproduced image.

**geometric mean** — The square root of the product of two quantities.

**geometric symmetry** — Filter response in which there is mirror-image symmetry about the center frequency when frequency is plotted on a logarithmic scale. (This is the natural response of many electrical circuits.) See also arithmetic symmetry.

**geometry** — The shape or configuration of a die or IC.

**geophysical cable** — Cable used in exploring for underground oil deposits.

**george box** — An amplitude-sensitive device employed in an intermediate-frequency amplifier. It rejects jamming signals of insufficient amplitude to operate its circuits; however, jamming signals having sufficient amplitude are not affected.

**geostationary** — Refers to a geosynchronous satellite angle with zero inclination so that the satellite appears to hover over one spot on the earth's equator. A satellite in the Clarke belt is geostationary.

**geostationary orbit** — Also called Clarke orbit, in honor of Arthur C. Clarke, who first described it. This circular orbit above the equator is precisely the altitude (35,863 km or 22,238 miles) at which any size satellite will revolve around the earth once every 24 hours.

From the ground below it thus appears parked in space overhead, and, from above, one-third of the earth's surface can always be seen. Television satellites are separated by 4° intervals on this orbit to avoid mutual interference.

**geosynchronous** — Within the Clarke circular orbit above the equator. For a planet the size and mass of the earth, this point is 22,238 miles above the surface.

**geosynchronous satellite** — A satellite positioned at the proper distance from the earth and moving at the proper relational speed to appear stationary to an observer on earth.

**germanium** — Symbol Ge. A brittle, grayish-white metallic element having semiconductor properties. Widely used in transistors and crystal diodes. Its atomic number is 32.

**germanium detector** — A type of photoconductive detector in which germanium, usually doped with boron, gallium, and indium, serves as a semiconductor and can detect frequencies up to and beyond 100 micrometers.

**germanium diode** — A semiconductor diode in which a germanium crystal pellet is used as the rectifying element.

**germanium transistor** — A transistor in which germanium is the semiconducting material.

**German silver** — Usually called nickel silver. A silverish alloy of copper, zinc, and nickel.

**getter** — An alkali metal introduced into a vacuum tube during manufacture. It is fired after the tube has been evacuated, to react chemically with and eliminate any remaining gases. The getter then remains inactive inside the tube. The silvery deposit sometimes seen on the inside of the glass envelope is due to getter firing.

**gettering** — A semiconductor manufacturing process that aims to remove defects from the neighborhood of the devices, either removing them completely from the silicon wafer or transporting them into regions where they will have no effect on device performance. Defects can be introduced at almost any time during processing, and the defects can take on many forms. Consequently, a large number of different types of gettering processes are presently used. Several different gettering processes may be used during the fabrication of one particular device.

**G force** — See g.

**g-g** — Abbreviation for ground-to-ground. Communication between two points on the ground.

**ghost** — 1. A spurious video image resulting from an echo. 2. An undesired duplicate image in a television picture, fainter and to one side of the normal picture, due to multipath transmission. See ghost image.

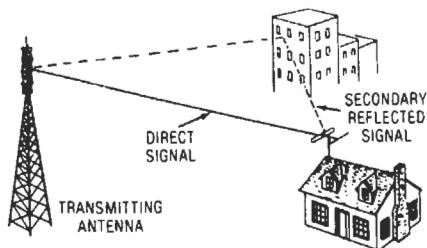
**ghost image** — Also called ghost. An undesired duplicate image offset somewhat from the desired image as viewed on a television screen. It is due to a reflected signal traveling over a longer path and, hence, arriving later than the desired signal. It may be eliminated by the use of a directional antenna array that receives signals over only one path.

**ghosting** — The appearance of multiple TV images, which is usually caused by reception of a signal via two different paths.

**ghost mode** — A waveguide mode in which there is a trapped field associated with an imperfection in the waveguide wall. A ghost mode can cause difficulty in a waveguide operated near the cutoff frequency of a propagation mode.

**ghost pulse** — See ghost signal.

**ghost signal** — Also called ghost pulse. An unwanted signal on the screen of a radar indicator. Echoes that experience multiple reflections before reaching the receiver are an example. The term also is applied to a reflected television signal. See ghost image.



Ghost signal.

**giant grid** — An extensive regional or national system of backbones and networks.

**giant ties** — See interconnection, 1.

**Gibson girl** — A portable, hand-operated transmitter used by pilots forced down at sea.

**GIF** — Abbreviation for Graphics Interchange Format. A standard color image format commonly encountered on the Internet. Other common formats are TIFF, PICT, and JPEG.

**giga-** — A prefix meaning one billion, or  $10^9$ .

**gigacycle** — One kilomegacycle, or one billion cycles. An obsolete term. The currently preferred term is gigahertz.

**gigahertz (GHz)** — One billion ( $10^9$ ) cycles per second. Used to replace the more cumbersome and obsolete term *kilomegacycle*.

**gigawatt** — One thousand megawatts ( $10^9$  watts). Letter symbol: GW.

**GIGO or gigo** — 1. An acronym formed from the phrase "garbage in, garbage out." It is used to describe a computer whose operation is suspect. 2. A term used to describe data moving into and out of a computer system. If the input is bad (garbage in), then the output will also be bad (garbage out).

**gigohm** — One thousand megohms ( $10^9$  ohms).

**gilbert** — A cgs unit of the magnetomotive force required to produce one maxwell of magnetic flux in a magnetic circuit of unit reluctance;  $1 \text{ gilbert} = 10/4\pi$  ampere-turn. Letter symbol: Gb.

**gilbert per centimeter** — The practical cgs unit of magnetic intensity. Gilberts per centimeter are the same as oersteds.

**Gill-Morrell oscillator** — A retarding-field oscillator in which the oscillation frequency depends not only on the electron transit time within the tube, but also on the associated circuit parameters.

**gill selector** — A slow-acting telegraph sender and calling key for selective signaling.

**gimbal** — A mechanical frame having two perpendicularly intersecting axes of rotation.

**gimmick** — 1. A capacitor with a value of a few picofarads, improvised by twisting together two insulated wires. 2. Length of twisted two-conductor cable used as a variable-capacity load, in which the capacity is varied by untwisting and separating the individual conductors.

**gimp** — A slang name given to the extremely flexible wire that was used in telephone cords and similar equipment. This wire cannot be directly soldered to, as it is a metallic cloth-type material.

**Giorgi system** — See mksa electromagnetic system of units.

**glass** — In fiber optics, an amorphous transparent or translucent brittle material usually made by fusion of silica, soda ash, lime, and salt cake or similar materials. Used as a fiber-optic cable, glass offers resistance to high

temperatures. It is not subject to corrosion, and eliminates fire hazards and problems caused by short circuits.

**glass-ambient technology** — The technique by which glass is applied directly to the surface of a semiconductor material. Typically, glass is placed on the surface of a microelectronic device by means of pyrolytic deposition, vapor deposition, or the firing of a glass powder to the surface.

**glass binder** — The glass powder added to a resistor or conductor ink to bind the metallic particles together after firing.

**glassbreak vibration detector** — A vibration-detection system that employs a contact microphone attached to a glass window to detect cutting or breakage of the glass.

**glass electrode** — In electronic pH measurement, an electrode used for determining the potential of a solution with respect to a reference electrode. The calomel type is the most common.

**glassivation** — Also called passivation. 1. A method of transistor passivation by a pyrolytic glass-deposition technique, whereby silicon semiconductor devices, complete with metal contact systems, are fully encapsulated in glass. 2. The deposition of glass on a chip to give protection to underlying device junctions. 3. A process in which a dielectric material is diffused over the entire wafer to provide mechanical and environmental protection for the circuits. 4. A method of semiconductor passivation by coating the element with a pyrolytic glass deposition.

**glass-plate capacitor** — A high-voltage capacitor in which the metal plates are separated by sheets of glass for dielectric. The complete assembly is generally immersed in oil.

**glass-to-metal seal** — An airtight seal between glass and metal parts of an electron tube, made by fusing together a special glass and special metal alloy having nearly the same temperature coefficients of expansion.

**glass tube** — A vacuum or gaseous tube that has a glass envelope.

**glazed substrate** — Ceramic substrate with a glass coating to effect a smooth and nonporous surface.

**glide path** — The approach path used by an aircraft making an instrument landing.

**glide-path localizer** — In an aircraft instrument-landing system, the part that indicates the altitude of the plane and creates a glide path for a blind landing.

**glide-path transmitter** — A transmitter that produces signals for vertical guidance of aircraft along an inclined surface that extends upward from the desired point of ground contact.

**glide slope** — A radio beam used by pilots to determine the altitude of the aircraft during a landing.

**glide-slope facility** — A radio transmitting facility that provides the glide-slope signals.

**glidetone** — A device used in electronic music that produces a continuous shift in the frequency of an audio signal.

**G-line** — 1. A round wire coated with a dielectric and used to transmit microwave energy. 2. A signal insulated wire that can be strung in the open and used as a surface-wave radio-frequency transmission line. A G-line acts like a coaxial cable without the outer tubular conductor.

**glint** — Also called glitter. 1. A distorted radar-signal echo that varies in amplitude from pulse to pulse because the beam is being reflected from a rapidly moving object such as an airplane propeller. 2. An electronic-countermeasures technique in which the scintillating effect of shuttered or rotating reflectors is used to degrade the tracking or seeking functions of an enemy weapons system.

**glissando**—A tone that changes smoothly from one pitch to another.

**glitch**—1. A form of low-frequency interference appearing as a narrow horizontal bar moving vertically through the television picture. This is also observed on an oscilloscope at the field or frame rate as an extraneous voltage pip moving along the signal at approximately the reference-black level. 2. An unwanted transient condition. 3. An undesired pulse or burst of noise that causes crashes and failures in computers. A small pulse of noise is called a snivitz. 4. A temporary or random error, or a problem or malfunction in hardware, such as a malfunction that can be caused by a power surge. 5. A spike caused by the skew (difference in turn-on/turn-off time) of switches or logic. Glitches are a troublesome source of error in high-speed D/A converters and are most prevalent at the midscale switching location, when all digital input bits are switching. Glitch energy is specified in picovolt-seconds, which describes the area under the voltage-time curve at its worst-case occurrence.

**glitter**—See glint.

**global beam**—1. An INTELSAT antenna down-link pattern covering a third of the earth's surface. These patterns are bore-sighted at the middle of an ocean to provide services to nations all the way around the ocean basin. 2. A broad pattern of signal radiation from a satellite that covers one-third of the earth's surface. (Type of beam used by INTELSAT satellites.)

#### Global Systems for Mobile Communications

Originally called the Groupe Speciale Mobile. Abbreviated GSM. The digital cellular standard for Europe.

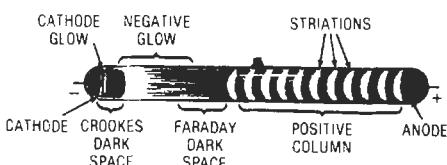
**globule test**—A solderability test specifically for component leads. The time required for a globule of solder to completely wet around a component lead is measured and recorded and then compared against a known standard. This particular test requires a certain amount of human evaluation.

**glossmeter**—A photoelectric instrument for determining the gloss factor of a surface (i.e., the ratio of light reflected in one direction to the light reflected in all directions).

**glow discharge**—A discharge of electricity through a gas in an electron tube. It is characterized by a cathode glow resulting from a space potential much higher than the ionization potential of the gas in the vicinity of the cathode.

**glow-discharge microphone**—A microphone in which the sound waves cause corresponding variations in the current forming a glow discharge between two electrodes.

**glow-discharge tube**—A gas tube that depends for its operation on the properties of a glow discharge.



Glow-discharge tube.

**glow-discharge voltage regulator**—A gas tube used for voltage regulation. The resistance of the gas

within the tube varies in step with the voltage applied across the tube.

**glow lamp**—1. A lamp containing a small amount of gas or vapor. Current between the two electrodes ionizes the gas and causes the lamp to glow but does not provide rectification. Neon gives a red-orange glow, mercury vapor a blue glow, and argon a purple glow. 2. Gas-discharge tube serving as a concentrated source of light whose brightness varies in proportion to current flow. When an audio-frequency signal is combined with the lamp current, the brightness of the glow discharge varies according to the audio-frequency signal variations. 3. Glow-discharge type of tube whose light brightness is proportional to the current passing through the tube; used for photographic recording of facsimile signals. 4. A lamp in which the ionization of the inert gas contained in it produces a glow in the space close to the negative electrode.

**glow potential**—The voltage at which a glow discharge begins in a gas-filled electronic tube as the voltage is gradually increased.

**glow-tube rectifier**—Also called a point-plane rectifier. A cold-cathode gas-discharge tube that provides a unidirectional current flow.

**glow switch**—An electron tube used in some fluorescent-lamp circuits. It contains two bimetal strips that are closed when heated by the glow discharge.

**glue-line heating**—An arrangement of electrodes designed to heat a thin film of material having a high loss factor between alternate layers of materials having a low loss factor.

**$g_m$** —Symbol for the mutual conductance or transconductance of a vacuum tube.

**G-M counter**—Abbreviation for Geiger-Mueller counter.

**GMT or Gmt**—Abbreviation for Greenwich mean time.

**gobo**—A dark mat used to shield the lens of a television camera from stray lights.

**gold**—A very soft, ductile material that is noted for its resistance to corrosive media. It is used primarily as a coating or plating.

**gold-bonded diode**—A semiconductor diode in which a preformed whisker of gold contacts an n-termination substrate as the junction is formed by millisecond electrical pulses.

**gold doping**—1. A technique used to control the lifetime of minority carriers in a diffused-mesa transistor. Gold is diffused into the base and collector regions to reduce the storage time. 2. A process sometimes used in the manufacture of integrated circuits, in which gold is diffused into the semiconductor material, resulting in higher operating speeds.

**gold-leaf electroscope**—An apparatus comprising two pieces of gold leaf joined at their upper ends and suspended inside a glass jar. When a charge is applied to the terminal connected to the leaves, they spread apart due to repulsion of the like charges on them.

**Goldschmidt alternator**—An early radio transmitter. It is a rotating machine employing oscillating circuits in connection with the field and the armature to introduce harmonics in the generated fundamental frequency. Interaction between the stator and rotor harmonics gives a cumulative effect and thereby provides very high radio frequencies.

**goniometer**—1. In a radio-range system, a device for electrically shifting the directional characteristics of an antenna. 2. An electrical device for determining the azimuth of a received signal by combining the outputs of

individual elements of an antenna array in certain phase relationships.

**go/no-go test** — A test that determines whether a unit under test is functioning in accordance with specifications, but does not perform any diagnostic tests to determine the cause of an incorrect output.

**Gopher** — 1. A menu-based system for organizing and distributing information on the Internet, which allows users to browse or download files and directories. Simpler to use but similar in functionality to FTP. A key feature is the ability to include menu items that connect the user to other Gopher servers. Developed at the University of Minnesota, and partially named after their mascot. 2. Internet databases that can be accessed by the World Wide Web (WWW) as well as other Gopher clients.

**Gopherspace** — All Gopher sites are at some point interconnected, and this network is known as Gopherspace. Gopherspace results from the ability to link different Gopher sites together.

**goto circuit** — A circuit capable of sensing the direction of current. It can be used in majority logic circuits, in which the output is either positive or negative depending on whether the majority of the inputs is positive or negative.

**goto pair** — Two tunnel diodes connected in series in a way such that one is in the reverse tunneling region when the other is in the forwarded conduction region. This arrangement is used in high-speed gate circuits.

**governed series motor** — A motor used with teletypewriter equipment. It has a governor for regulating the speed.

**governor** — 1. A motor attachment that automatically controls the speed at which the motor rotates. 2. The equipment that controls the gate or valve opening of a prime mover.

**GPI** — Abbreviation for ground-position indicator.

**GPIB** — Abbreviation for general-purpose interface bus. Also called HPIB (Hewlett Packard interface bus) and, more formally, IEEE Standard 488.2 interface. 1. A byte-serial bus created to interconnect instruments and computers. 2. The standard interface hardware used in computer systems. It has been adopted by the IEEE as the IEEE-488 instrument bus standard, which is intended to define standard interface techniques for limited transmission distances (up to 20 meters). It is an eight-bit wide digital interface applicable for both programmable and nonprogrammable components. The bus provides compatibility between interfacing components, offers noise immunity, and covers the use of interfacing with special connectors.

**grabber hand** — An on-screen image of a hand that is controlled with a mouse.

**graceful degradation** — A computer programming technique whose purpose is to prevent catastrophic system failure by permitting the machine to operate, although in a degraded mode, in spite of failures or malfunctions in several integral units or subsystems.

**graded-base transistor** — *See* diffused-base transistor.

**graded-core glass optical fiber** — For most applications of high information rate (bandwidth), a fiber that has a core in which the highest optical density is at the center. Optical density decreases with distance from the center until it is the same as the cladding. That is, the optical density of the core is graded downward from the center of the core to the edge of the core, at which point it is equal to the cladding optical density.

**graded filter** — A power-supply filter in which the output stage of a receiver or audio amplifier is connected at or near the filter input so that the maximum available

dc voltage will be obtained. The output stage has low gain; therefore, ripple is not too important.

**graded-index fiber** — 1. An optical fiber made with a refractive index that gets progressively lower as the diameter increases. 2. An optical fiber in which the index of refraction varies in the fiber, usually decreasing approximately parabolically from the center to the surface. 3. A fiber whose index of refraction decreases with increasing radial distance from the center of the core.

**graded insulation** — A combination of insulation proportioned so as to improve the distribution of the electric field to which the combination is subjected.

**graded-junction transistor** — *See* rate-grown transistor.

**graded thermoelectric arm** — A thermoelectric arm having a composition that changes continuously in the direction of the current.

**gradient** — The rate at which a variable quantity increases or decreases. For example, potential gradient is the difference of potential along a conductor or through a dielectric.

**gradient-index fibers** — Optical fibers that keep a pulse of photons together for a longer time by gradually bending the photon paths back to the core of the fiber before they get all the way to the surface. While the weaving photon travels a longer distance than those traveling in a straight line down the center of the fiber, the glass in the core is treated to slow down the light. This keeps the packets of photons in proximity for a longer time. This fiber is being used in almost all phone company installations today.

**gradient meter** — *See* generating electric field meter.

**gradient microphone** — A microphone in which the output rises and falls with the sound pressure. *See also* pressure microphone.

**grain growth** — The increase in the size of the crystal grains in a glass coating or other material over a period.

**gram** — A unit of mass and weight in the metric system. Letter symbol: g.

**gramme ring** — A ring-shaped iron armature around which the coils are wound. Each turn is tapped from the inside diameter of the ring to a commutator segment.

**grandfather cycle** — The period during which magnetic-tape records are retained before reusing so that records can be reconstructed in the event of loss of information stored on a magnetic tape.

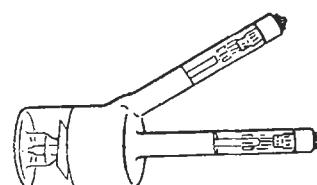
**grand-scale integration** — *See* GSI.

**granular carbon** — Small particles of carbon used in carbon microphones.

**granularity** — A characteristic of the output data of a measuring instrument. The measure of granularity is the smallest increment of the output data when it is in a digital form. The smallest increment is also called least count.

**graph** — A pictorial presentation of the relationship between two or more variables.

**graphetchon** — A specially designed electron memory tube, based on iconoscope principles, in which electrical signal information is stored and recovered at different



Graphechon.

scanning rates. It is used in radar and computer applications.

**graphic**—A symbol produced by a process such as handwriting, drawing, or printing.

**graphical analysis**—The use of diagrams and other graphic methods to obtain operating data and answers to scientific or mathematical problems.

**graphical data operations**—Manipulations that a system can perform on points, lines, symbols, angles, and other graphical representations. These operations include delete, insert, replace, move, rotate, expand, contract, and extrapolate.

**graphical language**—A programming language that expresses programs in a graphical form resembling flowcharts.

**graphic equalizer**—1. An equalizer that functions simultaneously at a number of preset frequencies, any of which may be boosted or cut independently of all others. Often done at standard 1,  $\frac{1}{2}$ ,  $\frac{1}{3}$ , or  $\frac{1}{6}$  octave center frequencies. Graphic equalizers are generally peaking-type equalizers. 2. A multiband equalizer whose controls are sliders, so that their settings can be seen as a rough graph of their frequency response characteristics. 3. Tone control device that uses separate adjustments to cut or boost different frequencies within the audio band. A graphic equalizer provides greater control over tone than single-knob tone controls.

**graphic instrument**—See recording instrument.

**graphics**—1. In communications systems, an information mode in which intelligence is reproduced by use of a graphic system (a variation of facsimile). 2. Nonvoice analog information modes and devices such as facsimile and television. 3. Using computer technology to create a drawing that is usually displayed on a terminal or plotter.

**graphics board**—A hardware add-on that boosts a computer's graphics capabilities. Common graphics adapters include CGA, EGA, VGA, and Super VGA.

**graphic symbol**—An electronic circuit diagram symbol formed using one or more basic elements such as lines, circles, arcs, and squares. The meaning of a symbol is not changed by its orientation, although some symbols are generally shown in one direction by convention. Line width and symbol size do not affect a graphic symbol's meaning.

**graphic tablet**—A surface through which coordinate points can be transmitted by identification with a cursor or stylus.

**graphic terminal**—1. A cathode-ray-tube display. 2. An XY plotter.

**graphite**—A finely divided carbon used as a lubricant and in the construction of some carbon resistance elements. The most common use is in so-called lead pencils.

**grass**—The pattern produced by random noise on an A-scope; it appears as closely spaced, sharp, constantly moving pulses on the base line. *See also* random noise.

**grasshopper fuse**—A small fuse with a spring-loaded fusible wire. When the wire fuses to open the circuit, the spring shows a visible signal and closes an auxiliary circuit to actuate an alarm.

**graticule**—A calibrated screen placed in front of a cathode-ray tube for measurement purposes.

**grating**—A device for spreading out light or other radiation. It consists of narrow parallel slits in a plate or narrow parallel reflecting surfaces made by ruling grooves on polished metal. The slits or grooves break up the waves as they emerge. *See also* ultrasonic cross grating; ultrasonic space grating.

**grating reflector**—An antenna reflector consisting of an openwork metal structure that resembles a grating.

## graphic — Greenwich mean time

**Gratz rectifier**—An arrangement of two rectifiers per phase connected into a three-phase bridge circuit to provide full-wave rectification.

**gravity**—The force that tends to pull bodies toward the center of the earth, thereby giving them weight. *See also* g.

**gravity cell**—A primary cell in which two electrolytes are kept separated by differences in specific gravity. It is a modification of the Daniell cell and is now obsolete.

**gray body**—A radiating body whose spectral emissivity remains the same at all wavelengths. It is in constant ratio of less than unity to the radiation of a blackbody radiator at the same temperature.

**Gray code**—1. A positional binary number notation in which any two numbers whose difference is 1 are represented by expressions that are the same except in one place or column and differ by only one unit in that place or column. 2. A numeric code composed of a number of bits, assigned in such a way that only one bit changes at each increment (or decrement). 3. A modified binary code. Sequential numbers are represented by binary expressions in which only one bit changes at a time; thus, errors are easily detected.

**Gray-code test patterns**—A sequence of input patterns in which only one input pin changes state at each test step.

**gray image**—Any image composed of the full spectrum of gray shades ranging from black to white.

**gray scale**—1. A series of regularly spaced tones ranging from white to black through intermediate shades if gray used as a reference scale for control purposes in photography or TV. 2. The discrete levels of the video signal between reference-black and reference-white levels.

**gray-scale capability**—The ability to accurately reproduce different light levels. At present there are several standards for judging gray-scale display. Some define each light "level" that makes up the scale as the brightness change discernible by the eye (typically a 3-to 5-percent change). Another standard, less subjective, defines gray scale as the difference in brightness required to produce a specified density change on processed film.

**gray scale image**—An image consisting of an array of pixels that can have more than two values.

**great manual**—Also called the accompaniment manual or lower manual. In an organ, the keyboard normally used for playing the accompaniment to the melody.

**green-gain control**—A variable resistor used in the matrix of a three-gun color television receiver to adjust the intensity of the green primary signal.

**green gun**—The electron gun whose beam, when properly adjusted, strikes only the green phosphor dots in the color picture tube.

**green restorer**—A dc restorer used in the green channel of a three-gun color-television picture-tube circuit.

**green video voltage**—The signal voltage that controls the grid of the green gun in a three-gun picture tube.

**Greenwich civil time**—*See* universal time.

**Greenwich mean time**—Abbreviated GMT or Gmt. The mean solar time at the meridian of Greenwich (zero longitude). It is used as a world-wide reference time. Also called zulu time, because of the Z time zone. This widely used standard time reference is equivalent to EDT plus 4 hours, EST or CDT plus 5 hours, CST or MDT plus 6 hours, MST or PDT plus 7 hours, and PST plus 8 hours.

**Gregorian antenna**—A satellite antenna with a sub-reflector mounted near the focal point, for improved focusing of satellite signals.

**grid**—1. An electrode having one or more openings for the passage of electrons or ions. *See also* control grid; screen grid; shield grid; space-charge grid; suppressor grid. 2. An interconnected system in which high-voltage, high-capacity backbone lines overlay and are connected with networks of lower voltages. 3. A two-dimensional network consisting of a set of equally spaced parallel lines superimposed upon another set of equally spaced parallel lines so that the lines of one set are perpendicular to the lines of the other, thereby forming square areas. The intersections of the lines provide the basis for an incremental location system. 4. An arrangement of electrically conducting wire, screen, or tubing placed in front of doors or windows or both, which is used as a part of a capacitance sensor. 5. A lattice of wooden dowels or slats concealing fine wires in a closed circuit that initiates an alarm signal when forcing or cutting the lattice breaks the wires. Used over accessible openings. Sometimes called a protective screen. 6. A screen or metal plate, connected to earth ground, sometimes used to provide a stable ground reference for objects protected by a capacitance sensor. If placed against the walls near the protected object, it prevents the sensor sensitivity from extending through the walls into areas of activity. 7. Network of uniformly spaced points on an input device used for locating position.

**grid battery**—Sometimes called a C battery. A source of energy for supplying a bias voltage to the grid of a vacuum tube.

**grid bearing**—A bearing made with the reference line to grid north.

**grid bias**—Also called C-bias. A constant potential applied between the grid and cathode of a vacuum tube to establish an operating point.

**grid-bias cell**—A small cell used in a vacuum-tube circuit to make the grid more negative than the cathode. It provides a voltage, but cannot supply an appreciable amount of current.

**grid blocking**—1. Blocking of capacitance-coupled stages in an amplifier because of an accumulated charge on the coupling capacitor as the result of current flow during the reception of large signals. 2. A method of keying a circuit by application of a negative grid voltage several times during key-up conditions; when the key is down, the blocking bias is removed, and normal current through the keyed circuit is restored.

**grid cap**—At the top of some vacuum tubes, the terminal that connects to the control grid.

**grid capacitor**—A capacitor in parallel with the grid resistor or in series with the grid lead of a tube.

**grid-cathode capacitance**—Capacitance between the grid and the cathode in a vacuum tube.

**grid characteristic**—The curve obtained by plotting grid-voltage values of a vacuum tube as abscissas against grid-current values as ordinates on a graph.

**grid circuit**—The circuit connected between the grid and cathode and forming the input circuit of a vacuum tube.

**grid-circuit tester**—A tester designed to measure the grid resistance of vacuum tubes without discriminating between the type or polarity of impedance.

**grid clip**—A spring clip used for making a connection to the top-cap terminal of some vacuum tubes.

**grid-conductance**—The in-phase component of the alternating grid current divided by the alternating grid voltage, all other electrode voltages being maintained constant.

**grid control**—Control of the anode current of an electron tube by means of changes in the voltage between the control grid and cathode of the tube.

**grid-controlled mercury-arc rectifier**—A mercury-arc rectifier employing one or more electrodes exclusively for controlling start of the discharge.

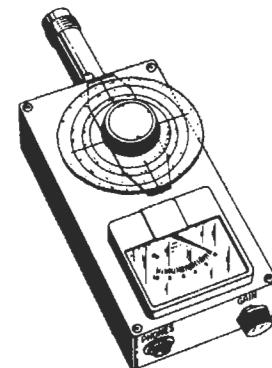
**grid-controlled rectifier**—A triode mercury-vapor rectifier tube in which the grid determines the instant at which plate current starts to flow during each cycle, but does not determine how much current will flow.

**grid-control tube**—A mercury-vapor-filled thermionic vacuum tube with an external grid control.

**grid current**—The current that flows in the grid-to-cathode circuit of a vacuum tube. It is usually a complex current made up of several currents having a variety of polarities and impedances.

**grid detection**—Detection by rectification in the grid circuit of a vacuum tube.

**grid-dip meter**—A multiple-range oscillator incorporating a meter in the grid circuit to indicate grid current. The meter is so named because its reading dips (reads a lower grid current) whenever an external resonant circuit is tuned to the oscillator frequency.



Grid-dip meter.

**grid dissipation**—The power lost as heat at the grid of a tube.

**grid-drive characteristic**—The relationship between the electrical or light output of an electron tube and the control-electrode voltage measured from cutoff.

**grid driving power**—The average product of the instantaneous value of grid current and the alternating component of grid voltage over a complete cycle.

**grid emission**—Electron or ion emission from the grid of an electron tube.

**grid-glow tube**—A glow-discharge cold cathode tube in which one or more control electrodes initiate the anode current but do not limit it except under certain conditions.

**gridistor**—A field-effect transistor that uses the principle of centripetal striction and has a multichannel structure, combining the advantages of both field-effect transistors and minority-carrier injection transistors.

**grid leak**—A high resistance connected across the grid capacitor or between the grid and cathode. It provides a direct-current path, to limit the accumulation of a charge on the grid.

**grid-leak capacitor**—A small capacitor connected in a vacuum-tube grid circuit, together with a resistor, to produce grid bias.

**grid-leak detector**—A triode or multielectrode tube in which rectification occurs because of electron current through a high resistance in the grid circuit. The voltage associated with this flow appears in amplified form in the plate circuit.

**grid limiting**—The use of grid-current bias derived from the signal, through a large series grid resistor, in order to cut off the plate current and consequently level the output wave for all input signals above a critical value.

**grid locking**—Faulty tube operation in which excessive grid emission causes the grid potential to become continuously positive.

**grid modulation**—Modulation produced by application of the modulating voltage to the control grid of any tube in which the carrier is present. Modulation in which the grid voltage contains externally generated pulses is called grid-pulse modulation.

**grid neutralization**—A method of neutralizing an amplifier. A portion of the grid-to-cathode alternating-current voltage is shifted 180° and applied to the plate-to-cathode circuit through a neutralizing capacitor.

**grid north**—An arbitrary reference direction used with the grid system of navigation.

**grid-plate capacitance**—The direct capacitance between the grid and plate of a vacuum tube.

**grid-plate transconductance**—Mutual conductance, which is the ratio of a plate-current change to the grid-voltage change that produces it.

**grid-pool tank**—A grid-pool tube having a heavy metal envelope somewhat resembling a tank in appearance.

**grid-pool tube**—A gas-discharge tube having a mercury-pool cathode, one or more anodes, and a control electrode or grid to control the start of current. *See also* exciton; ignitron.

**grid-pulse modulation**—Modulation produced in an amplifier or oscillator by application of one or more pulses to a grid circuit.

**grid pulsing**—Method of controlling the operation of a radio-frequency oscillator. The oscillator-tube grid is biased so negatively that oscillation occurs, even at full plate voltage, except when this negative bias is removed by application of a positive voltage pulse to the grid.

**grid resistor**—A general term that denotes any resistor in the grid circuit.

**grid return**—An external conducting path for the return of grid current to the cathode.

**grid suppressor**—A resistor, sometimes connected between the control grid and the external circuit of an amplifier, to prevent parasitic oscillations caused by stray-capacitance feedback.

**grid swing**—The total variation in grid-to-cathode voltage from the positive peak to the negative peak of the applied-signal voltage.

**grid-to-cathode capacitance**—The direct capacitance between the grid and cathode of a vacuum tube.

**grid-to-plate capacitance**—Designated  $C_{gp}$ . The direct capacitance between the grid and plate in a vacuum tube.

**grid-to-plate transconductance**—The mutual conductance, or ratio of plate-current to grid-voltage changes, in a vacuum tube.

**grid voltage**—The voltage between the grid and cathode of a tube.

**grid-voltage supply**—The means for supplying, to the grid of an electron tube, a potential that is usually negative with respect to the cathode.

**grille cloth**—A loosely woven fabric that is virtually transparent to sound, often stretched across the opening

in a speaker enclosure that seats the radiating side of the speaker.

**grommet**—An eyelet of rubber or neoprene placed in a hole in sheet metal, such as a terminal entrance, to insulate and protect wires that pass through.

**groove**—In mechanical recording, the track inscribed in the record by a cutting or embossing stylus, including undulations or modulations caused by vibration of the stylus. In stereo discs its cross section is a right-angled triangle, with each side at a 45° angle to the surface of the record; information is cut on both sides of the groove. In a long-playing record, groove dimensions could be: width 2.5 mils (63.5 µm); depth 1 mil (25.4 µm), and pitch 250–350 groove revolutions per inch (98–138 groove revolutions per centimeter).

**groove angle**—In disc recording, the angle between the two walls of an unmodulated groove in a radial plane perpendicular to the surface of the recording medium.

**groove shape**—In disc recording, the contour of the groove in a radial plane perpendicular to the surface of the recording medium.

**groove speed**—In disc recording, the linear speed of the groove with respect to the stylus.

**groove velocity**—The speed with which the record groove moves under the cartridge. An LP record rotates at a constant 33 1/3 rpm with grooves cut at diameters that decrease gradually from 11 1/2 to 4 3/4 inches (29.2 to 12.1 cm). Groove velocity therefore ranges from 20 in/s (50.8 cm/s) at the outside of the record to 8.3 in/s (21.1 cm/s) in the innermost groove.

**gross information content**—A measure of the total information, including redundant portions, contained in a message. It is expressed as the number of bits or hartleys necessary to transmit the message with specified accuracy by way of a noiseless medium without coding.

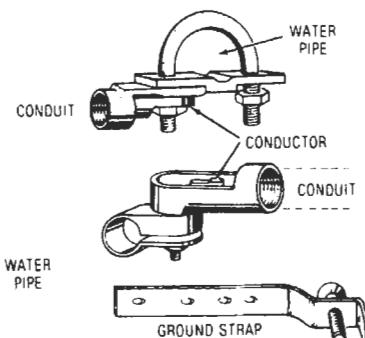
**ground**—1. A connection to the earth for conducting electrical current to and from the earth. 2. The voltage reference point in a circuit. There may or may not be an actual connection to earth, but it is understood that a point in the circuit said to be at ground potential could be connected to earth without disturbing the operation of the circuit in any way. 3. A point in an electrical system that has zero voltage. Usually, the chassis of an electrical component is at ground potential and thus serves as the return path for signals as well as for power circuits. The shield in coaxial signal cable is, or should be, at ground potential to avoid hum pickup. Ground also designates the earth, literally, which is used as a return path for radio waves from an antenna. In British terminology *earth* is used to designate all ground connections. 4. A conducting connection through which a circuit or electrical equipment is connected to the earth or to a conducting body that is at earth potential. A ground may be accidental or intentional. 5. To connect to a ground. 6. Connection (intentional or accidental) between an electrical circuit and the earth or its electrical equivalent.

**ground absorption**—The loss of energy during transmission because of the radio waves dissipated to ground.

**ground bus**—A conductor, usually large-diameter wire, that connects a number of points to one or more ground electrodes.

**ground check**—Also known as base-line check. 1. A procedure followed prior to the release of a radiosonde in order to obtain the temperature and humidity correction for the radiosonde system. 2. Any instrumental check prior to the ground launch of an airborne experiment.

**ground clamp**—A clamp used for connecting a grounding conductor (ground wire) to a grounded object such as a water pipe.



Ground clamps.

**ground clutter**—The pattern produced on the screen of a radar indicator by undesired ground return.

**ground conductor**—A conductor in a transmission cable or line that is grounded.

**ground conduit**—A conduit used solely to contain one or more grounding conductors.

**ground control**—To guide or direct an aircraft or missile by control exercises from the ground.

**ground-controlled approach**—Abbreviated GCA. 1. The radar system developed to give direction, distance, and elevation along a fixed approach path to an airport. The ground controller at the radarscope communicates instructions to the pilot to direct the aircraft along the approach line. 2. Technique or procedure for "talking down," through the use of both surveillance and precision approach radar, an aircraft during its approach so as to place it in a position for landing.

**ground-controlled interception**—Abbreviated GCI. A radar system used for directing an aircraft to intercept enemy aircraft.

**ground controller**—Aircraft controller stationed on the ground. Generic term applied to the controller in ground-controlled approach, ground-controlled interception, etc.

**ground current**—Current in the earth or grounding connection.

**ground detector**—1. An instrument or equipment that indicates the presence of a ground on a normally ungrounded system. 2. Device that indicates ground faults in electrical circuits.

**ground distance**—The great-circle component of distance from one point to another at mean sea level.

**grounded**—1. Connected to the earth, to a rod or pipe that makes a good electrical connection with the earth, or to some conduction body in place of the earth. 2. A system, circuit, or apparatus that is provided with a ground.

**grounded-base amplifier**—See common-base amplifier.

**grounded cable bond**—A cable bond used for grounding the armor and/or sheaths of cables.

**grounded capacitance**—In a system having several conductors, the capacitance between a given conductor and the other conductors when they are connected together and to ground.

**grounded-cathode amplifier**—The conventional amplifier circuit. It consists of a tube amplifier in which

the cathode is at ground potential at the operating frequency. The input is applied between the control grid and ground, and the output load is between the plate and ground.

**grounded circuit**—1. A circuit in which one conductor or point (usually the neutral conductor or neutral point of transformer or generator windings) is intentionally grounded (earthed) either solidly or through a grounding device. 2. A circuit that is connected to earth at one or more points.

**grounded-collector amplifier**—See common-collector amplifier.

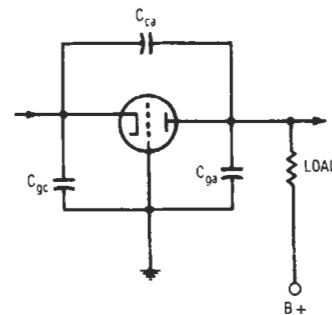
**grounded conductor**—A conductor that is intentionally grounded, either directly or through a current-limiting device.

**grounded dielectric constant**—The dielectric constant of the earth at a given location.

**grounded-emitter amplifier**—See common-emitter amplifier.

**grounded-gate amplifier**—A FET amplifier circuit in which the gate electrode is connected to ground. The input signal is applied to the source electrode, and the output is taken from the drain electrode.

**grounded-grid amplifier**—An electron-tube amplifier circuit in which the control grid is at ground potential at the operating frequency. The input is applied between the cathode and ground, and the output load is between the plate and ground. The grid-to-plate impedance of the tube is in parallel with the load, instead of acting as a feedback path.



Grounded-grid amplifier.

**grounded-grid triode**—A type of triode designed for use in a grounded-grid circuit.

**grounded-grid triode circuit**—A circuit in which the input signal is applied to the cathode and the output is taken from the plate. The grid is at rf ground and serves as a screen between the input and output circuits.

**grounded-grid triode mixer**—A triode in which the grid forms part of a grounded electrostatic screen between the anode and cathode. It is used as a mixer for centimeter wavelengths.

**grounded neutral**—The neutral wire in an electrical power system metallically connected to ground.

**grounded outlet**—An outlet equipped with a receptacle of the polarity type having, in addition to the current-carrying contacts, one ground contact, which can be used for the connection of an equipment-grounding conductor.

**grounded parts**—Parts of a completed installation that are so connected that they are substantially at the same potential as the earth.

**grounded-plate amplifier**—Also called cathode follower. An electron-tube amplifier circuit in which the

plate is at ground potential at the operating frequency. The input is applied between the control grid and ground, and the output load is between the cathode and ground.

**grounded system**—A system of electrical conductors in which at least one conductor or point (usually the middle wire or neutral point of transformer or generator windings) is intentionally grounded, either solidly or through a current-limiting device.

**ground environment**—1. The environment surrounding and affecting a system or item of equipment that operates on the ground. 2. A system or part of a system that functions on the ground. 3. The aggregate of all ground-installed equipment that makes up a communications-electronics system, facility, station, set, etc. 4. The portion of an air-defense system that provides for the detection, surveillance, and control of airborne objects. It includes ground-based facilities and overwater facilities, such as picket vessels and airborne early warning and control aircraft.

**ground-equalizer inductors**—Relatively low-inductance coils inserted in the circuit to one or more of the grounding points of an antenna to obtain a desired distribution of the current to the various points.

**ground fault**—1. An unintentional electrical path between a part operating normally at some potential to ground and ground. 2. A current leak from the hot side of the line through a path that bypasses the load to ground. This current leak causes an imbalance between the hot and neutral wires to the load.

**ground fault current**—A fault current that flows to ground rather than between conductors.

**ground-fault Interrupter**—A device that senses the imbalance caused by a ground fault with a differential-current transformer. Two primary windings, each in series with one side of the line, are wound on the transformer core. Equal currents in both lines cancel each other to produce no transformer signal in a third sensor winding. However, current imbalance generates a sensor output, which is amplified to trip a circuit-opening device. *See also* current limiter.

**ground-gate amplifier**—A FET amplifier circuit in which the gate electrode is connected to the ground. The input signal is applied to the source electrode, and the output is taken from the drain electrode.

**ground gating**—The conversion of pulse-amplitude modulated signals at a telemetry ground station to 50-percent duty-cycle signals.

**ground grid**—A system of grounding electrodes interconnected by bare cables buried in the earth to provide lower resistance than a single grounding electrode.

**ground indication**—An indication of the presence of a ground on one or more of the normally ungrounded conductors of a system.

**grounding**—1. Connecting to ground, or to a conductor that is grounded. 2. A means of referencing electrical circuits to the well-bonded equipotential surface. 3. A connection between the electrical system and the earth to prevent shock. Ground wires are usually bare; grounding connections are normally green in color. A safety measure to avoid electric shock.

**grounding conductor**—A conductor that, under normal conditions, carries no current but serves to connect exposed metal surfaces to earth ground, to prevent hazards in case of breakdown between current-carrying parts and the exposed surfaces. The connector, if insulated, is colored green with or without a yellow stripe.

**grounding connection**—A connection used to establish a ground, consisting of a grounding conductor, a grounding electrode, and the earth surrounding the electrode.

**grounding electrode**—A conductor or network of conductors, usually embedded in the earth, used for maintaining ground potential on conductors connected to it or for dissipating into the earth any current conducted to it.

**grounding outlet**—An alternating-current receptacle that has a third contact connected to ground. Used with three-wire plugs and cords to ground portable electric tools and appliances safely.

**grounding plate**—An electrically grounded metal plate on which a person stands in order to discharge any static electricity that may be picked up by his or her body.

**grounding switch**—A form of air switch for connecting a circuit or apparatus to ground.

**grounding transformer**—A transformer intended primarily for the purpose of providing a neutral point for grounding purposes.

**ground insulation**—The major insulation used between a winding and structural parts at ground potential.

**ground junction**—In a semiconductor, a junction formed during the growth of a crystal from a melt.

**ground level**—*See* ground state.

**ground loop**—1. An unwanted feedback condition in which power current in a single ground wire causes instability or errors. 2. A potentially detrimental condition produced when two or more points in an electrical system that are nominally at ground potential are connected by a conducting path. The term usually is applied when, because of improper design or by accident, unwanted noise signals are generated in the common return of relatively low-level signal circuits by the return currents or by magnetic fields produced by relatively high-power circuits or components. 3. The electrical path between two separate grounds. 4. A condition occurring when two or more paths to ground exist and a voltage is induced unequally in these paths, causing interference like hum, buzz, or noise. 5. A term used to describe situations occurring in ground systems in which a difference in potential exists between two ground points due to the resistance of ground conductors.

**ground-loop disturbances**—Detrimental interference formed when two or more points in an electrical system that are nominally at ground are connected by a conducting path such that either or both are not at the same ground potential.

**ground lug**—A lug for connecting a grounding conductor to a grounding electrode.

**ground mat**—A system of bare conductors, on or below the surface of the earth, connected to a ground or ground grid to provide protection from dangerous touch voltage.

**ground noise**—In recording and reproducing, the residual noise in the absence of a signal. It is usually caused by dissimilarities between the recording and reproducing media, but may also include amplifier noise such as from a tube or noise generated in resistive elements at the input of the reproducer amplifier system.

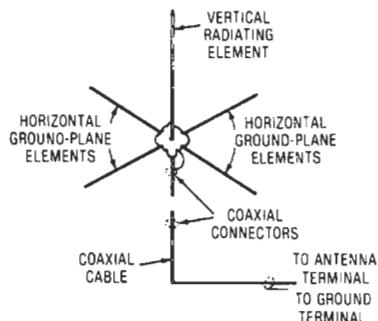
**ground-noise margin**—The voltage that may be applied at the ground connection of a logic circuit without causing the circuit to malfunction. It is usually measured by increasing the static ground voltage on a single gate until the logic fails to operate properly.

**ground outlet**—An electrical outlet equipped with a polarized receptacle that has, in addition to the current-carrying contacts, a grounded contact to which can be connected an equipment-grounding conductor.

**ground plane**—1. Copper or brass sheet used in interference testing to simulate missile, aircraft, or vehicle frame or skin so that actual installation and grounding conditions may be approximated. 2. A conductor layer,

or portion of a conductor layer, used as a common reference point for circuit returns, shielding, or heat sinking. 3. Expanded copper mesh that is laminated into some flat cable constructions as a shield. May be supplied with one, two, or no drain wires. A common ground electrical path for power and/or signals.

**ground-plane antenna** — A vertical antenna combined with a turnstile element to lower the angle of radiation. It has a concentric base support and a center conductor that place the antenna at ground potential, even though located several wavelengths above ground.



*Ground-plane antenna.*

**ground plate** — A plate of conductive material buried in the earth to serve as a grounding electrode.

**ground-position indicator** — Abbreviated GPI. A dead-reckoning computer, similar to an air-position indicator, with provision for taking drift into account.

**ground potential** — Zero potential with respect to ground or the earth.

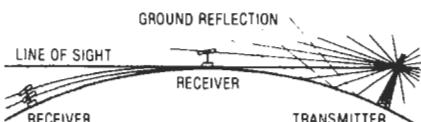
**ground power cable** — A cable assembly fitted with appropriate terminations to supply power to an aircraft from a ground power unit.

**ground protection** — Protection of a circuit by means of a device that opens the circuit when a fault to ground occurs.

**ground protective relay** — A device that functions on failure of the insulation of a machine, transformer, or other apparatus to ground, or on flashover of a dc machine to ground.

**ground range** — In range measurements related to airborne radar, the distance on the surface of the earth between the object under consideration and a point directly below the aircraft that carries the radar.

**ground-reflected wave** — 1. In a ground wave, the component reflected from the earth. 2. A radio wave reflected one or more times from the earth's surface before reaching the point of reception.



*Ground-reflected waves.*

**ground resistance** — 1. The opposition of the earth to the flow of current through it. Its value depends on

the nature and moisture content of the soil; the material, composition, and physical dimensions of the connection to earth; and the electrolytic action present. 2. The ohmic resistance between a grounding electrode and a remote or reference grounding electrode so spaced that their mutual resistance is essentially zero.

**ground return** — 1. In radar, the echoes reflected from the earth's surface and fixed objects on it. 2. A lead from an electronic circuit, antenna, or power line to ground.

**ground-return circuit** — A circuit that has a conductor (or two or more in parallel) between two points and which is completed through ground or the earth. A circuit using the earth as one side of the complete circuit.

**ground rod** — 1. A steel or copper rod driven into the earth to make an electrical contact with it. 2. A long metal rod that is driven into the ground near an antenna installation and to which are attached the grounding wires from the mast and antenna discharge unit to discharge static electricity to ground before it can enter and damage the TV receiver.

**ground-scatter propagation** — Multihop ionospheric propagation of radio waves along other than the great-circle path between the transmitting and receiving points. Radiation from the transmitter is returned from the ionosphere to the surface of the earth, from which it is then scattered in many directions.

**ground shift** — The variation in signal amplitude at different grounding points because of a voltage drop along a ground line.

**ground speed** — In navigation, the speed of a vehicle with reference to ground.

**ground state** — Also called ground level. The lowest energy level or state of an atom or atomic system; all other states of the system are called excited states.

**ground support cable** — Cable construction, usually rugged and heavy, for use in ground support control or power systems.

**ground-support equipment** — All ground equipment that is part of a complete weapons system and that must be furnished to ensure complete support of the weapons system.

**ground system of an antenna** — The portion of an antenna system that includes an extensive conducting surface, which may be the earth itself, and those parts of the antenna closely associated with that surface.

**ground-to-air communication** — One-way communication from ground stations to aircraft.

**ground wave** — 1. A radio wave that travels along the earth's surface rather than through the upper atmosphere. 2. That portion of a radio wave traveling between transmitting and receiving antennas that is associated with currents induced in the ground or water surface of the earth. Important only below about 10 MHz.

**ground wire** — 1. A conductor leading to an electric connection with the earth. 2. A heavy copper conductor, usually insulated, that is used to connect protectors or other equipment to a ground rod or cold water pipe.

**group** — 1. In carrier telephony, a number of voice channels multiplexed together and treated as a unit. Commonly, a group contains 12 channels, each with a bandwidth of 4 kHz, frequency multiplexed and occupying the band from 60 to 180 kHz. 2. The second-highest stratum of an organizational hierarchy, usually identifying departments, divisions, or regions.

**group busy tone** — A high tone fed to the jack sleeves of an outgoing trunk group to serve as an indication that all trunks in the group are busy.

**group channel** — A unit or method of organization on telephone carrier (multiplex) systems. A full group is a channel equivalent to 12 voice-grade channels (48 kHz).

A half group has the equivalent bandwidth of 6 voice-grade channels (24 kHz). (When not subdivided into voice facilities, group channels can furnish high-speed data communication.)

**group delay**—Also called envelope delay. 1. The delay in transmission of information modulated on a carrier. 2. Distortion resulting from nonuniform speed of transmission of the various frequency components of a signal through a transmission medium; specifically, the propagation delay of a lower frequency is different from that of a higher frequency. This creates a time-related delay-distortion error.

**grouped-frequency operation**—A method in which different frequency bands are used for channels in opposite directions in a two-wire carrier system.

**group frequency**—The number of sets or groups of waves passing a given point in one second.

**grouping**—1. Nonuniform spacing between the grooves of a disc recording. 2. Periodic error in the spacing between recorded lines in a facsimile system.

**grouping circuits**—Circuits used to interconnect two or more positions of a switchboard so that one operator may handle the several positions from one operator's set.

**group loop**—A source of interference when a system is grounded improperly at several points.

**group mark**—A mark used to identify the beginning or the end of a set of data, which could include words, blocks, or other items.

**group modulation**—The process by which a number of channels, already separately modulated to a specific frequency range, are again modulated to shift the group to another range.

**Group I fax**—An analog facsimile device that transmits or receives a standard page in four to six minutes. Group I machines are no longer being manufactured and are rarely in use today.

**group technology**—Facilitation of processing through combination of similar parts into production families.

**Group III fax**—The standard for current facsimile devices. Most current facsimile systems are digital devices offering operating speeds of one minute or less. When equipped with automatic speed recognition, these systems can be compatible with Group I and II units, although a number of the lower-cost models are strictly Group III compatible. Machines that can recognize speed automatically can select the fastest speed available when sending to or receiving from Group I or Group II devices.

**Group II fax**—An analog device that transmits or receives a page in two or three minutes. These systems offer some data-compression techniques for faster transmission and can be compatible with Group I devices. Like the Group I units, Group II models are not actively marketed today.

**group velocity**—1. Of a traveling plane wave, the velocity of propagation of the envelope delay is approximately constant. It is equal to the reciprocal of the envelope delay per unit length. (Group velocity differs from phase velocity in a medium in which the phase velocity varies with the frequency.) 2. The velocity of the envelope of an electromagnetic wave as it travels in a medium, usually identified with the velocity of energy propagation.

**groupware**—Software that is designed to be used by a group of people working on the same information, whether in the same room, building, or across town or the globe.

**Grove cell**—A primary cell with a platinum electrode submerged in an electrolyte of nitric acid within a porous cup, surrounded by a zinc electrode in an electrolyte of

sulfuric acid. This cell normally operates on a closed circuit.

**growler**—1. An electromagnetic device consisting essentially of two field poles arranged as in a motor, energized with ac and used for locating short-circuited coils in a generator or motor armature. A growling noise indicates a short-circuited coil. 2. An electromagnetic device for magnetizing or demagnetizing objects.

**grown-diffused transistor**—A transistor made by combining the diffusion and double-doped techniques. Suitable n- and p-type impurities are added simultaneously to the melt while the crystal is being grown. Subsequently, the base region is formed by diffusion as the crystal grows.

**grown junction**—The boundary between p- and n-type semiconducting materials. It is produced by varying the impurities during the growth of a crystal from the melt. Such junctions have strong rectifying properties, the forward current being obtained when p is positive to n.

**grown-junction photodiode**—A photodiode made of a small bar of semiconductor material that has a pn junction at right angles to its length and an ohmic contact at each end of the bar.

**grown-junction transistor**—A transistor in which junctions are formed by adding impurities to the melt while the crystal is being grown.

**grown-junction wafer**—A semiconductor wafer on which pn junctions are formed during manufacture.

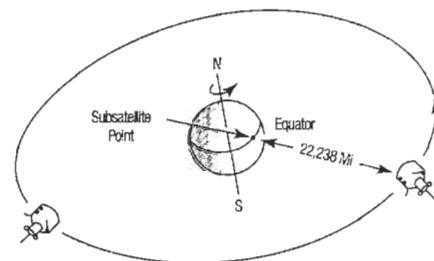
**grown semiconductor junction**—A junction formed during the growth of a crystal from a melt.

**G-scan**—See G-display.

**G-scope**—See G-display.

**GSI**—Abbreviation for grand-scale integration. Monolithic integrated circuits with a typical complexity in excess of 1000 or more gates or gate equivalent circuits.

**GSO**—Abbreviation for geostationary satellite orbit. A circular orbit 35,863 km above the earth, in the plane of the earth's equator, in which a satellite revolves around the earth in the same time that the earth rotates on its axis; thus, the satellite appears approximately stationary over one point on the earth.



Geostationary satellites.

**GTAW**—Abbreviation for gas tungsten arc welding. See also TIG.

**GTO SCR**—Abbreviation for gate turn-off SCR. A silicon-controlled rectifier whose output-current switching can be turned off by a voltage at the gate.

**guard**—A mechanism to terminate program execution (real or simulated) upon access to data at a specified memory location. Used in debugging.

**guard arm**—1. A crossarm placed across and in line with cable to protect it from damage. 2. A crossarm placed over wires to prevent other wires from falling into them.

**guard band**—1. Also called interference guard band. A frequency band left vacant between two channels to safeguard against mutual interference. 2. The unused chip surface area that, by virtue of physical spacing, serves to isolate functional elements in a printed circuit or an integrated circuit. Also refers to the consideration given instrumentation precision in electrical testing. 3. The unused bandwidth separating channels to prevent crosstalk.

**guard channel**—1. Unused portions of the frequency spectrum that are located between program channels to prevent adjacent channel interference. *See also* guard band. 2. One or more auxiliary parallel processing channels to control the main processing channel in order to reject interference that is partly in, but not centered on, the main channel. Guard channels may be displaced in time (range), Doppler frequency, carrier frequency, or angle.

**guard circle**—An inner concentric groove on disc records. It prevents the pickup from being thrown to the center of the record and possibly damaged.

**guarded input**—An input that has a third terminal that is maintained at a potential near the input-terminal potential for a single-ended input, or near the mean input potential for the differential input. It is used to shield the entire input circuit.

**guarded motor**—An open motor in which all openings given direct access to live or rotating parts (except smooth shafts) are limited in size by the structural parts or by screens, grilles, expanded metal, etc., to prevent accidental contact with such parts. Such openings shall not permit the passage of a cylindrical rod  $\frac{1}{2}$  inch (12.7 mm) in diameter.

**guard frequency**—The frequencies between subchannels in frequency-division multiplexed systems used to guard against subchannel interference.

**guarding**—1. The introduction of conducting surfaces at critical points in a circuit to intercept and divert leakage currents that otherwise would cause undesired effects or measurement errors. 2. A method of protecting the inputs to a high-gain op amp by surrounding the input terminals with a conducting ring of printed circuit board conductors. This isolates the inputs from potential leakage currents from other parts of the circuit. 3. The use of special circuitry, insulated from ground, to provide freedom from adverse effects of leakage currents. The stray current is bypassed through a noncritical path so that it does not affect the accuracy of measurement. Guarding is especially important when measuring low voltages and when measuring high-value resistances, particularly when high humidity causes a reduction in normally high insulation resistance.

**guard relay**—A relay used in the linefinder circuit to prevent more than one linefinder from being connected to any line circuit when two or more line relays are operated simultaneously.

**guard ring**—1. A metal ring placed around a charged terminal or object to distribute the charge uniformly over the surface of the object. 2. A ring-shaped electrode intended to limit the extent of an electric field, as, for instance, in elimination of the fringe effect at the edges of the plates of a capacitor.

**guard-ring capacitor**—A capacitor with parallel electrodes, one of which is surrounded by a ring held at the potential of that electrode in order to reduce the edge effect.

**guard shield**—An internal floating shield surrounding the input section of an amplifier. Effective shielding results only when the absolute potential of the guard is stabilized relative to the incoming signal.

**guard-well capacitor**—A primary standard capacitor, fixed or variable, for values of capacitance below 1 picofarad. The guard ring forms a well in which a Pyrex disk is mounted for the accurate location of the electrode assembly.

**guard wire**—A grounded wire used frequently where high-tension lines cross a thoroughfare. Should a line break, it will contact the guard wire and be grounded.

**Gudden-Pohl effect**—The momentary illumination produced when an electric field is applied to a phosphor previously excited by ultraviolet radiation.

**guidance**—Control of a missile or vehicle from within by a person, a preset or self-reacting automatic device, or a device that reacts to outside signals.

**guidance system**—A system that measures and evaluates flight information, correlates it with target data, converts the resultant into the parameters necessary to achieve the desired flight path, and communicates the appropriate commands to the flight-control system.

**guidance tapes**—Magnetic or paper tapes that are placed in a missile or computer and that contain previously entered information necessary for directing the missile to the selected target.

**guide**—In a tape recorder, a grooved or flanged pin or roller that guides the tape in a straight line between the reels and the heads, to keep it perfectly in line with the pole pieces.

**guided ballistic missile**—A ballistic missile that is guided during the powered portion of the trajectory and follows a free ballistic path during the remainder.

**guided clip**—*See* guided probe.

**guided missile**—An unmanned vehicle moving above the surface of the earth, the trajectory or flight path of which is capable of being altered by an external or internal mechanism.

**guided probe**—1. A fault-isolation technique in which the test system automatically displays the next mode or IC that the operator should probe or clip. The system leads the operator along a path back from a faulty output pin to the location of the fault. A software algorithm uses stored interconnection information and expected responses at each node to determine the next node to be probed. 2. A hand-held probing device (single-point or multipin clip) guided by an operator with instructions from a computer-controlled algorithm.

**guided propagation**—A type of radiowave propagation in which radiated rays are bent excessively by refraction in the lower layers of the atmosphere. This bending creates an effect much as if a duct or a waveguide had been formed in the atmosphere to guide part of the radiated energy over distances far beyond normal range.

**guided spark**—An electrical discharge between two electrodes that has its path guided or constrained by the presence of a dielectric material or a gas jet.

**guided wave**—A wave in which the energy is concentrated near a boundary (or between substantially parallel boundaries) separating materials of different properties. The direction of propagation is parallel to the boundary.

**guide pin**—A pin or rod that extends beyond the mating faces of a connector in such a way that it guides the closing or mating of the connector and ensures proper engagement of the contacts.

**guide wavelength**—*See* waveguide wavelength.

**Guillemin line**—A special type of artificial transmission line or pulse-forming network used in radar sets to control the duration of the pulses. It generates a nearly square pulse for use in high-level pulse modulation.

**guillotine capacitor**—A translatory motion tuning capacitor consisting of a pair of stators and a sliding plunger in place of a rotor.

**gullwing**—A common lead form used to interconnect surface-mounted packages to a printed circuit board.

**gun-directing radar**—Radar used for directing antiaircraft or similar artillery fire.

**Gunn diode**—1. A tiny wafer of n-type gallium arsenide consisting of a thin active layer of n-type gallium arsenide grown on a low-resistivity substrate of the same material. The substrate is bonded to the anode terminal of the encapsulation, and the other face of the wafer has an evaporated cathode contact connected by a bonded gold wire. The diode has no pn junction and cannot be used for rectification. When a few volts dc are applied to make the anode positive with respect to the cathode, the current that flows is dc with superimposed pulses. 2. A microwave diode that exhibits negative resistance arising from the bulk negative differential conductivity that occurs in several compound semiconductors, such as gallium arsenide, and that operates at a frequency determined by the transit time of charge bunches that are formed due to this negative differential conductivity.

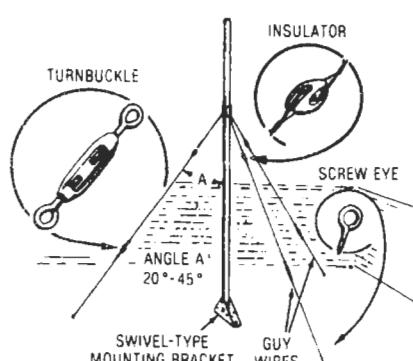
**Gunn effect**—Current oscillations that occur at an rf rate when an electric field of about 3000 V/cm is applied to a short (127  $\mu\text{m}$  or 0.005 in or less) specimen of n-type gallium arsenide. This effect takes place because electrons under the influence of sufficiently high fields are transferred from high- to low-mobility valleys in the conduction band of GaAs.

**Gunn oscillator**—An oscillator in which the active element is a Gunn diode operating in the negative resistance mode. This type of oscillator is one of the simplest means of generating microwave signals because only a microwave-tuned circuit, Gunn diode, bias network, and low-voltage power supply are required. Presently available units are restricted to operation above 4 GHz, and have dc to rf conversion efficiencies of less than 10 percent.

**gutta-percha**—A natural vegetable gum, similar to rubber, used principally as insulation for wire and cables.

**guy ring**—A circular metal collar with attachment holes (eyes) that is slipped on and clamped to an antenna mast. Guy wires are then attached to the mast through the holes in the guy ring.

**guy wire**—A wire used to brace the mast or tower of a transmitting or receiving antenna system.

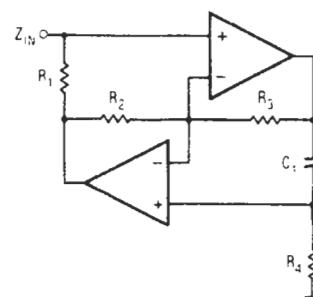


*Guy wire.*

**gyrator**—1. A two-port circuit element that exhibits a 180° differential, or nonreciprocal, phase shift. The

## guillotine capacitor — gyroscopic action

gyrator circuit symbol indicates that an rf signal transmitted from port 1 to port 2 will undergo a 180° phase shift relative to an rf signal transmitted in the reverse direction. 2. A negative-impedance device that can change the sign of a reactance, thus allowing a capacitor to act as an inductor. Usually consists of a ferrite section in a waveguide. Through the use of such a device, some of the shortcomings of inductors can be eliminated. These shortcomings are large physical size, low  $Q$ , nonlinearity, and interwinding capacitance. A properly designed gyrator will provide a synthetic inductor with  $Q$ , wide bandwidth, inductance value independent of frequency, and good stability. Filters for frequencies up to 50 kHz can be designed using gyrators. 3. A device providing 180° phase shift in one direction relative to the other direction of signal passage.



*Circuit.*



*Symbol.*

*Gyrator.*

**gyro**—Abbreviation for gyroscope.

**gyrocompass**—See gyroscope.

**gyrofrequency**—The natural frequency at which charged particles rotate around the lines of force of the earth's magnetic field. For electrons, it is 700 to 1600 kilohertz; for ions, it is in the audio-frequency range.

**gyromagnetic**—The magnetic properties of rotating electric charges, such as electrons spinning within atoms.

**gyromagnetic effect**—The change in the angular momentum of a body as a result of being magnetized, arising as a result of the fact that the magnetic moments of its electrons are associated with their spins or orbital angular momentum.

**gyropilot**—See autopilot.

**gyroscope**—Abbreviated gyro. A rotating device whose axle will maintain a constant direction, even though the earth is turning under it. It consists of a wheel mounted so that its spinning axis is free to rotate around either of two other axes perpendicular to itself and each other. When its axle is pointed north, it can be used as a gyrocompass.

**gyroscopic action**—An action that causes a mass to turn on an axis perpendicular to the applied torque and to the axis of spin.

**gyrostabilized platform**—*See* stable platform.

**gyrotron**—A microwave vacuum tube based on the interaction between an electron beam and microwave fields in which coupling is achieved by the cyclotron resonance condition. This type of coupling allows the beam and microwave circuit dimensions to be large compared with a wavelength. Thus, the power density problems encountered

in conventional traveling-wave tubes and klystrons at millimeter wavelengths are avoided in the gyrotron.

**G-Y signal**—In color television, the green-minus-luminance signal, representing primary green minus the luminance, or Y, signal. It is combined with a luminance, or Y, signal outside or inside the picture tube to yield a primary green signal.

# H

**H**—1. A radar air-navigation system using an airborne interrogator to measure the distance from two ground responder beacons. *See also* shoran. 2. Symbol for heater, magnetic field strength, or henry.

**hacker**—1. A person with computer expertise intrinsically interested in the exploration of computer systems and their capabilities. 2. A person who accesses computer systems without authorization. 3. One who deliberately tries to penetrate the security of other computers. 4. A skilled computer enthusiast who is obsessed with learning about programming and exploring the capabilities of computer systems. 5. A person who gains unauthorized access to a computer system.

**hacking**—Using a microcomputer system or terminal to bypass the security of a large computer system.

**hairpin pickup coil**—A hairpin-shaped, single-turn coil for transferring UHF energy.

**hairpin tuning bar**—A sliding hairpin-shaped metal bar inserted between the two halves of a doublet antenna to vary its electrical length.

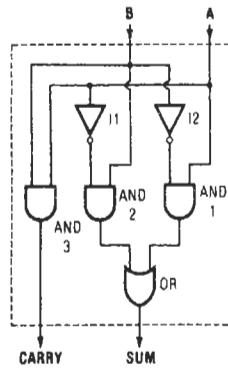
**halation**—1. Distortion seen as blurred images and caused by reflection of the image rays off the back of a fluorescent screen that is too thick. 2. The spreading of light in a photographic emulsion outside the intended area of exposure by reflection from the rear surface of the material supporting the emulsion; this is distinguished from the diffusion that takes place within the emulsion layer. 3. A glow or diffusion that surrounds a bright spot on a television picture tube screen. A defect in picture tube quality is indicated. 4. In a cathode-ray tube, the glow surrounding a bright spot that appears on the fluorescent screen as the result of the screen's light being reflected back by the front and rear surfaces of the tube's face.

**half-add**—In a computer, an operation that is performed first in carrying out a two-step binary addition. It consists of addition of corresponding bits in two binary numbers, with any carry information being ignored. *See also* exclusive OR.

**half adder**—1. A circuit that will accept two binary input signals and produce corresponding sum and carry outputs. So called because, above the first order, two half adders per order are required when adding two quantities. 2. Building-block circuit used in digital computers. A combination of logic gates adds two bits and delivers an answer—two bits called sum and carry. Half adders can be combined to add numbers of any length. Two half adders make up a full adder. 3. A logic element that adds two input bits, but does not have provision for adding the carry from a previous addition. *See also* full adder.

**half cell**—An electrode, submerged in an electrolyte, for measuring single electrode potentials.

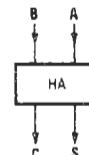
**half cycle**—The time interval required for the operating frequency to complete one-half, or 180°, of its cycle.



Circuit.

B	A	CARRY	SUM
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

Truth table.



Symbol.

**Half adder.**

**half-digit**—In digital meters provided with 100 percent overranging, an additional most-significant digit provided at the left of the readout, capable of displaying the numeral 1 when the measurement exceeds the full-scale range.

**half duplex**—1. A communication system in which information can be transmitted in either direction, but only in one direction at a time. 2. In communications, pertaining to an alternate independent transmission made in one direction at a time. 3. A mode of data transmission capable of communicating in one of two directions, but in only one direction at a time. 4. Refers to a communication channel that can receive and transmit, but not simultaneously.

**half-duplex circuit**—Abbreviated HDX. A circuit that permits one-direction electrical communications between stations. Technical arrangements may permit operation in either direction, but not simultaneously. Therefore, this term is qualified by one of the following suffixes: s/o for send only, r/o for receive only, or s/r for send or receive.

**half-duplex modem**—A modem with a single wire pair that can transmit in both directions but not simultaneously.

**half-duplex operation**—A duplex telegraph system capable of operating in either direction, but not in both simultaneously.

**half-duplex repeater**—A duplex telegraph repeater provided with interlocking arrangements that restrict the transmission of signals to one direction at a time.

**half-hertz transmission**—A data transmission and control system in which synchronized sources of 60-Hz power are used at transmitting and receiving ends. Either of two relays at the receiver can be actuated by proper choice of the half-hertz polarity of the transmitter power supply.

**half-life**—1. The time in which half the atoms in a radioactive substance decay. In the first half-life interval, the amount of radioactive material left unchanged is one-half the original amount; in the next half-life interval, half of the remaining amount, or one-fourth of the original amount, remains. Thus, by determining the remaining radioactivity of a fossil and comparing it with the half-life of the material, scientists can estimate the age of the fossil. The half-life of various materials varies greatly—from millionths of a second to billions of years. 2. Time required for a source to decay to one-half its initial millicurie value. Typical values are Cs-137, 30 years; Co-60, 5.3 years; Sr-90, 28 years; Kr-85, 10.7 years; Am-241, 457 years; and Ra, 1622 years.

**half-nut**—A feed nut that engages half the circumference or less of a lead screw, so that it can be withdrawn from the lead screw to stop the lateral scanning movement.

**half-power frequency**—Either a high frequency or a low frequency at which the output of an amplifier, network, transducer, etc., falls to one-half ( $\pm 3$  dB) of its maximum or nominal response.

**half-power point**—On an amplitude response characteristic or other curve of the magnitude of a network quantity versus frequency, distance, angle, or other variable, the point that corresponds to half the power of a neighboring point having maximum power.

**half-power width of a radiation lobe**—In a plane containing the direction of the maximum of the lobe, the full angle between the two directions in that plane in which the radiation intensity is one-half the maximum value of the lobe.

**half-shift register**—1. A logic circuit that consists of a gated input storage element with or without an inverter. 2. A logic device equivalent of half of a full master-slave flip-flop.

**half step**—See semitone.

**half tap**—A bridge that can be placed across conductors without disturbing their continuity.

**half-time emitter**—A device that produces synchronous pulses midway between the row pulses of a punched card.

**half-tone characteristic**—In facsimile, the fidelity of the recorded density shadings in comparison with the

original transmitted subject copy. Also used to express the relationship between the facsimile signal and the subject or recorded copy.

**half track**—See two track.

**half-track recorder**—See dual-track recorder.

**half-track tape**—Also called two-track tape. Quarter-inch magnetic tape on which half the width of the tape is used for one sound path. Such a tape provides stereo in one direction of tape travel, or mono sound in both directions.

**half-track tape-recording format**—A professional tape recording standard format in which independent tracks (channels) are recorded in the same direction. Two tracks on  $\frac{1}{4}$ -inch (6.35-mm) wide tape or four tracks on  $\frac{1}{2}$ -inch (12.7-mm) wide tape or eight tracks on 1-inch (25.4-mm) wide tape or 16 tracks on 2-inch (50.8-mm) wide tape are used.

**half wave**—A wave with an electrical length of half a wavelength.

**half-wave antenna**—An antenna having an electrical length equal to half the wavelength of the signal being transmitted or received.

**half-wave dipole**—A straight, ungrounded antenna measuring substantially one-half wavelength.

**half-wave rectification**—1. The production of a pulsating direct current by passing only half the input cycle of an alternating current. The other half is blocked by the rectifier. 2. The process of blocking the negative half cycle of current of an alternating input. This is accomplished by a single diode.

**half-wave rectifier**—A rectifier utilizing only one-half of each cycle to change alternating current into pulsating direct current.

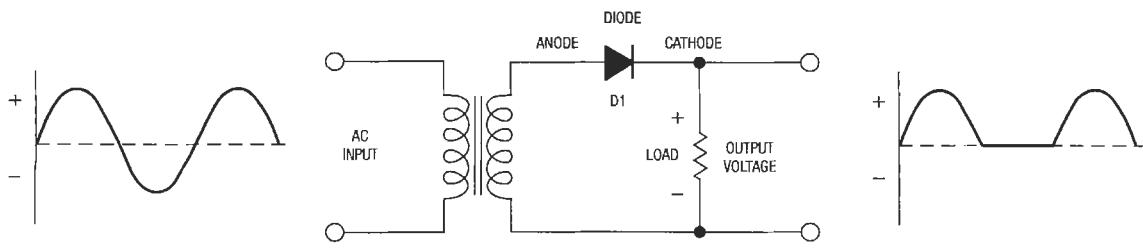
**half-wave transmission line**—A piece of transmission line having an electrical length equal to half the wavelength of the signal being transmitted or received.

**half-wave vibrator**—A vibrator used mainly in battery-operated mobile power supplies. It has only one pair of contacts, and supplies an intermittent unidirectional current at its output (usually connected to a half-wave rectifier).

**half word**—A nonbroken sequence of bits or characters that makes up half a computer word and that can be addressed as a unit.

**Hall constant**—The constant of a proportionality in the equation for a current-carrying conductor in a magnetic field. The constant is equal to the transverse electric field (Hall field) divided by the product of the current density and the magnetic field strength. The sign of the majority carrier can be inferred from the sign of the Hall constant.

**Hall effect**—1. In a current-carrying semiconductor bar located in a magnetic field that is perpendicular to the direction of the current, the production of a voltage perpendicular to both the current and the magnetic field. 2. The description given to the following phenomenon:



Half-wave rectifier.

**Hall-effect generator — handshaking**

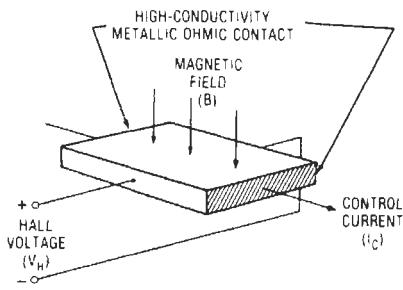
when a conductor, through which a current is flowing, is placed in a magnetic field, a potential difference is generated between the two opposed edges of the conductor in the direction mutually perpendicular to both the field and the conductor.

**Hall-effect generator**—Also called Hall sensor. 1. A magnetic sensor using the Hall effect to give an output voltage proportional to magnetic field strength. 2. A device made of compounds such as indium arsenide, indium antimonide, or silicon that produces a useful Hall-effect potential. Its output is proportional to magnetic induction through the semiconductor.

**Hall-effect modulation**—Use of a Hall-effect multiplier as a modulator to produce an output voltage proportional to the product of two input voltages or currents.

**Hall-effect switch**—A keyboard switch that incorporates an IC chip containing a Hall generator, trigger circuit, and amplifier. Depressing the key moves the magnet shunt member across the chip. This increases the magnetic flux through the chip and causes the analog voltage generated by the Hall element to switch the trigger circuit to its on state.

**Hall generator**—A thin wafer of semiconductor material used for measuring ac power and magnetic field strength. Its output voltage is proportional to the current passing through it times the magnetic field perpendicular to it.



*Hall generator.*

**Hall mobility**—The product of conductivity and the Hall constant for a conductor or semiconductor. It is a measure of the mobility of the electrons or holes in a semiconductor.

**Hall sensor**—See Hall-effect generator.

**halo**—1. The undesirable ring of light around a spot on the fluorescent screen of a cathode-ray tube. 2. The appearance of a blank border around unusually bright objects in a televised scene.

**halogen**—A general name applied to four chemical elements, fluorine, chlorine, bromine, and iodine, that have similar chemical properties.

**halogen quenching**—A method of quenching the discharge in a counter tube by the introduction of a small quantity of one of the halogens.

**halt**—The state in which a computer stops and does nothing.

**ham**—Also called amateur. Slang for a licensed radio operator who operates a station as a hobby rather than a business.

**Hamming code**—1. One of the error correction code systems used in data transmission. 2. A forward error correction technique named for its inventor. It corrects single-bit errors. 3. A seven-bit error-correcting computer code.

**hand capacitance**—The capacitance introduced when one's hand is brought near a tuning capacitor or other insufficiently shielded part of a tuned circuit.

**handheld**—An amateur radio transceiver small enough to be carried in one hand (often abbreviated HT). Typically, amateur handhelds are for VHF/UHF use.

**Handie-Talkie**—Trade name of the Motorola Communications Division for a two-way radio small enough to be carried in one's hand.

**handler**—Also called device handler. 1. A section of a computer program used to control or communicate with an external device. 2. A software routine that controls the operation of a peripheral.

**handoff**—The transfer of a cellular phone call to a new cell, designed to be transparent to the cellular phone user. During a cellular conversation, when the user reaches the edge of the service area of a cell, computers in the network assign another tower in the next cell to provide the phone with continuing service.

**hand receiver**—An earphone held to the ear by hand.

**hand reset**—A relay in which the contacts must be reset manually to their original positions after normal conditions are resumed.

**handset**—1. A telephone-type receiver and transmitter mounted on a single frame. 2. That portion of the telephone containing the transmitter and receiver that is hand-held when the telephone is in use. Consists of a receiver and transmitter about 6 inches (15.2 cm) apart at the ends of a common handle, connected by an electrical cord to the handset mounting. Sometimes includes a dial or Touchtone pad.

**handset telephone**—See hand telephone set.

**hands-free telephone**—A desk telephone containing a microphone and voice-switched amplifiers with a separate speaker unit, permitting telephone conversation without use of a hand-held handset.

**handshake**—1. An interface procedure that is based on status/data signals that assure orderly data transfer as opposed to asynchronous exchange. 2. In communications, a preliminary exchange of predetermined signals performed by modems and/or terminals to verify that communication has been established and can proceed.

**handshake cycle**—The process whereby digital signals effect the transfer of each data byte across the interface by means of an interlocked sequence of status and control signals. "Interlocked" denotes a fixed sequence of events in which one event in the sequence must occur before the next event may occur.

**handshaking**—1. A process in which predetermined arrangements of characters are exchanged by the receiving and transmitting equipment to establish synchronization. 2. The exchange of predetermined signals between machines connected by a communications channel to assure each that it is connected to the other. May also include the use of passwords and codes by an operator. 3. A colloquial term that describes the method used by a modem to establish contact with another modem at the other end of a telephone line. Often used interchangeably with buffering and interfacing, but with a fine line of difference in which handshaking implies a direct package-to-package connection regardless of functional circuitry. 4. A CPU-terminal interface process that prevents overrun and ignores signaling. The transmitter sends a signal in response to a request from the receiver, which then sends an acknowledgment signal to the transmitter. 5. The exchange of predetermined signals for control purposes during establishment of a connection between two data sets or modems. 6. Refers to the sequence of signals exchanged when a connection is established between two modems or between a DCE

and a DTE. 7. Line-termination interplay to establish a data-communication path. 8. Exchange of predetermined signals establishing contact between two data sets. *See answerback.*

**hand telephone set**—Also called a handset telephone. A telephone set having a handset and a mounting that supports the handset when not in use.

**hangover**—1. Also called tailing. The smared or blurred bass notes reproduced by a poorly damped speaker or one mounted in an improperly vented enclosure. 2. In television, overlapping and blurring, in the direction opposite to subject motion, of successive frames as a result of improper transient response. 3. In facsimile, distortion that occurs when the signal changes from maximum to minimum at a slower rate than required, with the result that there is tailing on the lines in the copy.

**hangup**—1. A condition in which the central processor of a computer is trying to perform an illegal or forbidden operation or in which it is continually repeating the same routine. 2. Commutation failure in which the load controlled by a solid-state relay cannot be turned off because the thyristor current does not reach zero or stay near zero for long enough for the gate circuit to regain control.

**hard**—1. Indicating an electron tube that has been evacuated to a high degree. 2. Indicating X-rays of relatively high penetrating power.

**hard automation**—Production technique in which equipment is engineered specifically for a unique manufacturing sequence. Hard automation implies programming with hardware in contrast to soft automation, which uses software or computer programming.

**hard contacts**—Any type of physical switch contacts. Contrasted with electronic switching devices, such as triacs and transistors.

**hard contact switch**—A keyboard switch in which switching action is accomplished by the movement of one gold-plated bar against another at right angles—the classic cross-bar switching. The knife-edge contact area is extremely small (typically about  $9 \times 10^{-6}$  square inch or  $5.8 \times 10^{-5}$  cm $^2$ ), resulting in an extremely high contact pressure (typically about 5000 psi or  $3.45 \times 10^7$  Pa).

**hard copy**—Also hardcopy. 1. Typewritten or printed characters on paper produced by a computer at the same time information is copied or converted into machine language that is not easily read by a human. 2. A printed copy of a machine output. 3. Data in a permanent and tangible form, such as printed, punched, or even handwritten. 4. The printed original copy of a message. 5. Output in printed form, such as the output of a teleprinter. Used as an adjective, signifies that the device involved produces such output. 6. Computer or machine output in a permanent, visually readable form. For example, printed reports, listings, translation lists, documents, and summaries. 7. A tangible, printed copy of a message, such as that obtained from a teletypewriter or computer, as opposed to a volatile display on a video terminal. *See also printout.*

**hard-copy printer**—An automatic device that produces intelligible symbols in a permanent form.

**hard disk**—A rigid disk of magnetic or magnetically coated material, rotating in a sealed housing and used as a recording and playback system for computer programs and data. Hard disks can store far more information than floppy disks and can write and read information more quickly.

**hard-drawn copper wire**—Copper wire that is not annealed after work hardening during drawing, thus providing increased tensile strength.

**hardened links**—1. Transmission links for which special construction or installation is necessary to assure

a high probability of survival under nuclear attack. 2. Passive protection to aid survival.

**hardener**—Also called curing agent. A chemical added to a thermosetting resin to stimulate curing.

**hard error**—1. An error in magnetic media, electromechanical devices, or electronics that is repeatable. 2. Semiconductor memory condition in which the cell or cells will not properly store data under any condition, test, or operation.

**hard firing**—A condition in which the gate signal of an SCR is several times the dc triggering current and in which the rise time of the gate current is short relative to the turn-on time.

**hard limiting**—The condition in which limiting takes place for at least 20 dB into the signal noise.

**hardline**—1. The intelligence link between two objects that consists of a wire or wires, as opposed to a radio or radar link. 2. A low-loss coaxial cable that has a continuous hard metal shield instead of a conductive braid around the outer perimeter.

**hard magnetic materials**—Magnetic materials that are not easily demagnetized.

**hardness**—1. Referring to X-rays, the quality that determines their penetrating ability. The shorter the wavelength, the harder and hence more penetrating they are. 2. Property of an installation, facility, transmission link, or equipment that will prevent an unacceptable level of damage.

**hardness tester**—Equipment for determining the force required to penetrate the surface of a solid.

**hard rubber**—A material formerly widely used for insulation. It is formed by vulcanizing rubber at high temperature and pressure to give it the desired hardness.

**hard scrambling**—An encryption method that uses proprietary, highly secure technology (i.e., digital), such as that used by VideoCipher II.

**hard-sectored**—A disk whose sectors are marked by holes in the disk itself.

**hard solder**—Solder composed principally of copper and zinc. It must be red hot before it will melt. Hard soldering is practically equivalent to brazing.

**hard soldering**—Process of joining two metals by utilizing an alloy with a melting temperature higher than 800°F (427°C). *See soft soldering.*

**hard tube**—A high-vacuum electronic tube.

**hardware**—1. Mechanical, magnetic, electrical, or electronic devices; physical equipment from which a system is fabricated. (Contrasted with software.) 2. Particular circuits or functions built into a system. 3. The physical components of a computer or a system. (Software is the term used to describe the programs and instructions for a computer.) 4. The electronic components, such as gates, inverters, and storage devices, that make up a system (as opposed to software and firmware). 5. Items of equipment used in a communications or data processing system. 6. The physical equipment components of a computer system, e.g., mechanical, magnetic, electrical, or electronic devices.

**hardware buffer**—A register or set of registers used to store information temporarily, usually to act as a transition medium between a fast and a slow device.

**hardware independent**—Computer software that is not dependent on a certain make of computer.

**hardwire**—A colloquialism meaning a circuit evidencing dc continuity.

**hardwired**—1. Electrical devices interconnected through physical wiring. 2. The implementation of a function with logic gates; i.e., hardware as opposed to software. 3. Electronic-programming technique using soldered connections; hence, not readily reprogrammable. 4. Physically

interconnected, usually for a specific purpose. Hardwired logic is essentially unalterable. 5. Pertaining to the physical connection of two pieces of electronic equipment by means of a cable or wires.

**hard-wired logic**—1. A group of solid-state logic modules mounted on one or more circuit boards and interconnected by electrical wiring. The logic control functions are determined by the way in which the modules are interconnected. (As contrasted with a programmable controller or microprocessor, in which the logic is in program form.) 2. A group of solid-state logic modules mounted on one or more circuit boards and interconnected by electrical wiring. The logic control functions are determined by the way in which the modules are interconnected. 3. A group of logic circuits permanently interconnected to perform a special function. Permanently assigned device addresses, memory block assignments, and interrupt vector addresses.

**hard X-rays**—Highly penetrating X-rays, as distinguished from less penetrating, or soft, X-rays.

**harmful interference**—Any radiation or any induction that disrupts the proper functioning of an electromagnetic system.

**harmonic**—A sinusoidal wave having a frequency that is an integral multiple of the fundamental frequency. For example, a wave with twice the frequency of the fundamental is called the second harmonic.

**harmonica bug**—See infinity device.

**harmonic analysis**—1. A method of identifying and evaluating the harmonics that make up a complex waveform of voltage, current, or some other varying quantity. 2. The expression of a given function as a series of sine and cosine terms that are approximately equal to the given function, such as a Fourier series. 3. Defining a complex wave as the sum of several harmonics of the fundamental wave, each harmonic having a specified magnitude and phase.

**harmonic analyzer**—Also called harmonic-wave analyzer. A mechanical or electronic device for measuring the amplitude and phase of the various harmonic components of a wave from its graph.

**harmonic antenna**—An antenna whose electrical wavelength is an integral multiple of a half wavelength.

**harmonic attenuation**—Elimination of a harmonic frequency by using a pi network and tuning its shunt resistances to zero for the frequency to be eliminated.

**harmonic component**—Of a periodic quantity, any one of the simple sinusoidal quantities of the Fourier series into which the periodic quantity may be resolved.

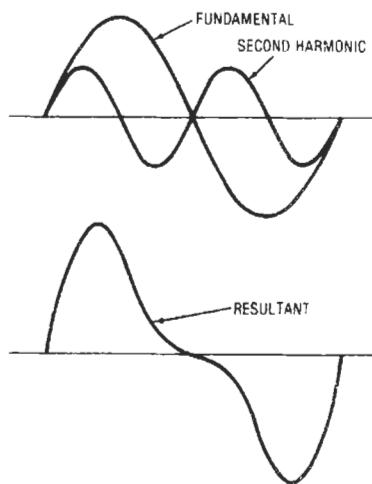
**harmonic content**—1. The degree of distortion in the output signal of an amplifier. 2. The components remaining after the fundamental frequency has been removed from a complex wave.

**harmonic conversion transducer**—A conversion transducer in which the useful output frequency is a multiple or submultiple of the input frequency.

**harmonic detector**—A voltmeter circuit that measures only a particular harmonic of the fundamental frequency.

**harmonic distortion**—1. The production of harmonic frequencies at the output by the nonlinearity of a transducer when a sinusoidal voltage is applied to the input. The amplitude of the distortion is usually a function of the amplitude of the input signal. 2. The voltages of harmonics resulting from amplitude distortion expressed as a percentage of the voltage of the fundamental. A common measurement is total harmonic distortion (THD), in which the fundamental of a very low distortion sinc-wave test signal is removed by a steep notch filter. The summed harmonics that remain are then measured as a voltage and expressed as a percentage (or dB value) of the voltage of

## hard-wired logic — harmonic producer



Harmonic content, I.

the fundamental at the required test power of the amplifier. (When measured in this manner, the term THD is not really correct since the distortion also has the amplifier noise added to it within the test passband. The correct term is *distortion factor*.) 3. The sum of all signals in an output that are multiples of the input signal frequencies (harmonics). Their intensities are expressed as a percentage of the total output intensity. 4. The production of spurious frequencies, not present in the original sound, that are multiples of the original sound frequency. For example, a 100-Hz tone in the original may produce spurious tones at 200 Hz, 300 Hz, and so on. The result is an audible blurring or loss in the reproduced sound. Total harmonic distortion of no more than 1 percent is considered to be inaudible. 5. A data-communication-line impairment caused by erroneous frequency generation along the line.

**harmonic filter**—A combination of inductance and capacitance tuned to an undesired harmonic to suppress it.

**harmonic generator**—A vacuum tube transistor, or other generator operated so that it generates strong harmonics in the output.

**harmonic interference**—Interference between radio stations because harmonics of the carrier frequency are present in the output of one or more stations.

**harmonic-leakage power (tr and pre-tr tubes)**—The total radio-frequency power transmitted, through the fired tube in its mount, at other than the fundamental frequencies generated by the transmitter.

**harmonic motion**—Back and forth motion, such as that of a pendulum, in which the distance on one side of equilibrium always equals the distance of the other side; the acceleration is toward the point of equilibrium and directly proportional to the distance from it. Graphically, harmonic motion is represented by a sine wave.

**harmonic oscillator**—1. A circuit in which the oscillating frequency of the active device and the output frequency are not the same. For example, in a push-push configuration, each transistor oscillates at  $f_0$  but the output is combined to provide  $2f_0$ . 2. An oscillator whose output is very nearly a sine wave and whose output amplitude and frequency are very nearly constant.

**harmonic producer**—A tuning-fork-controlled oscillator used to provide carrier frequencies for broadband carrier systems. It is capable of producing odd and even harmonics of the fundamental tuning-fork frequency.

**harmonic ringing**—A system of selectively signaling several parties on a subscriber's line. The different rings are produced by currents that are harmonics of several fundamental frequencies.

**harmonics**—Undesired signals that appear at multiples (2, 3, etc.) of the desired fundamental frequency. They are produced by nonlinear amplifiers and can cause interference and other phenomena.

**harmonic selective ringing**—Selective ringing that employs currents of several frequencies and ringers, each tuned mechanically or electrically to the frequency of one of the ringing currents, so that only the desired ringer responds.

**harmonic series of sounds**—A series in which each basic frequency is an integral multiple of a fundamental frequency.

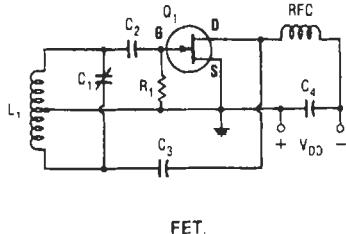
**harmonic telephone ringer**—A ringer that responds only to alternating current within a very narrow frequency band. A number of such ringers, each responding to a different frequency, are used in one type of selective ringing.

**harmonic-wave analyzer**—See harmonic analyzer.

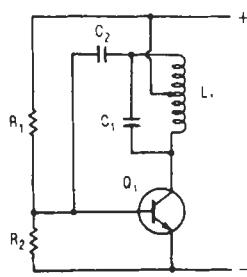
**harness**—1. Wires and cables arranged and tied together so they can be connected or disconnected as a unit. 2. A group of conductors laid parallel or twisted by hand, usually with many breakouts, laced or bundled together, or pulled into a rubber or plastic sheath. Used to interconnect electrical circuits.

**hartley**—In computers, a unit of information content equal to one decimal decision, or the designation of one of ten possible and equally likely values or states of anything used to store or convey information. One hartley equals  $\log_2 10 = 3.23$  bits.

**Hartley oscillator**—An oscillator in which a parallel-tuned tank circuit is connected between the grid and plate of an electron tube or between the base and collector of a junction transistor, the inductive element of the tank having an intermediate tap at the cathode or emitter potential.



FET.



Bipolar transistor.

Hartley oscillator.

**hash**—1. Electrical noise generated within a receiver by a vibrator or a mercury-vapor rectifier. See also grass. 2. A completely random interfering signal usually caused by arcing and occasionally by natural environmental disturbances.

**hash-mark stripe**—A noncontinuous helical stripe applied to a conductor for identification.

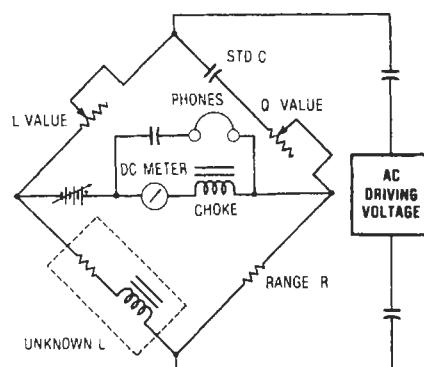
**hash total**—In a computer, a total for checking purposes. It is determined by adding all the digits or all the numbers in a particular field in a batch of unit records to be processed or manipulated, with no attention paid to the meaning or significance of the total. After processing, the hash total is recalculated and compared with the original total. If the two do not match, the original data has been changed in some way.

**hat**—To arrange a fixed number of symbols or groups of symbols in a random sequence, as if they had been drawn from a hat.

**hatted code**—A randomized code consisting of an encoding section. The plain-text groups are arranged in a significant order, accompanied by their code groups arranged in a random order.

**haul**—An arbitrary classification of telephone toll calls, as follows: short haul, less than 30 miles or 48 km; medium haul, 30 to 1000 miles or 48 to 1609 km; long haul, over 1000 miles or 1609 km.

**Hay bridge**—A four-arm, alternating-current bridge used for measuring inductance in terms of capacitance, resistance, and frequency. The arms adjacent to the unknown impedance are nonreactive resistors, and the opposite arm is composed of a capacitor in series with a resistor (unlike the Maxwell bridge, where it is in parallel). Usually the bridge is balanced by adjustment of the resistor, which is also in series with the capacitor and one of the nonreactive arms. The balance depends upon the frequency.



Hay bridge.

**Hayes-compatible**—A modem that recognizes the commands of a Hayes-manufactured modem.

**hazard**—See failure rate.

**hazard rate**—At a particular time, the rate of change of the number of items that have failed divided by the number of items surviving.

**Hazeltine neutralizing circuit**—An early form of neutralized radio-frequency amplifier circuit.

**H-beacon**—A nondirectional homing beacon with an output power of 50 to 2000 watts.

**H-bend**—Also called H-plane bend. In waveguide technique, a smooth change in the direction of the axis of

the waveguide. Throughout the change, the axis remains perpendicular to the direction of polarization.

**HBO** — Abbreviation for Home Box Office. The most popular pay-TV network, which is distributed on SAT-COM F1.

**HCD** — Abbreviation for hot-carrier diode.

**H-display** — Also called H-scan. In radar, a B-display modified to indicate the angle of elevation. The target appears as two closely spaced blips that approximate a short, bright line that slopes in proportion to the sine of the angle of target elevation.

**HDLC** — Abbreviation for high-level data link control. 1. A packet transmission protocol developed by the International Standards Organization (ISO) derived from IBM's Synchronous Data Link Control (SDLC). Messages are transmitted in units called frames, which can contain differing amounts of data but must be organized in a particular way. 2. A CCITT standard data-communication line protocol.

**HDTV** — *See* high-definition television.

**HDX** — *See* half-duplex circuit.

**head** — 1. A device that reads, records, or erases data on a storage medium. For example, a small electromagnet used to read, write, or erase data on a magnetic drum or tape, or the set of perforating reading or marketing devices used for punching, reading, or printing on paper tape. 2. In a tape recorder, any device intended to change the magnetic state of the tape. Specialized types of heads are used for erasing the tape, recording a signal on it, and playing back the signal from it. In many recorders, the recording and playback functions are both performed (at different times) by the same head. 3. An electromagnetic device, usually consisting of a ring-shaped metal core wound with coils of wire, in which the continuity of the core is broken at one place, called the gap. Tape touches the head at the gap as it moves past it. A reproducing or playback head senses signals already magnetized (recorded) on tape and transforms them into electrical impulses that are then amplified and fed to a loudspeaker. A recording head accepts electrical signals and transforms them into magnetic impulses that are deposited on tape as it passes the head. Most cassette recorders use a single, combination record/playback head.

**head alignment** — Also called azimuth alignment. 1. Positioning the record/playback head on a tape recorder so that its gap is perpendicular to the tape. 2. On a VTR or VCR, the positioning of the audio or video heads so that they describe the current path at the correct angle across the videotape; heads that are out of alignment won't record or play back properly. 3. Adjustment of the recording or reproducing head so that it's at right angles to the longitudinal axis of tape. 4. Mechanical adjustment of the spatial relationships between the head gaps and the tape.

**head amplifier** — An audio-frequency amplifier mounted on or near the sound head of a motion-picture projector to amplify the extremely weak output of the phototube.

**head demagnetizer** — Also called degausser. 1. A special demagnetizer with elongated pole pieces enabling them to be brought into proximity to head surfaces for elimination of the built-up magnetic charge that develops over a period of time as a result of asymmetrical electrical input signals. 2. A device used to neutralize possible residual or induced magnetism in heads or tape guides.

**headend** — 1. In a broadband transmission network, a group of active and/or passive components that translate one range of frequencies (Transmit) to a different frequency band (Receive); allows devices on a single cable network to send and receive signals without interference. 2. The master distribution center of a satellite TV

(SATV) system in which the incoming television signals from space and distant broadcast stations are received, amplified, and remodulated onto television channels for transmission down the SATV coaxial cable. 3. In a broadband local area network, the central location that has access to signals traveling in both inbound and outbound directions.

**header** — 1. The part of a sealed component or assembly that provides support and insulation for the leads passing through the walls. 2. A feedthrough device that forms a conductive path through an insulating plate or surface. 3. The part of a semiconductor device package to which the actual chip or die is mounted. May consist of metal, ceramic, or one of a number of plastics, such as epoxy resin. 4. The portion of a device package from which the external leads extend. Examples include the TO-5 header and flat-pack case. 5. An information structure that precedes and identifies the information that follows, such as a block of bytes in communications, a file on a disk, a set of records in a database, or an executable program.

**header card** — A card containing information about the data in other cards that follow.

**header record** — A computer input record that contains common, constant, or identifying information for other records that follow.

**head gap** — A space inserted intentionally into the magnetic circuit of a magnetic recorder head to force or direct the flux into the recording medium.

**head guy** — The messenger cable and attachments placed so they pull toward the pole line.

**heading** — The direction of a ship, aircraft, or other object with reference to true, magnetic, compass, or grid north.

**headlight** — An aircraft radar antenna small enough to be housed in the wing, like an automobile headlight. The beam operates like a searchlight.

**headphone** — Also called a head receiver or phone. 1. A device held against the ear and having a diaphragm that vibrates according to current variations. It reproduces the incoming electrical signals as sound. Thus it permits private listening to a receiver amplifier or other device. 2. Small sound reproducers, superficially resembling miniature loudspeakers, set in a suitable frame for wearing about the head and listening to by close coupling to the ears. Recent headphones, improved greatly in fidelity, have become increasingly popular among audiophiles for private listening without disturbing others, as well as to prevent outside noises from interfering with the listening. Headphones are available in mono or stereo. 3. A telephone receiver held against the ear by a headband. *See also* headset.

**head receiver** — *See* headphone.

**head room** — 1. The safety margin that is normally provided between the maximum recording level as indicated on a recorder level indicator and the actual point of severe tape overload. Most good recorders provide 6 to 8 dB of head room above the indicated 0-vu or normal maximum indicated recording level, to allow for the inability of the needle of the VU meter needle to respond fully to sudden, intense bursts of signal energy. 2. The difference between the nominal operating level and the maximum level at any point in a system or device. Usually expressed in decibels. 3. The margins between an actual signal operating level and the level that would cause substantial distortion. For a tape recorder this would be the level above 0 vu that gives a (specified) distortion.

**headset** — 1. A headphone (or a pair of headphones) and its associated headband and connecting cord. 2. Small portable telephone receivers, usually in pairs, with a connecting clamp to support the phones against the ears,

for operators of receiving equipment. 3. An operator's head telephone set.

**headset cord**—A very flexible cord used for communication equipment, usually 24 AWG to 22 AWG multicore conductor. Usually made with Buna insulation, rubber, or neoprene jacket; sometimes the outer jacket is a cotton braid. The conductor may be bare copper or cadmium bronze.

**headshell**—The end of a pickup arm where the cartridge fits. Sometimes bonded to the arm, though often detachable.

**head stack**—A group of two or more heads mounted in a single unit, used to provide multiple-track recording or reproduction.

**head-to-tape contact**—The degree to which the surface of the magnetic coating approaches the surface of the record or replay heads during normal operation of a recorder. Good head-to-tape contact minimizes separation loss and is essential in obtaining high resolution.

**heap**—A storage area used for dynamically allocated variables created by a running process without correlation to the static structure of the program.

**hearing aid**—A small audio-reproducing system for the hard of hearing. It consists of a microphone, amplifier, battery, and earphone and is used to increase the sound level normally received by the ear.

**hearing loss**—Also called deafness. 1. The hearing loss of an ear at a specified frequency—i.e., the ratio, expressed in decibels, of its threshold of audibility to the normal threshold. 2. The difference in level, expressed in decibels, between the weakest sound a particular human ear can hear and the weakest sound heard by an average, normal ear.

**hearing loss for speech**—The difference in decibels between the speech levels at which the average normal ear and the defective ear, respectively, reach the same intelligibility. It is often arbitrarily set at 50 percent.

**heart pacer**—See pacemaker.

**heat aging**—A test used to indicate the relative resistance of various insulating materials to heat degradation.

**heat coil**—A protective device that grounds or opens a circuit, or both, when the current rises above a predetermined value. A mechanical element moves when the fusible substance that holds it in place is heated above a certain point by current through the circuit.

**heater**—Also called filament. 1. An element that supplies the heat to an indirectly heated cathode. 2. A resistor that converts electrical energy into heat.

**heater biasing**—Application of a dc potential to the heater of a vacuum tube to eliminate diode conduction between it and some other element within the tube.

**heater cord**—Flexible stranded copper conductor, cotton wrapped, with rubber insulation and asbestos roving. For indoor use on household appliances.

**heater current**—The current flowing through a heater in a vacuum tube.

**heater voltage**—The voltage between the terminals of a heater.

**heater-voltage coefficient**—In a klystron, the frequency change per volt of heater voltage change when the reflector voltage is adjusted for the peak of a reflector voltage mode.

**heat-eye tube**—A cathode-ray tube powered by a midget generator. It is used as an infrared instrument that can "see" in the dark.

**heat gradient**—The difference in temperature between two parts of the same object.

**heating effect of a current**—Assuming a constant resistance, the amount of heat produced by the current through it. It is proportionate to the square of the current.

**heating element**—The wirewound resistor, terminals, and insulating supports used in electric cooking and heating devices.

**heating pattern**—In induction or dielectric heating, the distribution of temperature in a load or charge.

**heating station**—In induction or dielectric heating, the work coil or applicator and its associated production equipment.

**heat loss**—The loss due to conversion of part of the electric energy into heat.

**heat of emission**—Additional heat energy that must be supplied to an electron-emitting surface to keep its temperature constant.

**heat of radioactivity**—Heat generated by radioactive disintegration.

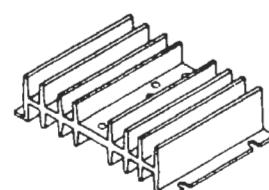
**heat sealing**—A method of joining plastic films by simultaneous application of heat and pressure to areas in contact. Heat may be supplied conductively or dielectrically.

**heatseeker**—A guided missile that uses an infrared sensor to detect and home in on an enemy target. The missile is guided by the high infrared emissions produced by a target, such as the heat from an aircraft or tank engine.

**heat sensor**—1. A sensor that responds to either a local temperature above a selected value or a local temperature increase that is at a rate of increase greater than a preselected rate. 2. A sensor that responds to infrared radiation from a remote source, such as a person.

**heat shock**—Test to determine stability of material by sudden exposure to a high temperature for a short period.

**heat sink**—1. A mounting base, usually metallic, that dissipates, carries away, or radiates into the surrounding atmosphere the heat generated within a semiconductor device. The package of the device often serves as a heat sink, but, for devices of higher power, a separate heat sink on which one or more packages are mounted is required to prevent overheating and consequent destruction of the semiconductor junction. 2. A mass of metal that is added to a device for the absorption or transfer of heat away from critical parts. Generally made from aluminum to achieve high heat conductivity and light weight, most heat sinks are of one-piece construction. They may also be designed for mounting on printed circuit boards. 3. A method used to transfer a rise in temperature. A metal plate or fin-shaped object with good heat-transfer efficiency that helps dissipate heat into the surrounding air, into a liquid, or into a larger mass. 4. A material capable of absorbing heat; a device utilizing such material for the thermal protection of components or systems. 5. A metal part with maximized surface areas to remove heat from electronic components, such as transistors, integrated circuit amplifiers, etc. 6. A mass of metal, often with fins, mounted on or under a circuit component that produces heat, such as a power transistor, silicon rectifier, etc. The heat sink absorbs and then radiates the heat to maintain a safe working temperature for the component.



Heat sink.

**heat sink compound — helix**

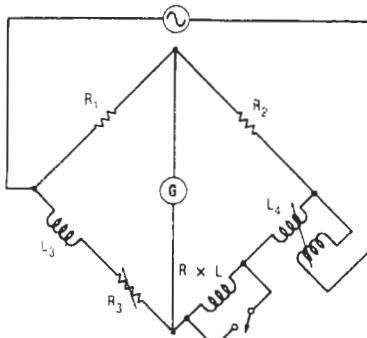
**heat sink compound**—A silicon compound filled with alumina or other heat-conductive oxide. Used to fill voids and irregularities in surfaces between two mating objects to permit optimum heat transfer.

**heat soak**—Heating a circuit over a period to allow all parts of the package and circuit to stabilize at the same temperature.

**heat waves**—Infrared radiation similar to radio waves but of a higher frequency.

**heat-writing recorder**—A type of stripchart recorder in which a heated stylus writes on a strip of chemically treated paper. The paper is discolored by the heat, and the path followed by the pen over the surface of the paper is thus made visible.

**Heaviside-Campbell mutual-inductance bridge**—A Heaviside mutual-inductance bridge in which one inductive arm contains a separate inductor that is included in the bridge arm during the first of a pair of measurements and is short-circuited during the second. The balance is independent of frequency. *See also* Heaviside mutual-inductance bridge.



*Heaviside-Campbell mutual-inductance bridge.*

**Heaviside layer**—Also called the Kennelly-Heaviside layer. The region of the ionosphere that reflects radio waves back to earth.

**Heaviside mutual-inductance bridge**—An alternating-current bridge normally used for the comparison of self- and mutual inductances. Each of the two adjacent arms contains self-inductance, and one or both of them have mutual inductance to the supply circuit. The other two arms normally are nonreactive resistors. The balance is independent of frequency.

**heavy hydrogen**—Another term for deuterium ( ${}_1^2\text{H}^2$ ) or tritium ( ${}_1^3\text{H}^3$ ).

**hecto-**—A prefix meaning 100.

**hectometric wave**—An electromagnetic wave between the wavelength limits of 100 and 1000 meters, corresponding to the frequency range 300 kHz to 3 MHz.

**heelpiece**—1. Part of a relay magnetic structure at the end of a coil, opposite the armature. It generally supports the armature and completes the magnetic path between it and the core of the coil. 2. The base of a relay, on which one or more contact spring assemblies are mounted, and to which the core of a relay is fastened.

**Hefner lamp**—A standard source that gives a luminous intensity of 0.9 candlepower.

**HEI**—Abbreviation for high-energy ignition. Conventional (General Motors) automotive electronic ignition

that replaces the distributor point system. Provides high voltage for high-energy spark timing control.

**height control**—In a television receiver, the adjustment that determines the amplitude of the vertical-scanning pulses and hence the height of the picture.

**height finder**—A radar that measures the altitude of an airborne object.

**height input**—Information regarding target height received by a computer from a height finder and relayed by way of a ground-to-ground data link or telephone.

**height overlap coverage**—A region of height-finder coverage within which there is duplicated coverage from adjacent height finders of other radar stations.

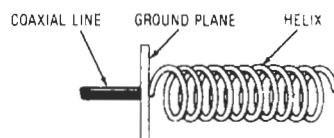
**height-position indicator**—A radar display that simultaneously shows the angular-elevation slant range and height of objects.

**height-range indicator**—A cathode-ray tube from which altitude and range measurements of airborne objects may be viewed.

**Heising modulation**—*See* constant-current modulation.

**helical**—Spiral-shaped.

**helical antenna**—Also called a helical-beam antenna. 1. A spiral conductor wound around a circular or polygonal cross section. The axis of the spiral normally is mounted parallel to the ground and fed at the adjacent end. The radiation produced has approximately a circular polarization and is confined mainly to a single lobe located along the axis of the spiral. 2. An antenna made of wire wound as a coil, usually on a Fiberglas rod and with the wire usually within Fiberglas.



*Helical antenna.*

**helical-beam antenna**—*See* helical antenna.

**helical potentiometer**—A precision potentiometer that requires several turns of the control knob to move the contact arm from one end of the spiral-wound resistance element to the other end.

**helical scanning**—1. Radar scanning in which the rf beam describes a distorted spiral motion. The antenna rotates about the vertical axis while the elevation angle rises slowly from 0° to 90°. 2. Method of facsimile scanning in which the elemental area sweeps across the copy in a spiral motion.

**helical stripe**—A continuous, colored, spiral stripe applied to a conductor for circuit identification.

**helicone**—A circularly polarized antenna that produces a low side-lobe level. It consists of a helix excited in the axial mode and placed inside a conical horn. The axial length of the helix is approximately equal to the altitude of the truncated cone.

**helionics**—The conversion of solar heat to electric energy.

**helitron oscillator**—An electrostatically focused, low-noise, backward-wave microwave oscillator. The frequency of the output signal can be swept rapidly through a wide range by variation of the voltage applied between the cathode and the associated rf circuit.

**helium tight**—*See* hermetic.

**helix**—A spiral winding, such as a coil.

**helix recorder**—A recorder in which helical scanning is used.

**Helmholtz coil**—A phase-shifting network used for determining the range in certain types of radar equipment. It consists of fixed and movable coils. The phase is kept constant at the input, but may be continually shifted from 0° to 360° at the output.

**Helmholtz resonator**—An acoustic enclosure with a small opening that causes the enclosure to resonate. The frequency at which it does depends on the geometry of the resonator.

**hemimorphic**—Terminated at the two ends by dissimilar sets of faces.

**HEM wave**—See hybrid electromagnetic wave.

**henry**—The cgs electromagnetic unit of inductance or mutual inductance. The inductance of a closed circuit in which an electromotive force of 1 volt is produced when the electric current in the circuit is varied uniformly at a rate of 1 ampere per second. Letter symbol: H.

**heptode**—A vacuum tube that contains seven electrodes: an anode, a cathode, a control electrode, and four additional electrodes, usually grids.

**hermaphrodite connector**—A cable connector in which the jack and the plug are identically shaped.

**hermaphroditic connector**—1. A connector in which both mating members are exactly alike at their mating face. There are no male or female members, but provisions have been made to maintain correct polarity, hot lead protection, sealing, and coupling. 2. Either of a pair of coaxial connectors whose mating faces are alike. 3. A connector design in which pin and socket contacts are arranged in a balanced manner such that both mating connectors are identical. The contacts may also be hermaphroditic and arranged as male and female contacts, as for pins and sockets. Hermaphroditic contacts may also be used in a manner such that one half of each contact mating surface protrudes beyond the connector interface, and both mating connectors are identical.

**hermaphroditic contact**—1. A contact designed so that it is neither pin nor socket and can be mated with any other contact of the same design. 2. Slotted contacts with beveled contacting surfaces in which both mating portions are exactly alike in shape, but mate at a 90° angle from each other.

**hermetic**—Also called helium tight, leak tight, and vacuum tight. 1. Pertaining to permanent sealing, by fusion, soldering, or other means, to prevent the transmission of gases. 2. A characteristic of packages providing an absolute seal against moisture to prevent degradation. These packages are generally metal cans, dual-in-line packages (DIPs) with solder seals, or ceramic packages. Plastic packages, although less expensive, are not hermetic.

**hermetically sealed**—Contained within an enclosure that is sealed by fusion or other comparable means to ensure a low rate of gas leakage over a long period. This generally refers to metal-to-metal or metal-to-glass seal.

**hermetic seal**—1. An airtight seal between two parts of a container, such as between the can and header of a metal component package. 2. A mechanical or physical closure that is impervious to moisture or gas, including air. Usually pertains to an envelope or enclosure containing electronic components or parts, or to a header. 3. An IC package enclosure technique by which the IC chip is completely protected from environmental contaminants.

**herringbone pattern**—Television interference seen as one or more horizontal bands of closely spaced V- or S-shaped lines.

**hertz**—The standard unit for frequency, equivalent to one cycle per second. Letter symbol: Hz. Named after H. R. Hertz, a 19th-century German physicist.

**Hertz antenna**—1. An antenna system that does not depend for its operation on the presence of ground. Its resonant frequency is determined by its distributed capacitance, which varies according to its physical length. 2. An elementary linear dipole radiator; it may or may not have spherical or flat-plate ends.

**Hertz effect**—The ionization and spark emission due to exposure to ultraviolet radiation.

**Hertzian oscillator**—A type of oscillator for producing ultrahigh-frequency oscillations. It consists of two metal plates or other conductors separated by an air gap. The capacitor formed has such a small capacitance that ultrahigh-frequency oscillations can occur.

**Hertzian waves**—Electromagnetic waves of frequencies between 10 kHz and 30,000 GHz. Radio waves.

**hertz-matching loran**—See low-frequency loran.

**Hertz vector**—A vector that specifies the electromagnetic field of a radio wave. Both the electric and the magnetic intensities can be specified in terms of it.

**heterodyne**—Also called beat. To mix two frequencies together in a nonlinear component in order to produce two other frequencies equal to the sum and difference of the first two. For example, heterodyning a 100-kHz and a 10-kHz signal will produce a 110-kHz (sum frequency) and a 90-kHz (difference frequency) signal.

**heterodyne conversion transducer (converter)**—A conversion transducer in which the output frequency is the sum or difference of the input frequency and an integral multiple of the frequency of another wave.

**heterodyne detection**—Detection (or conversion) by mixing two signals together to generate the intermediate frequency in a superheterodyne receiver or to make cw signals audible.

**heterodyne detector**—A detector that converts an incoming rf signal to an audible tone by heterodyning. It incorporates a local oscillator (called a beat-frequency oscillator).

**heterodyne frequency**—1. The sum or difference frequency produced by combining two other frequencies. 2. Either of the two frequencies, the sum or the difference, that result from an amplitude-modulation process.

**heterodyne frequency meter**—See heterodyne wavemeter.

**heterodyne oscillator**—An oscillator that produces a desired frequency by combining two other frequencies (e.g., two radio frequencies to produce an audio frequency, or the incoming and local-oscillator frequencies to produce the intermediate frequency of a superheterodyne receiver).

**heterodyne principle**—See heterodyne.

**heterodyne reception**—Also called beat reception.

1. Reception by combining a received high-frequency wave with a locally generated wave in a nonlinear device to produce sum and difference frequencies at the output. 2. A form of reception in which the receiver combines the incoming signal with a locally generated signal of different frequency. The combination creates a new signal, the intermediate frequency, at the difference, or beat, frequency between the two components.

**heterodyne repeater**—A radio repeater in which the incoming radio signals are converted to an intermediate frequency, amplified, and reconverted to another frequency band before being transmitted over the next repeater section.

**heterodyne-type frequency meter**—An instrument for measuring frequency by producing a zero

difference frequency (zero beat) between the signal under test and an internally generated signal.

**heterodyne wavemeter**—A wavemeter employing the heterodyne principle to compare the frequency being measured with a frequency being generated in a calibrated oscillator circuit.

**heterodyne whistle**—A steady squeal heard in a radio receiver when the signals from stations having nearly equal frequencies beat together.

**heterodyning**—See heterodyne.

**heterogeneity**—A state or condition of being unlike in nature, kind, or degree.

**heterogeneous**—Composed of different materials (opposite of homogeneous).

**heterojunction**—An interface between two semiconductors of different chemical compositions (for example, between indium gallium arsenide phosphide and indium phosphide) but not necessarily different majority carrier types (n-type or p-type).

**heterosphere**—The portion of the upper atmosphere in which the relative proportions of oxygen, nitrogen, and other gases are unfixed and radiation particles and micrometeoroids are mixed with the air particles.

**heuristic**—1. Pertaining to exploratory problem-solving methods in which solutions are discovered through evaluation of the progress made toward the final result (as opposed to algorithmic methods). 2. Empirical. Referring to knowledge or procedures determined by experience, but difficult to prove. 3. A problem-solving technique in which general principles and rules of thumb are used to approach a solution. Unlike an algorithm, the heuristic approach does not guarantee a solution. However, heuristic methods can result in a faster and simpler solution, and where algorithms are not available they are often the only resource. 4. A rule of thumb or an educated guess that simplifies and limits a search for solutions and applications that are difficult or poorly understood.

**heuristic program**—A set of computer instructions that simulate the behavior of human operators in approaching similar problems.

**Hewlett-Packard Interface Bus**—Abbreviated HP-IB. The Hewlett-Packard implementation of the IEEE-488 bus used to interface multiple devices by a well-defined hardware protocol. See GPIB.

**hex**—The hexadecimal numbering system. Since 16 is a power of 2, binary numbers are easily converted into hex, so machine-language computer programs are often written in hex to save space. For example, binary 11010110 (decimal 214) could be written in hex as D6.

**hexadecimal**—1. Number system using 0, 1, . . . , A, B, C, D, E, F to represent all the possible values of a four-bit digit. The decimal equivalent is 0 to 15. Two hexadecimal digits can be used to specify a byte. 2. A counting system similar to BCD. 3. A number system using the equivalent of the decimal number 16 as base. Compare binary number system.

**hexadecimal counter**—See divide-by-16 counter.

**hexadecimal display**—A solid-state display capable of exhibiting numbers 0 through 9 and alphabet characters A through F.

**hexadecimal number system**—A number system having as its base the equivalent of the decimal number 16.

**hex inverter**—A group of six logic inverters contained in a single package.

**hexode**—A vacuum tube containing six electrodes: an anode, a cathode, a control electrode, and three additional electrodes, usually grids.

**HF**—Abbreviation for high frequency.

## heterodyne wavemeter — high-density disk

### Hexadecimal system

Decimal	Binary	Octal	Hexadecimal
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

**H-field sensor**—A passive sensor that detects changes in the earth's ambient magnetic field caused by the movement of an intruder. See also E-field sensor.

**HH beacon**—A nondirectional radio homing beacon with a power output of 2000 watts or more.

**HIC**—Abbreviation for hybrid integrated circuit.

**hidden codes**—Formatting codes embedded into a document that are not visible on the screen.

**hidden file**—Also called invisible file. A file in a computer that occupies disk space but does not appear in directory listings. Files are hidden to prevent their display or change. Users cannot display, erase, or copy hidden files.

**hierarchical network**—Also called a tree network. A network topology organized in the form of a pyramid with one terminal at the top and increasing numbers of terminals at each lower level.

**hierarchy**—1. A series of items classified according to rank or order. 2. The order in which arithmetic operations within a formula or a statement will be executed. 3. An arrangement into a graded series.

**hi-fi**—See high fidelity.

**high-altitude electromagnetic pulse**—An electromagnetic radiation of very short rise time, large amplitude, and brief duration that follows a nuclear explosion above the atmosphere.

**high band**—Television channels 7 to 13, covering a frequency range of 174 to 216 MHz.

**high boost**—See high-frequency compensation.

**high-contrast image**—A picture in which strong contrast between light and dark areas is visible. Intermediate values, however, may be missing.

**high definition**—The condition of a reproduced television or facsimile image in which it contains sufficient accurately reproduced elements for the picture details to approximate those of the original scene.

**high-definition television**—Abbreviated HDTV. A television picture of higher quality than standard NTSC video. This usually involves 720 lines, progressive scan more horizontal lines (e.g., 1080 or higher rather than 525), a different aspect ratio (16:9 rather than 4:3), and Dolby digital audio.

**high-density disk**—A floppy disk that holds more information than a double-density disk. A 3.5-inch high-density disk holds 1.44 megabytes.

**high-energy materials**—Also called hard magnetic materials. Magnetic materials having a comparatively high-energy product; e.g., materials used for permanent magnets.

**higher-level language**—A programming language that closely resembles natural language. A statement in a higher-level language will produce many machine-language instructions. The higher-level languages are usually independent of the computer.

**highest probable frequency**—Abbreviated HPF. An arbitrarily chosen frequency value 15 percent above the  $F_2$  layer MUF (maximum usable frequency) for the radio circuit. For the E-layer, the HPF is equal to the MUF.

**high fidelity**—Popularly called hi-fi. 1. The characteristic that enables a system to reproduce sound as nearly like the original as possible. 2. Reproduction of audio so perfect that listeners hear exactly what they would have heard if present at the original performance. 3. The reproduction of audio sounds so perfectly that a listener is not aware of any loss of naturalness.

**high-fidelity receiver**—A radio receiver capable of receiving and reproducing, without noticeable distortion, the original modulation impressed on the carrier waves.

**high filter**—An audio circuit designed to remove undesired high-frequency noise from the program material. Such noise includes record scratch, tape hiss, AM whistles, etc.

**high frequency**—Abbreviated HF. The frequency bands from 3 to 30 MHz (100 meters to 10 meters).

**high-frequency alternator**—An alternator capable of generating radio-frequency carrier waves.

**high-frequency band**—The band of frequencies extending from 3 to 30 MHz.

**high-frequency bias**—In a tape recorder, a sinusoidal voltage that is mixed with the signal being recorded to improve the linearity and dynamic range of the recorded signal. In practice, the bias frequency is three to four times the highest information frequency to be recorded.

**high-frequency carrier telephony**—Carrier telephony with the carrier currents above the frequencies transmitted over a voice telephone channel.

**high-frequency compensation**—Also called high boost. An increase in the amplification of the high frequencies with respect to the low and middle frequencies within a given band of frequencies.

**high-frequency heating**—*See* electronic heating.

**high-frequency induction heater or furnace**—An induction heater or furnace using frequencies much higher than the standard 60 hertz.

**high-frequency resistance**—Also called rf or ac resistance. The total resistance offered by a device in a high-frequency ac circuit. This includes the dc and all other resistances due to the effects of the alternating current.

**high-frequency treatment**—Therapeutic use of intermittent and isolated trains of heavily damped oscillations having a high frequency and voltage and a relatively low current.

**high-frequency trimmer**—A trimmer capacitor that is used to calibrate the high-frequency end of the tuning range in a superheterodyne receiver.

**high-frequency unit**—*See* tweeter.

**high-frequency welding**—*See* radio-frequency welding.

**high-intensity discharge lamps**—Abbreviated HID. A general group of lamps, consisting of mercury, metal halide, and high-pressure sodium lamps.

**high-K ceramic**—A ceramic dielectric composition (usually BaTiO<sub>3</sub>) that exhibits large dielectric constants

and nonlinear voltage and temperature response characteristics.

**high level**—1. In digital logic, the more positive of the two binary-system logic levels. 2. Commands for computer systems in which each instruction is actually equated to many machine-code instructions strung together. *See also* low level; negative logic; positive logic. 3. Term describing a computer language in which the statements are closer to human communication than to machine code. Usually high-level languages can be easily read and understood by people since they consist of pseudo-English statements. To be used by a processor, high-level statements must be translated into machine code.

**high-level crossover network**—A crossover network designed to operate at high levels and which is placed between the power amplifier and the speakers (this type of crossover is normally built into a speaker system).

**high-level data link control**—*See* HDLC.

**high-level detector**—A linear power detector with a voltage-current characteristic that may be treated as a straight line or two intersecting lines.

**high-level firing time**—The time required to establish a radio-frequency discharge in a switching tube after radio-frequency power is applied.

**high-level language**—1. An application or problem-oriented programming language, as distinguished from a machine-oriented programming language. The instruction approach is closer to the needs of the problems to be solved than it is to the language of the machine on which it is to be run. Examples are Ada, C, COBOL, FORTRAN, Lisp, and Pascal. 2. Any programming language that allows a person to give instructions to a computer in English-like text rather than in the numerical (binary) code of 1s and 0s that the computer understands. FORTRAN and BASIC are high-level languages. 3. A step above assembly language. It can be translated to a lower level but not into English except by a programmer. 4. A sophisticated, though easy to use, computer language (written words and special punctuation) that allows a programmer to write software without being concerned with housekeeping functions (e.g., register allocation) or optimization.

**high-level modulation**—A system in which the modulation is introduced at a point where the power level approximates the output power.

**high-level radio-frequency signal (tr, atr, and pre-tr tubes)**—A radio-frequency signal with sufficient power to fire the tube.

**high-level VSWR (switching tubes)**—The voltage standing-wave ratio caused by a fired tube located between a generator and the matched termination in a waveguide.

**highlight**—The brightest portion of a reproduced image.

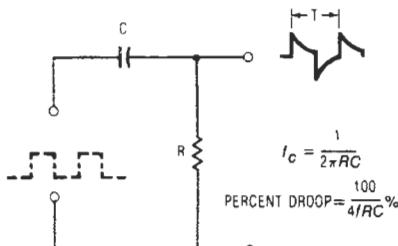
**high-mu tube**—A vacuum tube with a high amplification factor.

**high-noise-immunity logic**—Abbreviated HNIL. A special type of logic designed specifically to provide very high resistance to electrical noise. Sometimes called HTL (high-threshold logic).

**high-order language**—A programming language that is independent of the computer. Usually, it resembles natural languages, and a compiler is required for translation into machine language. Examples are FORTRAN and ALGOL.

**high-pass filter**—1. A wave filter having a single transmission band extending from some critical, or cutoff, frequency other than zero, up to infinite frequency. 2. A filter that, above a critical frequency, allows the unrestricted passage of high-frequency signals.

## high-performance equipment — hinge



*High-pass RC filter.*

Reciprocally, a bass-cut filter. 3. A filter that passes frequency components above some limited frequency and rejects components below that limit.

**high-performance equipment** — Equipment having sufficiently exacting characteristics to permit their use in trunk or link circuits.

**high pot** — *See* flash test.

**high-potential test** — A test for determining the breakdown point of insulating materials and spacings. It consists of applying a voltage higher than the rated voltage between two points or between two or more windings. However, it is not a test of conductor insulation.

**high potting** — *See* flash test.

**high-power silicon rectifiers** — A group of rectifiers with continuous ratings exceeding 50 average amperes per section in a single-phase, half-wave circuit.

**high Q** — Having a high ratio of reactance to effective resistance. The factor determining the efficiency of a reactive component.

**high-rate discharge** — The storage-battery discharge equivalent to the heaviest possible duty in service.

**high-recombination rate contact** — A semiconductor contact at which thermal equilibrium charge-carrier concentrations are maintained substantially independent of current density.

**high-resistance joint** — A faulty union of conductors or conductor and terminal. The result is less current flow and a drop in voltage at the union.

**high-resistance voltmeter** — A voltmeter having a resistance considerably higher than 1000 ohms per volt. As a result, it draws very little current from the circuit being measured.

**high resolution** — Descriptive of a camera or monitor capable of displaying a great number of scanning lines (1000–2000), which produces a picture that is very detailed, defined, and sharp.

**high-speed bus** — *See* memory register.

**high-speed carry** — Also called standing-on-nines carry. 1. A carry into a column results in a carry out of that column, because the sum without carry in that column is 9. 2. Instead of a normal adding process, a special process is used which takes the carry at high speed to the actual column where it is added.

**high-speed data rate** — Data transmission at a rate between 2401 bauds and 500 kilobauds.

**high-speed dc circuit breaker** — A device that starts to reduce the current in the main circuit in 0.01 second or less after the occurrence of a dc overcurrent or an excessive rate of current rise.

**high-speed excitation system** — An excitation system that can change its voltage rapidly in response to a change in the field circuit of the excited generator.

**high-speed pattern board** — Board completely covered with copper foil on both sides with the exception of small annular rings etched away to provide isolated interconnections. High  $V_{CC}$  and ground-plane coverage

enhance high-speed logic operation due to afforded control of signal-line impedance and reduction of noise and crosstalk.

**high-speed printer** — 1. A printer that has a speed of operation compatible with the speed of computation and data processing so that it may operate online. 2. A signal-responsive alphanumeric printer capable of printing computer output signals at rates on the order of 300 characters per second or greater.

**high-speed reader** — A reading device that can be connected to a computer so as to operate online without seriously slowing the operation of the computer.

**high-speed relay** — A relay designed specifically for short operate or short release time, or both.

**high-speed storage** — *See* rapid storage.

**high-speed telegraph transmission** — Transmission of code at higher speeds than are possible with hand-operated keys.

**high state** — The relatively more positive signal level used to assert a specific message content associated with one of two binary logic states.

**high-tech** — A general term that refers to sophisticated technical innovation; cutting-edge technology, often involving computers and other electronic devices.

**high-temperature reverse bias** — Burning-type test of diodes and transistors, conducted with the junctions reverse biased to effect any failure due to ion migration in bonds of dissimilar metals.

**high-tension** — Lethal voltages, on the order of thousands of volts.

**high-tension magneto** — A self-contained generator in which the required high potential is generated directly; no induction coil is needed.

**high-threshold logic** — Abbreviated HTL. 1. Logic with a high noise margin, used primarily in industrial applications. It closely resembles diode-transistor logic (DTL), except that in HTL a reverse-biased emitter junction is used as a threshold element operating as a zener diode. A typical noise margin is 6 volts with a 15-volt supply. 2. Logic that allows for higher degree of inherent electrical noise immunity. A considerably larger input threshold characteristic is exhibited by HTL devices by using a reversed-biased base-emitter junction that operates in the breakdown avalanche mode. A higher input signal is required to turn on the HTL output-inverting transistor than the DTL.

**high-vacuum phototube** — A phototube that is highly evacuated so that its electrical characteristics are essentially unaffected by gaseous ionization. In a gas phototube, some gas is intentionally introduced.

**high-vacuum rectifier** — A vacuum-tube rectifier in which conduction is entirely by electrons emitted from the cathode.

**high-vacuum tube** — Also known as a hard tube. An electron tube whose electrical characteristics will not be affected by gaseous ionization because of its high degree of evacuation.

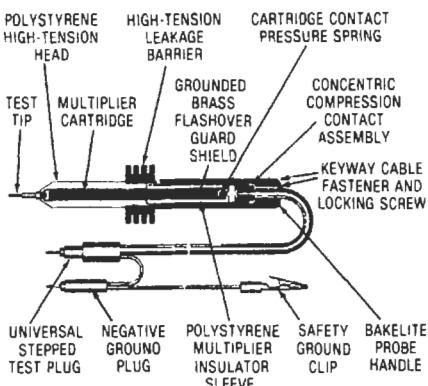
**high-velocity scanning** — The scanning of a target with electrons of such velocity that the secondary-emission ratio is greater than unity.

**high voltage** — The accelerating potential that speeds up the electrons in a beam of a cathode-ray tube.

**high-voltage probe** — A probe with a high internal resistance, for measuring extremely high voltages. It is used with a voltmeter having an internal resistance of 20,000 ohms per volt or more. *See* Figure on p. 352.

**hill-and-dale recording** — *See* vertical recording.

**hinge** — A joint in a relay that permits movement of the armature relative to the stationary parts of the relay structure.



High-voltage probe.

**hinged-iron ammeter** — A moving-iron ammeter in which the fixed portion of the magnetic circuit is placed around the conductor to measure the current through it.

**HIPERNAS** — Acronym for *high-performance navigation system*. A self-compensated, pure-inertial guidance system.

**hipot** — 1. *See* dielectric breakdown voltage. 2. Contraction of high potential. Commonly refers to a device used, with high voltages, for testing insulation breakdown or leakage. High potting is the verb. 3. High-potential voltage applied across a conductor to test the insulation. 4. A test designed to determine the highest potential that can be applied to a conductor without breaking through the insulation.

**hipot tester** — A high-potential test instrument that applies a high-voltage source to the insulating material of a device or cable to determine the ability of the unit to withstand the voltage without breakdown.

**hi-rel** — A contraction of high reliability; refers to products that are assembled and inspected under rigid standards, given extra testing and conditioning, and typically used in military, space, or medical applications.

**hiss** — 1. Random noise characterized by prolonged sibilant sounds in the audio-frequency range. 2. The primary background noise in tape recording, stemming from circuit noise in the playback amplifiers or from residual magnetism of the tape.

**histogram** — 1. A graphical representation of a frequency distribution by a series of rectangles that have for one dimension a distance proportional to a definite range of frequencies, and for the other dimension a distance proportional to the number of frequencies appearing within range. 2. A description of one (or all) parameters, showing distribution, standard deviation, mean-value failure limits, and sample lot size for all samples within the lot. 3. A graph of contiguous vertical bars representing a frequency distribution in which the groups or classes of items are marked on the *x*-axis, and the number of items in each class is indicated by a horizontal line segment drawn above the *x*-axis at a height equal to the number of items in the class.

**hit** — 1. *See* flash. 2. Momentary surge of voltage on a transmission channel. 3. An impulse noise having a duration of about 1 millisecond.

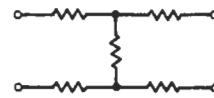
**hit-on-the-fly printer** — 1. A mechanical printer in which the printing head is in continual motion. 2. A printer in which the paper and/or the printing mechanism are in constant motion so that starts and stops are not needed.

**hits** — Momentary line disturbances that could result in mutilation of characters being transmitted.

**H-lines** — Imaginary lines that represent the direction and strength of magnetic flux on a diagram.

**HNDT** — *See* holographic nondestructive testing.

**H-network** — A network composed of five impedance branches. Two are connected in series between an input terminal and an output terminal, and two are connected between another input and another output terminal. The fifth is connected from the junction points of the two branches.



H-network.

**HNIL** — Abbreviation for high-noise-immunity logic.

**hobby computer** — A computer that is not used for profit.

**hog horn** — A microwave feed horn shaped so that the input energy from the waveguide approaches from the same direction as the horn opening.

**hold** — Opposite of clear. 1. To maintain storage elements in charge storage tubes at equilibrium potentials by electron bombardment. 2. To retain the information contained in one storage location for a computer after copying the information into another storage location, as opposed to clearing or erasing the information. 3. To maintain an established telephone connection, possibly while disconnecting to answer another call.

**hold control** — In a television receiver, the adjustment that controls the frequency of the vertical or horizontal scanning pulses and hence the stability of the picture.

**hold current** — Also called the electrical hold value. The minimum current that will keep the contact springs energized in a relay.

**hold electrode** — In a mercury switch, the electrode that remains in contact with the mercury pool while the circuit is being closed or opened.

**holding anode** — In a mercury-arc rectifier, a small auxiliary anode that maintains the ionization while the main anode current is zero.

**holding beam** — A diffused beam of electrons for regenerating the charges retained on the dielectric surface of an electrostatic memory or storage tube.

**holding circuit** — Also called a locking circuit. An alternate operating circuit that, when completed, maintains sufficient current in a relay winding to keep the relay energized after the initial current has ceased.

**holding coil** — A separate relay coil that keeps the relay energized after the original current has been removed.

**holding current** — 1. That value of average forward current (with the gate open) below which a silicon-controlled rectifier returns to the forward blocking state after having been in forward conduction. 2. The minimum current that must pass through a device such as a silicon-controlled rectifier, thyratron, neon glow tube, etc., to maintain it in a conducting condition. 3. The minimum current that will hold a relay in its operated position. The holding current is less than the operating current. 4. The minimum principal current required to maintain a thyristor in the on state.

**holding gun** — In a storage tube, the source of electrons constituting the holding beam.

**holding time**—The total time a trunk or circuit is in use on a call, including both operator's and user's time.

**holding torque**—Also called restoring or stall torque. 1. Force moment required to deflect the rotor of a stepper motor a full step with the motor energized but at a standstill. 2. A measure of the maximum torque that can be applied to the shaft of a stepper motor with one or more of its phases energized before the shaft begins to rotate.

**hold lamp**—An indicating lamp that stays lighted while a telephone connection is being held.

**hold mode**—In integrators or other charge-storage circuits, a condition or time interval in which input(s) are removed and the circuit is commanded (or expected) to maintain a constant output.

**hold-mode drop**—In a sample-and-hold circuit, the output voltage change per unit of time while in hold. Commonly specified in volts per second, microvolts per microsecond, and other convenient units.

**hold-mode feedthrough**—In a sample-and-hold circuit, the percentage of an input sinusoidal signal that is measured at the output of a sample hold when it is in hold mode.

**hold-mode settling time**—In a sample-and-hold circuit, the time from the hold-command transition until the output of the sample hold has settled within the specified error band. It includes aperture delay time.

**hold-off voltage**—The maximum voltage an electronic flash tube will stand without self-flashing. Normal hold-off voltage is reduced at the end of lamp life and in the presence of high temperatures or rf fields.

**holdover**—The condition that occurs when a lightning-protector gap continues to conduct follow current.

**holdover time**—Also called holdup time. The length of time a power supply will maintain its rated output after the input has been lost. In nonuninterruptible power supplies, the holdover time is usually measured in milliseconds.

**holdover voltage**—The steady-state voltage at which a gap just fails to clear a given value of follow current.

**hold time**—Also called release time. 1. In resistance welding, the time that is allowed for the weld to harden. 2. The length of time after the clocking of a flip-flop that data must remain unchanged.

**holdup**—The ability of a power supply to provide energy for approximately 30 to 50 milliseconds after an ac power loss. This provides an adequate amount of time to make a transfer to a standby power system. Holdup time is especially useful in computer systems, in which data in volatile memories may be lost in nuisance shutdowns.

**holdup button**—A manually actuated mechanical switch used to initiate a duress alarm signal; usually constructed to minimize accidental activation.

**holdup time**—See holdover time.

**hole**—1. In the electronic valence structure of a semiconductor, a mobile vacancy that acts like a positive electronic charge with a positive mass. 2. In a semiconductor, the term used to describe the absence of an electron; this absence has the same electrical properties as an electron except that it carries a positive charge. 3. A mobile vacancy or electron deficiency in the valence structure of a semiconductor. It is equivalent to a positive charge. 4. A defect in the valence electron system of a semiconductor crystal lattice, equivalent to the absence of a single valence electron. Like a conduction electron, a hole is capable of moving through the crystal and thus forms an effective current carrier having a positive charge. However, unlike a conduction electron, the hole must remain in the valence-bonding system of the crystal and thus it has a lower mobility.

**hole conduction**—Conduction occurring in a semiconductor when electrons move into holes under the influence of an applied voltage and thereby create new holes. The apparent movement of such holes is toward the more negative terminal, and is hence equivalent to a flow of positive charges in that direction.

**hole current**—Conduction in a semiconductor when electrons move into holes, creating new holes. The holes appear to move toward the negative terminal, giving the equivalent of positive charges flowing to the terminal.

**hole density**—In a semiconductor, the density of holes in an otherwise full band.

**hole-electron pair**—A positive charge carrier (hole) and a negative charge carrier (electron) considered together as one entity.

**hole injection**—The production of mobile vacancies in an n-type semiconductor when a voltage is applied to a sharp metal point in contact with the surface of the material.

**hole injector**—A pointed metallic device for injecting holes into an n-type semiconductor.

**hole-in-the-center effect**—Also called hole-in-the-middle effect. The lower volume or absence of sound between the left and right speakers of a stereo system.

**hole mobility**—The ability of a hole to travel easily through a semiconductor.

**hole site**—The area on a computer punch card or paper tape where a hole may or may not be punched. It can be a form of binary storage, in which a hole represents a 1 and the absence of a hole represents a 0.

**hole storage factor**—In a transistor, the excess stored charge (when the transistor is in saturation) per unit excess base current. Excess base current is defined as the amount of current supplied to the base in excess of the current required to just keep the transistor in saturation.

**hole trap**—A semiconductor impurity that can trap holes by releasing electrons into the conduction or valence bands.

**Hollerith**—Pertaining to a particular type of code or punched card utilizing 12 rows per column and usually 80 columns per card.

**Hollerith code**—1. A code based on the punching of holes in cards at specified locations. From one to three punches may be made in each column of the card and up to 80 columns may be punched in each card. Each column corresponds to one character; the specific character is determined by the number and location of the punches in that column. 2. A 12-level (12 bits per character) code that defines the relation between an alphanumeric character and the punched holes in an 80-column data card.

**hollow-cathode tube**—A gas discharge tube with a hollow cathode closed at one end. Almost all the radiation is from the cathode glow within the hollow cathode.

**hollow core**—A plain ferrite core having a center hole for mounting purposes.

**hologram**—1. A photograph, made with laser light, that appears to have three dimensions. 2. A recording of the two-dimensional intensity distribution of the interference pattern produced by the interaction of two or more monochromatic waves that have phases derived from the same source. One of the waves is reconstructed when a replica of the other wave is diffracted from the hologram. 3. An interference pattern recorded on photographic film or similar media. This pattern is created by directing two beams of coherent light into the film. One, called the reference beam, strikes the film directly. The second, called the object beam, bounces off, or passes through the test specimen, then strikes the film. The interaction of these two beams makes up the interference pattern called a hologram. To "decode" the swirls and dots of the pattern and create a visible

## **holographic cinematography — homotaxial**

three-dimensional image, a coherent light beam is directed onto the hologram.

**holographic cinematography**—A technique used to create a succession of interrelated holographic images that give an appearance of motion when projected in sequence. A flashing laser is used in both the recording and projecting of the images.

**holographic display**—A three-dimensional display created by using lasers.

**holographic lenses**—Photographic recordings of interference patterns between a plane wave and a spherical wave on a high-resolution photographic emulsion.

**holographic memory**—The storage of data as bits in memory by holographic processes. A laser beam is divided into reference and object beams, and bit information is stored as a hologram.

**holographic nondestructive testing**—Abbreviated HNDT. The application of coherent wavefront techniques to the determination of the physical state of a system without appreciably altering that state.

**holography**—1. The optical recording of an object wave formed by the resulting interference pattern of two mutually coherent component light beams. A coherent beam is first split into two component beams, one of which irradiates the object, the second of which irradiates a recording medium. The diffraction or scattering of the first wave by the object forms the object wave that proceeds to and interferes with the second coherent beam, or reference wave, at the medium. The resulting pattern is a three-dimensional record (hologram) of the object wave. 2. The recording of an object wave (usually optical) in such a way that an identical wave can subsequently be reconstructed. Whereas a conventional photograph records only the intensity of the light incident on it, a hologram records both the amplitude and phase. The additional phase information is contained in an interference pattern that is formed from the object wave and a reference wave. 3. The science and technique of producing holograms.

**holcite contact system**—A pluggable solderless means of connecting DIP, SIP, and discrete-component packages to printed circuit boards with none of the socket material showing above the board surface.

**Home Box Office**—*See HBO.*

**home loop**—An operation involving only those input and output units associated with the hole terminal.

**home-on-jam**—A radar feature that permits angular tracking of a jamming source.

**home page**—1. An HTML document associated with an individual or organization. It contains text, pictures, sounds, and links to other sites that appear (generally in blue) as underlined words or phrases. Clicking on these underlined words opens a network connection to other HTML documents, which can be anywhere on the Internet, or spawns an application on the host computer. 2. An HTML page that is the primary or index document representing an entity such as a company or individual. It is usually the first page received from a web server and, as such, serves as an introduction to the entity or content being served. 3. The first screen of a collection of web sites particular to one person or business.

**hometaxial-base transistor**—A transistor manufactured by a single-diffusion process so that both the emitter and collector junctions are formed in a uniformly doped silicon slice. The homogeneously doped base region that results is free from accelerating fields in the axial (collector-to-emitter) direction; such fields could cause undesirable high flow and destroy the transistor.

**homing**—1. Approaching a desired point by maintaining some indicated navigational parameter constant

(other than altitude). 2. In missile guidance, the use of radiation from a target to establish a collision course.

**homing adapter**—A device used with an aircraft radio receiver to produce aural and/or visual signals that indicate the direction of a transmitting radio station.

**homing antenna**—A type of directional-antenna array used for pinpointing a target.

**homing beacon**—A radio transmitter that emits a distinctive signal for determining bearing, course, or location.

**homing device**—1. An automatic device that moves or rotates in the correct direction without first having to go to the end of its travel in the opposite direction. 2. A radio device that guides an aircraft to an airport or transmitter site.

**homing guidance**—A missile-guidance system in which the missile steers itself toward a target by means of a self-contained mechanism (infrared detectors, radar, etc.). It is activated by some distinguishing characteristic of the target. Homing guidance may be active, semi-active, or passive.

**homing guidance system**—A system of sensors and related instrumentation that allows a navigable object (usually a missile) to locate its destination by some distinguishing characteristics of that target, and then calculate and alter its course so that the destination is reached.

**homing relay**—A stepping relay that returns to a specified starting position prior to each operating cycle.

**homing station**—A radionavigational aid incorporating direction-finding facilities.

**homodyne reception**—Also called zero-beat reception. 1. A form of reception in which the receiver generates a signal at the original carrier frequency and combines it with the incoming signal. 2. A system of reception using a locally generated voltage at the carrier frequency.

**homogeneity**—The state or condition of being similar in nature, kind, or degree.

**homogeneous**—Of the same nature (the opposite of heterogeneous). That property of a substance that determines that all components of volume are the same relative to composition and other properties.

**homogeneous crystal**—Crystalline material having a uniform composition. In the context of impurity semiconductor materials, a homogeneous crystal is one having a uniform doping concentration.

**homogeneous multiprocessor**—A multiprocessor in which all processors of significance are functionally identical.

**homologous field**—A field in which the lines of force in a given plane all pass through one point (e.g., the electric field between two coaxial charged cylinders).

**homopolar**—Electrically symmetrical, i.e., having equally distributed charges.

**homopolar generator**—A dc generator in which all the poles presented to the armature are of the same polarity, so that the armature conductor always cuts the magnetic lines of force in the same direction. A pure direct current can thus be produced without commutation.

**homopolar magnet**—A magnet with concentric pole pieces.

**homosphere**—That part of the atmosphere which is made up mostly of atoms and molecules found near the earth's surface and which retains the same relative proportions of oxygen, nitrogen, and other gases throughout.

**homotaxial**—A term coined by RCA from *homogeneous* and *axial* to describe a single-diffused transistor with a base region of homogeneous resistivity silicon on the axial (emitter-to-collector) direction.

**honeycomb coil — horizontal field-strength diagram**

**honeycomb coil**—An air-core radio-frequency inductance wound in a crisscross lattice to reduce its distributed capacitance.

**honeycomb winding**—A method of winding a coil with crisscross turns to minimize distributed capacitance.

**hood**—1. A shield placed over a cathode-ray tube to eliminate extraneous light and thus make the image on the screen appear more clearly. 2. An enclosure, attached to the back of a connector, to contain and protect wires and cable attached to the terminals of a connector. A cable clamp is usually an integral part of the hood.

**hood contact**—A switch that is used for the supervision of a closed safe or vault door. Usually installed on the outside surface of the protected door.

**hook**—1. Hidden capacitance between conductors on a printed wiring board. Molecular structure causes capacitance change with frequency. Hook is responsible for signal-waveshape distortion and timing problems. 2. The effect on a signal's voltage caused by a change in printed circuit board capacitance with frequency. Board capacitance is created between printed circuit board conductors separated by dielectric material. It can change the response time of a square wave and can bring about erroneous responses at certain frequencies of sine waves.

**hookswitch**—The device on which a telephone receiver hangs or on which a telephone handset hangs or rests when not in use. The weight of the receiver or handset operates a switch that opens the telephone circuit, leaving only the bell connected to the line. When the handset is lifted, the switch closes the telephone circuit or loop.

**hook terminal**—Terminal with a hook-shaped tongue.

**hook tongue**—Type of terminal with a tongue that opens from the side rather than from the end.

**hook transistor**—A transistor having four alternating p-type and n-type layers, with one layer floating between the base layer and the collector layer. This arrangement gives high emitter-input current gains. The npn transistor has a p-type floating layer, while the npn transistor has an n-type floating layer.

**hookup**—1. Method of connection between the various units in a circuit. 2. The diagram of connections used. 3. An interconnection of circuit components for a particular purpose.

**hookup wire**—1. The wire used in coupling circuits together. It may be solid or stranded, and is usually tinned and insulated No. 18 or 20 soft-drawn copper. 2. Wire used for point-to-point connection within electronic equipment, usually carrying low voltages (under 1000 V) and currents. 3. Wire used to make the internal connections between the various electrical parts of electronic assemblies.

**hop**—An excursion of a radio wave from the earth to the ionosphere and back. It is usually expressed as single-, double-, and multihop. The number of hops is called the order of reflection.

**hopoff**—In a potentiometer, the sudden jump in resistance as the contact is rotated over the junction of two resistance slopes. The magnitude of the hopoff is dependent on the ratio of the slopes and on the junction blending characteristic.

**hopper**—An area in a temporary memory unit, such as a call store, used to record a list of items for subsequent communications with processing programs or input-output programs sent to central control.

**horizon**—An apparent or visible junction of earth and sky as seen on or above the earth. It bounds the part of the earth's surface that can be reached by the direct wave

of a radio station. The distance to the horizon is affected by atmospheric refraction.

**horizon distance**—The space between the farthest visible point and the transmitter antenna. It is the distance over which ultrahigh-frequency transmission can be received under ordinary conditions with an unelevated receiving antenna.

**horizontal**—1. Perpendicular to the direction of gravity. 2. In the direction of or parallel to the horizon. 3. On a level.

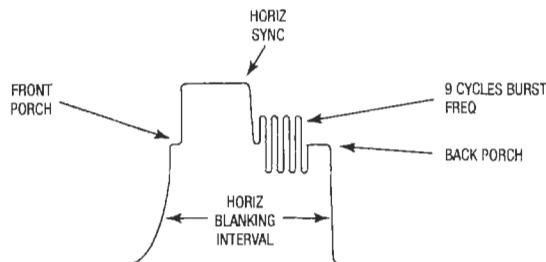
**horizontal angle of deviation**—The horizontal angle between the great-circle path from the transmitter to the receiver and the direction of departure or arrival of the wave along the line of propagation.

**horizontal axes**—The three horizontal axes of crystallographic reference.

**horizontal blanking**—Cutting off the CRT electron beam between successive active horizontal lines during retrace. Blanking of the picture during the period of horizontal retrace.

**horizontal blanking interval**—The brief time between scan lines required for the scanning electron gun to retrace from the right edge of the image back to the left to begin the next scan line.

**horizontal blanking pulse**—A rectangular pedestal in the composite television signal. It occurs between active horizontal lines and cuts off the beam current of the picture tube during retrace.



Horizontal blanking pulse.

**horizontal centering control**—In a television receiver or cathode-ray oscilloscope, the adjustment for moving the entire display back and forth.

**horizontal-convergence control**—In a color television receiver, the control that adjusts the amplitude of the horizontal dynamic convergence voltage.

**horizontal definition**—See horizontal resolution.

**horizontal-deflecting electrodes**—A pair of electrodes that move the electron beam from side to side on the screen of a cathode-ray tube employing electrostatic deflection.

**horizontal-discharge tube**—A vacuum tube used in the horizontal-deflection circuit to discharge a capacitor and thereby form the sawtooth scanning wave. See also discharge tube.

**horizontal-drive control**—In an electromagnetically deflected television receiver, the control that adjusts the ratio of the pulse amplitude to the linear portion of the scanning-current wave.

**horizontal dynamic convergence**—Convergence of the three electron beams in a color picture tube at the aperture mask during scanning of a horizontal line.

**horizontal field-strength diagram**—A representation of the field strength in a horizontal plane and at

a constant distance from an antenna. Unless otherwise specified, the plane passes through the antenna.

**horizontal frequency** — See line frequency, 1.

**horizontal hold control** — A synchronization control that varies the free-running frequency of the horizontal deflection oscillator so it will be in step with the scanning frequency at the transmitter.

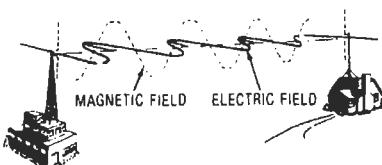
**horizontal hum bars** — Broad, horizontal, moving or stationary bars, alternately dark and light, that extend over an entire television picture. They are caused by interference at approximately 60 Hz or a harmonic of 60 Hz.

**horizontal-linearity control** — In a television receiver, the control for adjusting the width at the left side of the screen.

**horizontal line frequency** — See line frequency, 1.

**horizontal lock** — The circuit that maintains horizontal synchronization in a television receiver.

**horizontally polarized wave** — A linearly polarized wave with a horizontal electric-field vector.



Horizontally polarized wave.

**horizontal-output transformer** — See flyback transformer.

**horizontal parabola control** — See phase control, 1.

**horizontal polarization** — 1. Transmission in which the electrostatic field leaves the antenna in a horizontal plane. Elements of the transmitting and receiving antennas likewise are horizontal. Horizontal polarization is standard for television in the United States. 2. Transmission of radio waves whose undulations vary horizontally with respect to the earth. (Horizontally polarized antennas are used mainly for base-to-base transmission.)

**horizontal redundancy checking** — See HRC.

**horizontal repetition rate** — Also called horizontal scanning frequency. The number of horizontal lines per second (15,750 hertz in the United States).

**horizontal resolution** — Also called horizontal definition. 1. The number of individual picture elements that can be distinguished in a horizontal scanning line. 2. The capability of a TV system to resolve detail in a horizontal direction across the screen. The higher the resolution number, the sharper the picture will be. 3. The number of vertical lines that can be displayed in a picture width equal to the picture height. This measurement is usually done via direct (RGB or Y/C) input in order to bypass limiting factors such as transmission standards (bandwidth, color carrier, etc.). For standard NTSC (60 Hz, 525 lines, 4:3 aspect ratio) and PAL (50 Hz, 625 lines, 4:3 aspect ratio), the picture is in practice the same: 80 lines per MHz bandwidth.

**horizontal retrace** — 1. The return of the electron beam from the right to the left side of a CRT raster after the scanning of one line. 2. The line that would be seen on a CRT screen while the spot is returning from right to left, if retrace blanking were not used.

**horizontal ring-induction furnace** — A furnace for melting metal. It comprises an open trough or melting

channel, a primary inductor winding, and a magnetic core that links the melting channel to the primary winding.

**horizontal-scanning frequency** — See horizontal repetition rate.

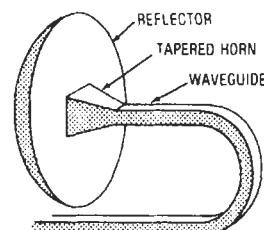
**horizontal sweep** — Movement of the electron beam from left to right across the screen or the scene being televised.

**horizontal-sync discriminator** — A circuit employed in the flywheel method of synchronization to compare the phase of the horizontal-sync pulses with that of the horizontal-scanning oscillator.

**horizontal-sync pulse** — The rectangular pulse that occurs above the pedestal level between each active horizontal line. The pulses keep the horizontal scanning at the receiver in step with that at the transmitter.

**horn** — Also called an acoustic horn. 1. A tubular or rectangular enclosure for radiating or receiving acoustic waves. 2. A primary element consisting of a section of metal waveguide in which one or both of the cross-sectional dimensions increase toward the open end. 3. Any flared or funnel-shaped passage used to couple a speaker efficiently to the air in the environment. It also provides control over sound dispersion pattern over a specified frequency range. The driver is connected to the throat of the horn, and the sound emerges from its mouth. *See also horn antenna.*

**horn antenna** — Also called a horn. 1. A tubular or rectangular microwave antenna that is wider at the open end and through which radio waves are radiated into space. 2. A microwave antenna formed by flaring the end of a waveguide into the shape of a horn.



Horn antenna.

**horn arrester** — A lightning arrester that has a spark gap with upward-projecting diversion horns of thick wire. When the arc is formed, it travels up the gap and is extinguished upon reaching the widest part of the gap.

**horn cutoff frequency** — A frequency below which an exponential horn will not function correctly because it fails to provide for proper expansion of the sound waves.

**horn gap** — A type of spark gap with divergent electrodes.

**horn-gap switch** — A form of air switch with arcing horns.

**horn loading** — A method of coupling a speaker diaphragm to the listening space by an expanding air column having a small throat and large mouth.

**horn loudspeaker** — A very directional speaker in which the driver is fed into a metal horn, whose flare is usually an exponential curve.

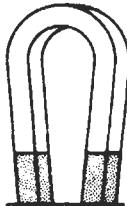
**horn mouth** — An open-ended metallic device for concentrating energy from a waveguide and directing this energy into space.

**horn speaker** — A speaker in which a horn couples the radiating element to the medium.

**horn throat** — The narrow end of a horn.

**horsepower**—Abbreviated hp. A unit of power, or the capacity of a mechanism to do work. It is the equivalent of raising 33,000 pounds 1 foot in 1 minute, or 550 pounds 1 foot in 1 second. One horsepower equals 746 watts.

**horseshoe magnet**—A permanent magnet or electromagnet shaped like a horseshoe or U to bring the two poles close together.



Horseshoe magnet.

**host**—1. A node computer on a network. The etymology of the term *host* may be from the days when a computer on a network hosted multiple users and services. 2. Any computer on a network that is a repository for services available to other computers on the network. It is quite common to have one host machine provide several services, such as WWW and Usenet. 3. The primary or controlling computer in a multiple-part system.

**host computer**—1. In the context of networks, a computer that directly provides service to a user. In contrast to a network server, which provides services to a user through an intermediary host computer. 2. The master or controlling computer in a multicomputer network. 3. A computer that prepares programs to be run on another computer system. 4. A computer that monitors and controls other computers and programmable controllers. 5. The central computer (or one of a collection of computers) that provides functions such as computation, database access, or special programs or programming languages; often shortened to *host*. 6. The central computer (or one of a collection of computers) in a data-communications system, which provides the primary data-processing functions such as computation, database access, or special programs or programming languages.

**host system**—The computer system in which an emulation program or accessory card is used to imitate another system.

**hot**—1. Connected, alive, energized; pertains to a terminal or any ungrounded conductor. 2. Not grounded. 3. Strongly radioactive. 4. Excited to a relatively high energy level. 5. Idiomatic term generally used to describe conductors carrying an electrical charge.

**hot-carrier diode**—Abbreviated HCD. A diode in which a closely controlled metal-semiconductor junction provides virtual elimination of charge storage. The device has extremely fast turn-on and turn-off times, excellent diode forward and reverse characteristics, lower noise characteristics, and wider dynamic range. *See* Schottky barrier diode.

**hot carriers**—In barrier diodes, carriers that have energies greater than those that are in terminal equilibrium with the metal. Thus, electrons that cross the junction from semiconductor to metal must be energetic enough to surmount the barrier. Therefore, electrons that are energetic enough to cross the junction are called hot electrons.

## horsepower — hot-wire microphone

**hot cathode**—Also called thermionic cathode. 1. A cathode that supplies electrons by thermionic emission. (As opposed to a cold cathode, which has no heater.) 2. An electron-tube cathode in which electron emission is produced by heat.

**hot-cathode tube**—Also called thermionic tube. Any electron tube containing a hot cathode.

**hot-cathode X-ray tube**—A high-vacuum X-ray tube in which a hot rather than cold cathode is used.

**hot electrons**—*See* hot carriers.

**hot-electron triode**—A solid-state, evaporated-thin-film structure that is directly equivalent to a triode vacuum tube.

**hotkey**—A single key or a simple key combination that can be used to activate a computer program, or a function in a program.

**hot line**—Communications channel between two points available for immediate use without patching or switching.

**hot plate**—Electrically heated flat surface, sometimes combined with auxiliary equipment such as a magnetic stirrer.

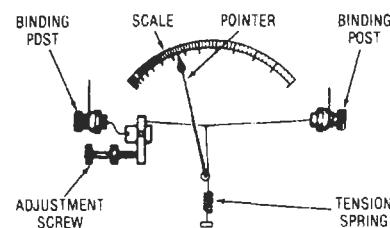
**hot spot**—The point of maximum temperature on the outside of a device or component.

**hot-spot temperature**—The maximum temperature measured on a resistor due to both internal heating and the ambient operating temperature. Maximum hot-spot temperature is predicted on thermal limits of the materials and the design. The hot-spot temperature is also usually established as the top temperature on the derating curve at which the resistor is derated to zero power.

**hot stamping**—Method of imprinting letters, numbers, and symbols with a heated die.

**hot tin dip**—A process of passing a bare wire through a bath of molten tin to provide a coating.

**hot-wire ammeter**—Also called thermal ammeter. An ammeter in which the expansion of a wire moves a pointer to indicate the amount of current being measured. The current flows through the wire and changes its length in proportion to  $I^2$ . Instability because of wire stretching, and the lack of ambient temperature compensation, make the hot-wire ammeter commercially unsatisfactory.



Hot-wire ammeter.

**hot-wire anemometer**—An instrument that measures the velocity of wind or a gas by its cooling on an electrically heated wire.

**hot-wire instrument**—1. An electrothermic instrument operated by expansion of a wire heated by the current it is carrying. 2. A measuring device or transducer whose operation depends either on the expansion of a wire due to its being heated by an electric current or on the change in electrical resistance on the part of a wire that is heated or cooled.

**hot-wire microphone**—A microphone in which the cooling or heating effect of a sound wave changes the resistance of a hot wire and thus the current through it.

**hot-wire relay**—A form of linear-expansion time-delay relay in which the longitudinal expansion of a wire, when heated, provides the mechanical motion to open or close contacts. The time required to heat the wire constitutes the delay.

**hot wires**—In an electrical system, those wires that carry the live current through the electrical system. Hot wires are usually black or red.

**hot-wire transducer**—A unilateral transducer in which the cooling or heating effect of a sound wave changes the resistance of a hot wire and thus the current.

**house cables**—Conductors inside a building used to connect communication equipment to outside lines.

**housekeeping**—In a computer routine, those operations, such as setting up constants and variables for use in the program, that contribute directly to the proper operation of the computer but not to the solution of the problem.

**howl**—An undesirable prolonged wail produced in a speaker by electric or acoustic feedback.

**howler**—1. An electromechanical device that produces an audio-frequency tone. 2. A unit by which the operator at a telephone test desk may apply a high tone of varying loudness to a line to call a subscriber's attention to the fact that his or her receiver is off the hook.

**howling**—System instability caused by acoustic feedback from loudspeaker to microphone.

**howl repeater**—In the operation of telephone repeaters, a condition in which more energy is returned than is sent, with the result that an oscillation is set up on the circuit.

**hp**—Abbreviation for horsepower.

**H-pad**—An attenuation network in which the elements are arranged in the form of the letter H.

**h-parameters**—See hybrid parameters.

**h-particle**—The positive hydrogen ion or proton resulting from bombardment of the hydrogen atom by alpha rays or fast-moving positive ions.

**HPF**—Abbreviation for highest probable frequency.

**H-plane**—The plane in which the magnetic field of an antenna lies. It is perpendicular to the E-plane. The principal H-plane of an antenna is the H-plane that also contains the direction of maximum radiation.

**H-plane bend**—See H-bend.

**H-plane T-junction**—Also called shunt T-junction. A wavelength T-junction in which the structure changes in the plane of the magnetic field.

**HRC**—Abbreviation for horizontal redundancy checking. A validity-checking technique used on data-transmission blocks, in which redundant information is included with the information to be checked.

**H-scan**—See H-display.

**HTL**—Abbreviation for high-threshold logic.

**HTML**—Abbreviation for Hypertext Markup Language. The coding language used to create hypertext documents for use on the World Wide Web. HTML allows a document to contain links to another document, giving WWW its hypertext capabilities.

**HTML page**—A single file document written in HTML. Although this page may require multiple pages of paper if printed, it is typically viewed as a single scrolled page in a web browser.

**HTTP**—Abbreviation for Hypertext Transfer Protocol. A client/server networking protocol for retrieving HTML documents on the World Wide Web. The client software application used in HTTP transactions is a web browser.

**hub**—1. On a control panel or plugboard, a socket or receptacle into which an electrical lead or plug wire may be connected for the purpose of carrying signals. 2. The narrow spindle around which the tape is wound on a reel

or in a cassette. 3. Local distribution center where signals from a master feed are relayed to other inputs.

**hue**—1. Often used synonymously with the term *color*, but does not include gray. It is the dominant wavelength—i.e., the one that distinguishes a color as red, yellow, etc. Varying saturations may have the same hue. 2. A more inclusive and more precise identification of the optical wavelengths than the commonly used word *color*. Rather than state that the maximum daylight sensitivity of the eye is to green-yellow or yellow-green, it is technically more rigorous to state that it occurs at a hue of 555 nanometers. 3. The perceptual term for that aspect of color described by words such as red, yellow, or blue. Achromatic colors, such as white, gray, and black, do not exhibit hue. 4. In color TV, one of the three characteristics of color. Defines color on the basis of its position in the frequency spectrum, i.e., whether red, blue, green, or yellow, etc. See also luminance; saturation.

**hue control**—On a color television receiver, the operating control that changes the hue (color) of the picture.

**hull potential**—The voltage difference between a reference electrode and an immersed metallic hull, or the bonded underwater metallic appendages of a nonmetallic hull.

**hum**—1. In audio-frequency systems, a low-pitched droning noise consisting of several harmonically related frequencies. It results from an alternating-current power supply, ripple from a direct-current power supply, or induction from exposure to a power system. By extension, the term is applied in visual systems to interference from similar sources. 2. A pattern produced on a facsimile record sheet when a signal at the power-line frequency or a harmonic of the power-line frequency is mixed with or modulates the facsimile signal. 3. A continuous low-frequency interference caused by inadvertent pickup of 60-Hz or 120-Hz energy from nearby ac power sources. Most likely to originate in devices (like microphones) requiring substantial amplification. 4. A background tone caused by improper shielding of audio components or inadequate filtering of line voltage entering the equipment. 5. Electrical disturbance at the power supply frequency or harmonics thereof.

**human engineering**—1. The science and art of developing machines for human use, giving consideration to the abilities, limitations, habits, and preferences of the human operator. 2. The determination of man's capabilities and limitations as they relate to the equipment or systems he will use, and the application of this knowledge to the planning, design, and testing of man-machine combinations to obtain optimum performance, operability, reliability, efficiency, safety, and maintainability. 3. The study of the behavioral properties of humans in interaction with machines, and of total human-machine systems; the structuring of human-machine systems to enhance system performance.

**human factors**—A body of scientific facts about human characteristics. The term covers biomedical and psychosocial considerations in the areas of human engineering, personnel selection, training, life support, job performance aid, and human-performance evaluation.

**humanoid**—Robot in the form of a person.

**hum-balancing pot**—A potentiometer usually placed across the heater circuit. Its arm is grounded so that the heater voltage is balanced with respect to ground.

**hum bar**—A dark band extending across the picture. It is caused by excessive 60-Hz hum (or harmonics) in the signal applied to the picture-tube input.

**hum bars**—Relatively broad horizontal bars, alternately black and white, that extend over an entire TV picture. They may be stationary or may move up and

down. Sometimes referred to as a venetian-blind effect, they are caused by an approximate 60-Hz interfering frequency or one of its harmonic frequencies.

**hum-bucking**—The introduction of a small amount of voltage, at the power-line frequency, into a circuit to cancel unwanted power.

**hum-bucking coil**—A coil wound around the field coil of a dynamic speaker and connected in series opposition with the voice coil. In this way, any hum voltage induced in the field coil will be induced in the voice coil in the opposite direction and will buck, or cancel, the effects of the hum.

**humidity**—1. An indication of the water-vapor content of a gas mixture. 2. The amount of moisture in the air. Measured in percent relative humidity.

**humidity transducer**—A layer of hygroscopic (moisture-absorbing) substance deposited between two metal electrodes. These electrodes establish electrical contact with the hygroscopic chemical, which serves as a resistance element. Since the chemical coating tends to absorb moisture from the surrounding air, its resistance decreases as the humidity increases. In this manner, humidity variations are converted to resistance variations.

**hum loop**—A condition arising from the connection of two or more grounds to an amplifier system whereby circulating currents of low value at power-line frequency and harmonics are added to the program signals, causing hum to appear in the background.

**humming**—A sound produced by transformers having loose laminations or by magnetostriction effects in iron cores. The frequency of the sound is twice the power-line frequency.

**hum modulation**—Modulation of an rf signal or detected audio-frequency signal by hum. This type of hum is heard only when the receiver is tuned to a station.

**hunting**—1. Continuous, cyclical searching by a control system for a desired or ideal value. Rapid hunting usually is termed oscillation; slower cycling is called bird-dogging. 2. Movements of a selector from terminal to terminal until an idle one is found.

**HV**—Abbreviation for high voltage.

**H-vector**—A vector that represents the magnetic field of an electromagnetic wave. In free space, it is perpendicular to the E-vector and the direction of propagation.

**H-wave**—A mode in which electromagnetic energy can be transmitted in a waveguide. An H-wave has an electric field perpendicular to the length of the waveguide, and a magnetic field parallel as well as perpendicular to the length.

**hybrid**—1. An electronic circuit that contains both vacuum tubes and transistors. 2. A mixture of thin-film and discrete integrated circuits. 3. A computer that has both analog and digital capabilities. 4. See hybrid junction. 5. A transformer or combination of transformers or resistors that affords paths to three branches, A, B, and C, so arranged that A can send to C, and B can receive from C, but A and B are effectively isolated. 6. A mixture or combination of two different technologies. 7. Made up of several different components. 8. A telephone circuit that joins a two-wire line to a four-wire line. Originally, hybrids were transformers, but today they are electronic circuits. 9. In telecommunications, a circuit that divides a signal transmission channel into two channels (i.e., one for each direction) or, conversely, combines two channels into one.

**hybrid arrangement**—On a telephone system, the use of hybrid-type transformers with carrier circuits or two-wire repeaters to amplify conversations in both directions without causing feedback or singing effects.

## hum-bucking — hybrid integrated circuit

**hybrid balance**—A measure of the degree of balance between two impedances connected to two conjugate sides of a hybrid set. Given by the formula for return loss. The better the balance, the greater is the transhybrid loss.

**hybrid circuit**—1. A circuit that combines the thin-film and semiconductor technologies. Generally, the passive components are made by thin-film techniques, and the active components by semiconductor techniques. The active devices are attached to the thin-film passive components by a suitable bonding process. 2. Also called two-wire-four-wire terminating set. In telephone transmission circuits, a circuit for interconnecting two-wire and four-wire circuits through a differential balance or bridge circuit in which the two sides of the four-wire circuit form conjugate arms. 3. Any circuit made by using a combination of the following component manufacturing technologies: monolithic IC, thin film, thick film, and discrete component. 4. An integrated microelectronic circuit in which each component is fabricated on a separate chip or substrate, interconnected by means of lead wires so that each component can be independently optimized for performance. Example: a circuit package composed of transistor and diode dice, capacitor chips, and thick-film resistors and conductors.

**hybrid coil**—Also called bridge transformer. 1. A single transformer that has, effectively, three windings and that is designed to be connected to four branches of a circuit so as to render these branches conjugate in pairs. 2. A four-winding transformer used at the junction between a two-wire and a four-wire circuit. It effectively separates the transmit and receive paths. 3. A hybrid consisting of a three-winding tapped transformer used with a balancing network to convert a four-wire telephone line to a two-wire line.

**hybrid computer**—1. A computer that results from the interconnection of an analog computer and a digital computer, plus conversion equipment, each contributing its special advantages to an assigned part of the solution of a class of complex problems. 2. A computer that combines both analog and digital equipment for purposes of solving problems that cannot be adequately or economically handled by either type of computer operating independently. The term does not denote the use of some analog equipment to preprocess data that is then converted to digital form and subsequently entered into a conventional digital computer. Rather, there is usually a continual flow of data in both directions between analog and digital equipment. 3. A computer for data processing in which both analog and discrete representations of data are used. 4. A computer designed with both digital and analog characteristics, combining the advantages of analog and digital computers when working as a system.

**hybrid electromagnetic wave**—Abbreviated HEM wave. A wave in the electromagnetic spectrum that has both electric and magnetic field vectors in the direction of propagation.

**hybrid electromechanical relay**—A relay with isolated input and output in which electromechanical and electronic devices such as a solid-state amplifiers are combined to perform a switching function with an electromechanical output.

**hybrid integrated circuit**—Abbreviated HIC. 1. An integrated circuit combining parts made by a number of techniques, such as diffused monolithic portions, thin-film elements, and discrete devices. 2. An arrangement consisting of one or more integrated circuits in combination with one or more discrete passive devices. Alternatively, the combination of more than one type of integrated circuit into a single integrated component. Hybrid ICs offer more circuit complexity than can be achieved with present-generation monolithic ICs. 3. A

composite of either monolithic integrated circuits or discrete semiconductor device circuits, in a unit-packaging configuration. 4. The physical realization of electronic circuits or subsystems from a number of extremely small circuit elements electrically and mechanically interconnected on a substrate. 4. The combination of thin-film or thick-film circuitry deposited on a substrate with chip transistors, capacitors, and other components. Thin-film construction is used for microwave integrated circuits (MICs).

**hybrid junction** — 1. A transformer or waveguide circuit having four terminals (or four ports) so arranged that a signal entering at one terminal will divide and emerge from the two adjacent terminals but will be unable to reach the opposite terminal. Hybrid junctions (quadrature hybrids) are widely used in microwave circuits as power dividers and combiners (e. g., in balanced amplifiers, double-balanced mixers). 2. Also called hybrid tee or magic tee. A waveguide arrangement with four branches. When they are properly terminated, energy is transferred from any one branch into two of the remaining three branches. In common usage, this energy is divided equally between the two. 3. Any network or device that provides a low impedance path and impedance matching between adjacent circuits, but maintains a high degree of isolation between opposite circuits. Several types are common: (a) a three-winding hybrid transformer, (b) a resistance bridge circuit, and (c) a waveguide device known as a hybrid tee.

**hybrid loss** — The transmission loss incurred when a signal goes through a hybrid coil. This loss is about 3.6 dB (3 dB because the current divides into two equal halves, and 0.6 dB for coil loss).

**hybrid microcircuit** — A circuit produced by the combination of several different components in a single package. Hybrids form a middle ground between boards or modules using packaged components and monolithic ICs, which may not offer sufficient performance. Hybrids are commonly formed from a combination of chip or packaged active devices and thin- or thick-film passive devices.

**hybrid microelectronics** — The entire body of electronic art that is connected with or applied to the realization of electronic systems using hybrid circuit technology.

**hybrid network** — A nonhomogeneous communication network required to operate with signals of dissimilar characteristics (such as analog and digital modes).

**hybrid parameters** — Also called h-parameters. The resultant parameters of an equivalent transistor circuit when the input current and output voltage are selected as independent variables.

**hybrid ring** — Also called a rat race. A hybrid junction commonly used as an equal power divider. It consists of a reentrant line (waveguide) to which four side arms are connected. The line is of the proper electrical length to sustain standing waves.

**hybrids** — A particular type of circuit or module consisting of a combination of two or more integrated circuits, or one integrated circuit and discrete elements. See hybrid integrated circuit.

**hybrid set** — Two or more transformers interconnected to form a network having four pairs of accessible terminals. Four impedances may be connected to the four terminals, so that the branches containing them may be made conjugate in pairs.

**hybrid solid-state relay** — A relay with isolated input and output in which electromechanical and electronic devices are combined to perform switching functions with a solid-state output. Typically, a reed switch is used to trigger a solid-state output device.

**hybrid tee** — See hybrid junction, 2.

**hybrid thin-film circuit** — A microcircuit formed by attaching discrete components and semiconductor devices to networks of passive components and conductors that have been vacuum deposited on glazed ceramic, sapphire, or glass substrates.

**hybrid transformer** — See hybrid coil.

**hybrid-type circuit** — See hybrid integrated circuit; multichip circuit.

**hydraulic robot** — Programmable machine that uses hydraulic motors and cylinders much as pneumatic robots use pneumonic motors and cylinders. In most cases these motors and cylinders are controlled by servo valves, a system that permits smooth motion as well as high lifting capacity. However, some hydraulic robots control their motors and cylinders with mechanical stops.

**hydroelectric** — The production of electricity by water power.

**hydrogen electrode** — A platinum electrode covered with platinum black, around which a stream of hydrogen is bubbled. The hydrogen electrode furnishes a standard against which other electrode potentials can be compared.

**hydrogen lamp** — A special light source, used in some spectrophotometers, that produces invisible light energy. It is used in finding the light-energy frequency of test solutions.

**hydrogen thyratron** — A thyratron containing hydrogen.

**hydrolysis** — The chemical decomposition of a substance in the presence of water. Usually, it is considered in the sense of chemical degradation of insulating materials under the influence of heat or pressure and in contact with moisture (for example, hydrolysis of polyester films and coatings).

**hydromagnetics** — See magnetohydrodynamic power generator.

**hydromagnetic waves** — Waves in which the energy oscillates between the magnetic field energy and kinetic energy of the hydrodynamic motion, the reservoirs being the self-inductance of the conductive matter and the mass inertia of the moving fluid.

**hydrometer** — An instrument for determining the specific gravity of liquids, especially of a storage-battery electrolyte. It consists of a weighted glass float having a graduated stem that sinks into the liquid to a point determined by the specific gravity of the liquid. The float is usually contained in a glass, and a rubber syringe is used to withdraw a sample of the liquid.

**hydrophone** — An electroacoustic transducer that responds to waterborne sound waves and delivers essentially equivalent electric waves.

**hydrostatic pressure** — See static pressure.

**hygrometer** — An instrument that measures the relative humidity of the atmosphere.

**hygroscopic** — Readily capable of absorbing and retaining moisture from the atmosphere. The opposite term is nonhygroscopic.

**hygrostat** — A device that closes a pair of contacts when the humidity reaches a prescribed level.

**hyperbola** — 1. A curve that is the locus of points having a constant difference of distance from two fixed points. 2. In hyperbolic guidance systems, a path along which the difference between the arrival times of pulses from two transmitters is constant. See also hyperbolic guidance system.

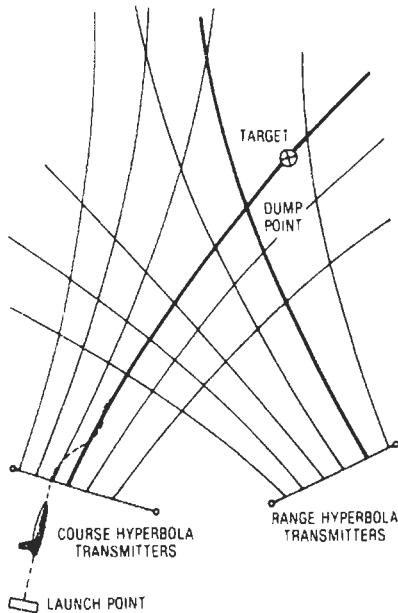
**hyperbolic error** — The error in an interferometer system arising from the assumption that the directions of the wavefronts incident at two antennas of a base

**hyperbolic grind — hysteresis**

line are parallel, whereby the equiphase path is a cone. Mathematically the equiphase path is a hyperbola.

**hyperbolic grind**—A shape of tape playback and record heads. It permits good head contact and better response at high frequencies.

**hyperbolic guidance system**—A method of guidance in which sets of ground stations transmit pulses from which a hyperbolic path can be derived to give range and course information for steering. *See also* hyperbola.



*Hyperbolic guidance.*

**hyperbolic head**—A recording head whose pole-piece surfaces (when viewed from the edge of the tape) are shaped like the graph of a mathematical hyperbolic function. This shape offers a good compromise between intimate tape contact at the gap and proximity to the tape of the rest of the pole-piece face (the latter is necessary for good low-frequency response).

**hyperbolic horn**—A horn in which the equivalent cross-sectional radius increases according to a hyperbolic law.

**hyperbolic navigation system**—A method of radionavigation (e.g., loran) in which pulses transmitted by two ground stations are received by an aircraft or ship. The difference in arrival time from each station is a measure of the difference in distance between the aircraft or ship and each station. This distance is plotted on one of many hyperbolic curves on a map. A second reading from another pair of stations (or from the same master and a different slave) establishes another point on a different hyperbolic curve. The intersection of the two curves gives the position of the aircraft or ship.

**hyperboloidal subreflector**—The secondary reflector used in a Cassegrain antenna system. The surface has a hyperbolic shape.

**HyperCard**—A software tool introduced by Apple computer in 1987 to provide new ways to organize, display, and navigate through data that broadened the capability of the Macintosh computer so noncomputer programmers could design and write their own computer applications.

**hyperfocal distance**—That object distance at which a camera must be focused so that the far depth of field just extends to infinity. The near limit of the depth of field is then half the hyperfocal distance. For normal photographic work this distance equals 1000 times the lens aperture diameter.

**hyperfrequency waves**—Microwaves having wavelengths in the range from 1 centimeter to 1 meter.

**hyperlink**—On a computer screen, a colored section of text (usually blue) that, when clicked, takes one to another web page.

**hypersensor**—A single-component, reset-table circuit breaker that operates as a majority-carrier tunneling device. It is used to provide overcurrent or overvoltage protection of integrated circuits.

**hypersonic**—Having five or more times the speed of sound.

**hypertext**—1. A concept for organizing information made possible by computers, in which keywords or phrases not only reference additional resources but also serve as software links to these resources. When viewing an HTML document with a browser, hypertext links or anchors are displayed (usually in blue) as underlined text. Clicking on this text immediately establishes a network connection to another file (or another place in the same file) containing more information on the underlined subject, and causes the browser to display this information. The other file can be anywhere on the Internet, and may contain almost anything including text, images, movies, or sounds. 2. A system that allows documents to be cross-linked in such a way that the reader can explore related documents by clicking on a highlighted word or symbol. 3. Generally, any text that contains links to other documents—words or phrases in the document that, when selected by a reader, cause another document to be retrieved and displayed.

**hypersyn motor**—A synchronous motor that combines the desirable features of the induction, hysteresis, and dc-excited synchronous motor, resulting in high efficiency and power factor. It possesses the vigorous starting torque of an induction motor, the synchronization torque of a hysteresis motor, and the stiffness of an externally dc-excited synchronous motor.

**hysteresigraph**—A device for experimentally presenting or recording the hysteresis loop of a magnetic specimen.

**hysteresis**—1. A property of all magnetic materials that causes the value of magnetic flux density to lag behind the change in value of the magnetizing force that produces the flux. It is caused by the reluctance of the molecules to change their orientation. Work done to move the molecular magnets is a loss and appears in the form of heat. 2. A type of oscillator behavior in which multiple values of the output power and/or frequency correspond to given values of an operating parameter. 3. The temporary change in the counting rate-versus-voltage characteristic of a radiation-counter tube (caused by previous operation). 4. The difference between the response of a unit or system to an increasing and a decreasing signal. 5. A form of nonlinearity in which the response of a circuit to a particular set of input conditions depends not only on the instantaneous values of those conditions, but also on the immediate past (recent history) of the input and output signal. Hysteretical behavior is characterized by inability to retrace exactly on the reverse swing a particular locus of input/output conditions. 6. The lag in the response of an instrument or process when a force acting on it changes abruptly. 7. The property of a magnetic material by virtue of which the magnetic induction for a given magnetizing force depends on the previous conditions of magnetization. 8. This term literally means to lag behind.

It is quite often used to describe the residual effect that remains after the primary effect has been removed, or the lag that exists between the responding parameter and the changing parameter. It can be seen in stress-strain and magnetizing-force magnetic-field relationships. 9. A tendency for a display element to stay in either the on or off condition once it has been switched. With hysteresis, for example, a sustaining voltage can be applied to a display to keep all lighted pixels glowing without lighting any that are supposed to be off.

**hysteresis brake** — See hysteresis clutch.

**hysteresis clutch** — Also called hysteresis brake. A proportional torque-control device that employs the hysteresis effect in a permanent-magnet rotor to develop its output torque. It is capable of synchronous driving or continuous slip, provided heat can be removed, with almost no torque variation at any slip differential. Its control-power requirement is small enough for vacuum-tube or transistorized drive.

**hysteresiscope** — An instrument used to obtain hysteresis loops on a cathode-ray oscilloscope screen without the need for specially prepared ring samples. It is used in the inspection of magnetic material.

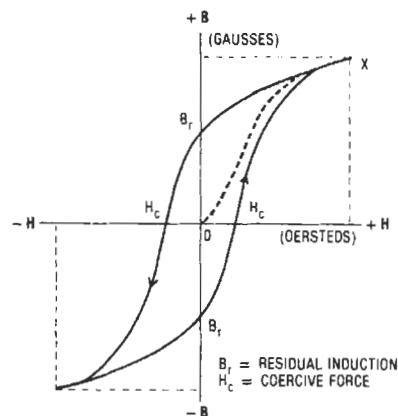
**hysteresis curve** — 1. A curve showing the relationship between a magnetizing force and the resultant magnetic flux. 2. A graph showing the amount of magnetism imparted to a magnetizable material as the result of a varying magnetic field. This coincides with the variations of the applied field only through a relatively narrow range between zero magnetism and saturation, but the addition of a bias allows an audio signal to be recorded on a magnetic tape within this linear range, for minimum distortion.

**hysteresis distortion** — Distortion of waveforms in circuits containing magnetic components. It is due to the hysteresis of the magnetic cores.

**hysteresis error** — The difference in the reading obtained on a measuring instrument containing iron when the current is increased to a definite value and when the current is reduced from a higher value to the same definite value.

**hysteresis heater** — An induction device in which a charge (or a muffle around the charge) is heated by hysteresis losses due to the magnetic flux produced in the charge.

**hysteresis loop** — 1. A curve (usually with rectangular coordinates) that shows, for a magnetic material in a cyclically magnetized condition, two values of the magnetic induction for each value of the magnetizing force: one when the magnetizing force is increasing, the other when it is decreasing. 2. The graphical representation of



Hysteresis loop.

relationship between the magnetizing force and the resultant induced magnetization of a ferromagnetic material when the magnetizing field is carried through a complete cycle of equal and opposite values under cyclic conditions.

**hysteresis loss** — 1. The power expended in a magnetic material as a result of magnetic hysteresis. 2. The power dissipated in a ferromagnetic core as a result of its hysteresis; proportional to the product of the area of the loop, times the frequency, times the volume of the core. 3. Loss that occurs when a rapidly changing current, such as ac, is forced to continually supply energy to an iron core that tends to "memorize" previous magnetic states. 4. The power loss in a magnetic core, such as in a transformer energized by an alternating current, that is due to hysteresis.

**hysteresis meter** — An instrument for determining the hysteresis loss in a ferromagnetic material. It measures the torque produced when the test specimen is placed in a rotating magnetic field or is rotated in a stationary magnetic field.

**hysteresis motor** — A synchronous motor without salient poles or direct-current excitation. It is started by the hysteresis losses induced in its secondary by the revolving field.

**hysteroscope** — An instrument used to observe, measure, and record the magnetic characteristics of both easy and hard axes of magnetic materials.

**Hz** — Letter symbol for hertz, meaning cycles per second (of any periodic phenomenon).

# I

**I**—1. Symbol for current. 2. Abbreviation for luminous intensity.

**IACS**—Abbreviation for International Annealed Copper Standard. A standard of copper conductivity by specifying resistivity and temperature.

**IBM card**—A type of paper card that may have information recorded on it by means of punched holes and that may be read by a computer.

**IC**—1. Abbreviation for integrated circuit. 2. Abbreviation for internal connection.

**ICBO**—The reverse current that occurs when a specific dc voltage is applied in the nonconducting direction to the collector junction of a transistor while the emitter is open-circuited.

**ICE**—Abbreviation for in-circuit emulator and in-circuit emulation.

**ice loading**—The weight of ice an antenna can accumulate without being damaged.

**icon**—A small picture displayed on a computer screen that represents a command or an object that can be manipulated by the user. Usually, the picture shows what the icon does. For example, the PRINT icon generally looks like a printer.

**iconoscope**—A camera tube in which a beam of high-velocity electrons scans a photoemissive mosaic capable of storing an electrical charge pattern.

**IC socket**—Female contact that provides pluggable electrical engagement on its inner surface for integrated circuit components to achieve interfacing to a printed circuit board.

**ICW**—Abbreviation for interrupted continuous wave.

**ID**—Abbreviation for inside diameter.

**ideal bunching**—A theoretical condition in which bunching of the electrons in a velocity-modulated tube would give an infinitely large current peak during each cycle.

**ideal capacitor**—A capacitor having a single-valued transferred-charge characteristic.

**ideal crystal**—A crystal having no mosaic structure and capable of X-ray reflection in accordance with the Darwin-Ewald-Prins law.

**ideal dielectric**—A dielectric in which all the energy required to establish an electric field in the dielectric is returned to the source when the field is removed. (A perfect dielectric must have zero conductivity. Also, all absorption phenomena must be lacking. A vacuum is the only known perfect dielectric.)

**ideal filter**—Any filter in which the range of frequencies within a chosen radius suffers no attenuation and the range of frequencies outside the radius is entirely attenuated.

**ideal-noise diode**—A diode that has an infinite internal impedance and in which the current exhibits full shot-noise fluctuations.

**ideal transducer**—Theoretically, any linear passive transducer that—if it dissipated no energy and, when connected to a source and load, presented its combined impedance to each—would transfer maximum power from source to load.

**ideal transformer**—A hypothetical transformer that would neither store nor dissipate energy. Its self-inductances would have a finite ratio and unity coefficient of coupling, and its self- and mutual impedances would be pure inductances of infinitely great value.

**demodulator**—A demodulator circuit whose inputs are the chrominance signal and the signal from the local 3.58-MHz oscillator. The output of this demodulator is a video signal representing color in the televised scene. The Q demodulator is similar except that its input from the local oscillator is shifted 90°.

**identification**—1. In radar, determining the identity of a displayed target (i.e., which one of the blips in the display represents the target). 2. In a computer, a code number or code name that uniquely identifies a record, block, file, or other unit of information.

**identification beacon**—A code beacon used for positively identifying a particular point on the earth's surface.

**identification, friend or foe**—Abbreviated IFF. A system using radar transmissions to which equipment carried by friendly forces automatically responds, for example, by emitting pulses, thereby distinguishing themselves from enemy forces. It is the primary method of determining the friendly or unfriendly character of aircraft and ships by other aircraft or ships and by ground forces employing radar-detection equipment and associated IFF units.

**identifier**—1. A symbol whose purpose is to identify, indicate, or name a body of data. 2. A mnemonic code used to identify or name an item of data or data format in a computer.

**identify**—In a computer, to attach a unique code or code name to a specific unit of information.

**idiochromatic**—Having photoelectric properties characteristic of the pure crystal itself and not due to foreign matter.

**I-display**—In radar, a display in which a target appears as a circle when the radar antenna is pointed directly at it. The radius of the circle is proportionate to the target distance. When the antenna is not pointing at the target, only a segment of the circle appears. Its length is inversely proportional to the magnitude of the pointing error, and the segment points away from the direction of error.

**idle characters**—Control characters interchanged by a synchronized transmitter and receiver to maintain synchronization during a nondata period.

**idle noise**—1. Noise that exists in a communication system when no signals are present. 2. Unwanted, random

electrical energy present in a transmission system under unmodulated conditions.

**idler**—1. A rubber-tired wheel that transfers power from a phonograph motor to the turntable rim. 2. An intermediate drive wheel, usually with a rubber or neoprene "tire," that transfers rotational energy from a driven wheel to a third wheel. Often used for speed reduction between a drive motor and capstan shaft. *See also* pinch roller.

**idler drive**—1. A drive system used to rotate a turntable, which consists of a drive-shaft that is turned by the motor pulley and that drives the inside rim of the turntable platter. 2. A system for transferring power from a motor to a turntable through a rubber wheel that contacts the motor shaft and the inside rim of the platter.

**idler frequency**—A sum or difference frequency, other than the input, output, or pump frequencies, generated within a parametric device and requiring specific circuit consideration to achieve the desired performance of the device.

**idler pulley**—A pulley used only for tightening a belt or changing its direction. The shaft does not drive any other part.

**idle time**—That portion of available time during which the hardware is not in use.

**idle-trunk lamp**—A signal lamp that indicates that the outgoing trunk with which it is associated is not busy.

**idling current**—Also called quiescent current. The zero-signal power supply current drawn by a circuit or by a complete amplifier.

**IDT**—Abbreviation for interdigital transducer.

**IEC**—1. Abbreviation for integrated electronic component. 2. Abbreviation for International Electrotechnical Commission. An organization that cooperates with the ISO for technology standards.

**IEEE**—Abbreviation for Institute of Electrical and Electronic Engineers. A professional organization of scientists and engineers whose purpose is the advancement of electrical engineering, electronics, and allied branches of engineering and science. (The IEEE resulted from the merger of the IRE and the AIEE.)

**IEEE-488 bus**—Also known as the general-purpose interface bus (GPIB). 1. An interface standard that defines digital data exchange between up to 15 instruments; a bus widely used to connect test instrumentation. 2. An industry-standard bus that defines a digital interface for programmable instrumentation; it uses a byte-serial, bit-parallel technique to handle 8-bit-wide data words. Published by the IEEE in 1975, revised 1978.

**IEM**—Abbreviation for illuminated entry module. An electronic convenience control (offered by Ford Motor and General Motors) that lights up a car's interior and door keyhole slots for a timed interval of about 20 seconds while the car owner unlocks the door.

**IF**—Abbreviation for intermediate frequency.

**IF amplifier**—*See* intermediate-frequency amplifier.

**IF bandwidth**—The range of frequencies centered about the intermediate frequency limited by the -3-dB amplitude points.

**IF canceler**—In radar, a moving-target-indicator canceler operating at intermediate frequencies.

**IFF**—*See* identification, friend or foe.

**IF rejection**—The ability of a superheterodyne AM or FM tuner's IF circuits to reject external interference at the intermediate frequency. Measured in decibels (the higher the better), it is of more significance in AM than in FM reception because the lowest broadcast AM frequency, now 530 kHz, is so close to the standard AM intermediate frequency of 455 kHz.

**IFRU**—*See* interference-rejection unit.

**IF selectivity**—The ability of the IF stages of a superheterodyne receiver to accept the signal from one

station while rejecting the signal of the adjacent stations; it is the ratio of desired to undesired signal required for 30-dB suppression of the undesired signal (IHF standard).

**if statement**—*See* conditional statement.

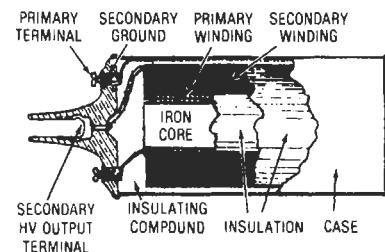
**IF strip**—*See* intermediate-frequency strip.

**IF transformer**—*See* intermediate-frequency transformer.

**IGFET**—Abbreviation for insulated-gate field-effect transistor. Though a less popular term than MOS (metal-oxide semiconductor), it more precisely defines devices made by various MOS processes. *See also* metal-oxide semiconductor field-effect transistor.

**ignition cable**—Cable designed primarily for automotive ignition systems.

**ignition coil**—1. An iron-core transformer that converts a low direct voltage to the 20,000 volts or so required to produce an ignition spark in gasoline engines. It has an open core, a heavy primary winding connected to the battery or other source through a vibrating armature contact, and a secondary winding with many turns of fine wire. 2. That part of the ignition system which acts as a transformer to step up the battery voltage to many thousands of volts. The high-voltage surge then produces a spark at the spark-plug gap.



*Ignition coil.*

**ignition control**—Control of the instant that static current begins to flow in the anode circuit of a gas tube.

**ignition interference**—Noise produced by sparks or other ignition discharges in a car, motor, or furnace ignition, or by equipment with loose contacts or connections.

**ignition reserve**—In a gasoline engine, the difference between the available voltage and the required ignition voltage.

**ignition system**—In an automobile, the system that furnishes high-voltage sparks to the engine cylinders to fire the compressed air-fuel charges. It consists of battery, ignition coil, ignition distributor, ignition switch, wiring, and spark plugs.

**ignition terminal**—Solderless terminal designed for use in automotive ignition work.

**ignition voltage**—In a gasoline engine, the peak voltage required to produce a spark across the plug electrodes.

**ignitor discharge**—In switching tubes, a dc glow discharge between the ignitor electrode and a suitably located electrode. It is used to facilitate radio-frequency ionization.

**ignitor electrode**—An electrode (which is partly immersed in the mercury-pool cathode of an ignitron) used to initiate conduction at the desired points in each cycle.

**ignitor firing time**—In switching tubes, the interval between application of a dc voltage to the ignitor electrode and start of current flow.

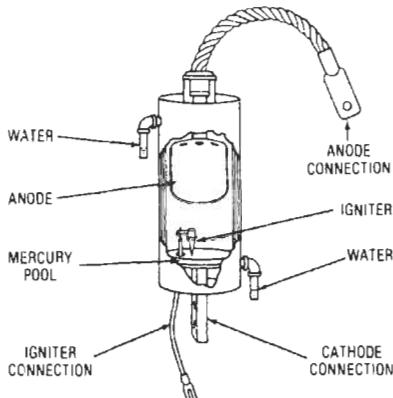
**ignitor interaction**—In a tr, pre-tr, or attenuator tube, the difference between the insertion loss measured at a specified level of ignitor current and that measured at zero ignitor current.

**ignitor leakage resistance**—In a switching tube, the insulation resistance measured between the ignitor electrode terminal and the adjacent rf electrode in the absence of an ignitor discharge.

**ignitor oscillation**—A relaxation type of oscillation in the ignitor circuit of a tr, pre-tr, or attenuator tube.

**ignitor voltage drop**—In switching tubes, the dc voltage between the cathode and anode at a specified ignitor current.

**ignitron**—A type of mercury-pool rectifier that has only one anode. The arc is started for each cycle of operation by an ignitor that dips into the mercury pool. The mercury pool serves as the cathode of the rectifier. The ignitron is characterized by the ability to withstand tube currents several times as high as rated values for a few cycles.



*Ignitron.*

**ignore**—In a computer, a character code indicating that no action is to be taken.

**IGY**—Abbreviation for international geophysical year.

**IHFM**—Abbreviation for Institute of High-Fidelity Manufacturers, an association of manufacturers that publishes ratings and standards for high-fidelity equipment.

**I<sup>2</sup>L**—Abbreviation for integrated injection logic (pronounced "I-squared L"). 1. A bipolar logic circuit that has a much higher packing density than conventional transistor-transistor logic or complementary metal-oxide semiconductor (CMOS), dissipates low power, and has high-speed characteristics. To an extent it combines bipolar speed, MOS circuit density, and the low-power dissipation of CMOS.

**I<sup>3</sup>L®**—Abbreviation for isoplanar integrated injection logic (Fairchild Camera & Instrument Corp.).

**illegal character**—A character or combination of bits that does not have validity according to some criterion; for example, a character that is not a member of a specified alphabet.

**illegal operation**—An impossible-to-execute computer instruction.

**illuminance**—1. The density of luminous flux at a given distance from the center of a source. It is equal to the total flux divided by the surface area over which it is uniformly spread. The units of illuminance are

lumens/cm<sup>2</sup>, lumens/ft<sup>2</sup>, etc. One lumen/ft<sup>2</sup> is the same as a footcandle; one lumen/cm<sup>2</sup> is the same as one phot; and one lumen/m<sup>2</sup> is equal to one lux, or one meter-candle. 2. Luminous flux incident per unit area of a surface; luminous incidence. (The use of the term *illumination* for this quantity conflicts with its more general meaning.)

**illuminant-C**—The reference white of color television—i.e., light that most nearly matches average daylight.

**illuminate**—1. To expose to light. 2. In radar, to strike with a radar signal so that reflection returns the signal to the source for interpretation.

**illuminated**—Characteristic of a surface or object that has luminous flux incident on it.

**illuminated entry module**—See IEM.

**illumination**—1. The light flux incident on a unit projected area; it is the photometric counterpart of irradiance and is expressed in footcandles. 2. The density of the luminous flux incident on a surface; it is the quotient of the luminous flux by the area of the surface, when the latter is uniformly illuminated (SI unit = lux or lx). 3. The general term meaning the application of light to a subject. Should not be used in place of the specific quantity *illuminance*.

**illumination control**—A photorelay circuit that turns on artificial lighting when natural illumination decreases below a predetermined level.

**illumination sensitivity**—The output current of a photosensitive device divided by the incident illumination at constant electrode voltages.

**illuminometer**—A photometric instrument used to measure the illumination falling on a surface. May be photoelectric or visual.

**ILO**—See injection-locked oscillator.

**ILS**—Abbreviation for instrument landing system. A radio beacon system forming a straight pencil beam from the runway that planes can follow from 5 to 7 miles (8 to 12 kilometers) away. An alternative is a microwave landing system.

**image**—1. The instantaneous illusion of a picture on a flat surface. 2. The unused one of the two groups of sidebands generated in amplitude modulation. 3. A spatial distribution of some physical property (e.g., radiation, electric charge, conductivity, or reflectivity) made to correspond with another distribution of the same or another physical property. 4. A two-dimensional representation of an object or a scene formed by creating a pattern from the light received from the scene.

**image admittance**—Reciprocal of image impedance.

**image antenna**—The imaginary counterpart of an actual antenna. For mathematical purposes it is assumed to be located below the ground and symmetrical with the actual antenna.

**image-attenuation constant**—The real part of the transfer constant.

**image compression**—The translation of data in any format (such as video or graphics) to a more compact form for storage or transmission such that it takes up less space in a computer's memory.

**image converter**—1. A solid-state optoelectric device capable of changing the spectral characteristics of a radiant image. Examples of such changes are infrared-to-visible and X-ray-to-visible. 2. An electron tube that employs electromagnetic radiation to produce a visual replica of an image produced on its cathode. Electrons ejected from the photosensitive cathode by the incident radiation are accelerated to and focused upon a fluorescent phosphor screen, thus forming the visual replica. Image converters can be used in the infrared, ultraviolet, and

X-ray regions as well as in the visible. An example of an infrared-sensitive image converter is the snooperscope.

**image-converter tube** — See image tube.

**image dissection** — An optical, mechanical, or electronic process, or a combination of such processes, in which an optical image is divided into discrete segments prior to being photographed, recorded, transmitted, or processed in some other way.

**image dissector** — 1. A television camera tube in which the image is swept past an aperture in a series of 525 interlaced lines 30 times per second. Instead of a beam scanning the image, the entire image is scanned past the aperture, which "dissects" the image — hence the name. See also dissector tube. 2. In OCR, a mechanical or electronic transducer that detects in sequence the light levels in different areas of a completely illuminated sample space.

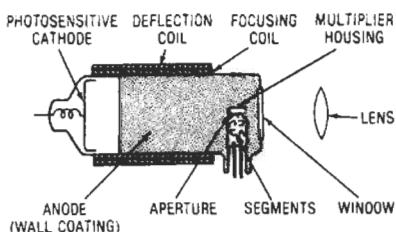


Image dissector, 1.

**image dissector tube** — An electron tube that is used as a camera tube for a television system. When the picture to be transmitted is focused on a photosensitive surface, electrons are emitted from each section of the surface in proportion to the amount of light in that certain part of the picture, and are then drawn down the tube in a positive anode. However, the electrons are still focused in an electric field. The focusing fields are changed regularly to sweep the electron picture horizontally and vertically as it travels down the tube. The picture then passes through an aperture into an electron multiplier, where the output of the multiplier varies with the different parts of the picture. This output represents the dissecting of the picture into ordered parts.

**image distortion** — Failure of the reproduced image in a television receiver to resemble the original scene scanned by the camera.

**image effect** — An effect produced on the field of an antenna as the electromagnetic waves are reflected from the earth's surface.

**image enhancement** — Also called detail enhancement. The process by which the image is manipulated to increase the information extracted by the human visual system.

**image-enhancing equipment** — An elaborate device, often involving a computer, in which a photograph is scanned by a point of light, the amplitude of the electrical signal being modified electronically before being rerecorded on another film.

**image force** — The force on a charge due to that charge or polarization which it induces on neighboring conductors or dielectrics.

**image frequency** — 1. In heterodyne frequency converters, an undesired input frequency capable of producing the selected frequency by selecting one of the two sidebands produced by beating. The word *image* implies the mirrorlike symmetry of signal and image frequencies about the beating oscillator frequency or intermediate

frequency, whichever is higher. 2. An undesired signal obtained in frequency conversion using a mixing or heterodyning process.

**image-frequency rejection ratio** — Of a superheterodyne receiver, the ratio of the response at the desired frequency to the response at the image frequency.

**image iconoscope** — 1. An iconoscope in which greater sensitivity is obtained by separating the function of charge storage from that of photoelectric emission. An optical image is projected on a continuous photosensitive screen, and the electron emission from the back of this screen is focused electromagnetically onto a mosaic screen that is scanned by an electron beam as the original emitron cathode-ray tube. The British term is super-emitron. 2. A camera tube similar in design to the iconoscope. However, the image formed in the image iconoscope is projected on a photocathode that emits photoelectrons to be focused on a material, forming the charge image.

**image impedance** — The impedances that will simultaneously terminate all inputs and outputs of a transducer so that at each of its input and outputs the impedances in both directions are equal.

**image intensifier** — 1. A system for increasing the sensor response to a radiation pattern or image by interposing active elements between the sensor and the image, and supplying power to the active element. This is normally done by focusing the scene to be imaged on the photocathode of the tube, giving rise to a photoelectron pattern corresponding to the optical image. This pattern is accelerated and focused onto a phosphor, which emits light to reproduce a visual image of the scene. 2. Device used in X-ray techniques for brightening the fluoroscopic image several hundred times and reducing radiation exposure. 3. An electronic tube equipped with a light-sensitive electron emitter at one end and a phosphor screen at the other end; an electron lens inside the tube relays the image. This device is used in astronomy and in military and surveillance systems to provide night vision.

**image interference** — In a receiver, a response due to signals of a frequency removed from the desired signal by twice the intermediate frequency.

**image-interference ratio** — In a superheterodyne receiver, the effectiveness of the preselector in rejecting signals at the image frequency.

**image inverter** — A fiber-optic device that rotates an image through a predetermined angle.

**image orthicon** — 1. A camera tube in which a photoemitting surface produces an electronic image and focuses it on one side of a separate storage target. The opposite side of the target is then scanned by low-velocity electrons to produce the output. 2. A camera tube widely used in TV broadcasting. It consists of three sections all included in a single vacuum envelope. The three parts are as follows: (a) A photosensitive film sometimes called the photocathode. The scene to be televised is focused on this film by an outside camera lens. (b) The scanning beam provided by an electron gun, which scans lines of the target film. The gun's beam is deflected by electromagnets within the tube (the whole picture is scanned by the beam in  $1/30$  of a second). (c) A return beam of electrons falls on a multiplier section, where an electron current of sufficient magnitude is developed to be sent out from the broadcast transmitter as a video signal. See Figure on p. 367.

**image phase constant** — The imaginary part of the transfer constant.

**image plane holography** — A type of holographic process in which a lens is used to image the subject in the film plane.

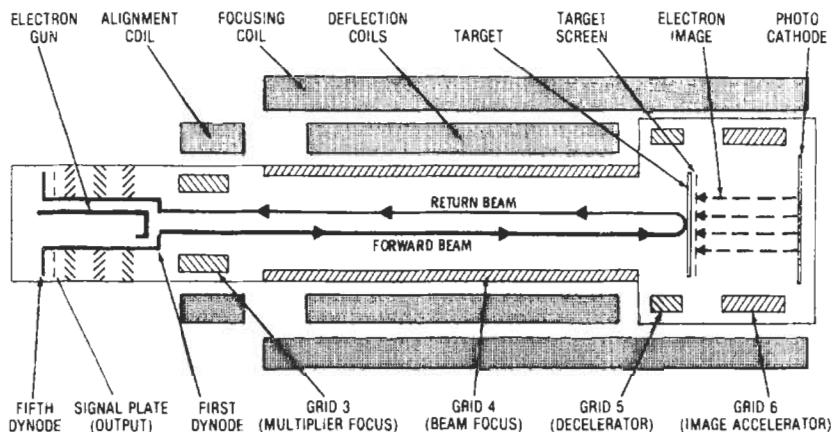


Image orthicon.

**image ratio**—In a heterodyne receiver, the ratio of the image-frequency signal input to the desired signal input for identical amplitude outputs.

**image redundancy**—The multiple storage of a single image.

**image rejection**—1. The suppression of image-frequency signals in a superheterodyne receiver. 2. The rejection by the tuner of a signal at the image (second-channel) frequency, corresponding to the tuned (real) frequency plus twice the intermediate frequency when the local oscillator is working above the signal frequency, or minus twice the intermediate frequency when the local oscillator is working below the signal frequency. 3. The ability of a superheterodyne receiver to ignore signals removed from the desired frequency by twice the intermediate frequency (10.7 MHz in home FM receivers, 455 kHz in home AM receivers). Image response can be reduced by using selective tuned stages in the input circuits of the tuner. As with most tuner rejection or suppression specifications, it is measured in decibels, with higher numbers indicating more suppression.

**image-rejection ratio**—The ratio (in decibels) of the signal required for a 30-dB signal-to-noise ratio to that required for the same ratio but at the image frequency. An increase in front-end selectivity increases the ratio.

**image-reject mixer**—A combination of two balanced mixers and associated hybrid circuits designed for separation of the image channel from the signal channels normally present in a conventional mixer. The arrangement makes possible image rejection of up to 30 dB without the use of filters.

**image response**—The response of a heterodyne receiver to a signal that is separated by twice the intermediate frequency from the frequency to which the receiver is tuned. Unless there is some preselection, images will cause spurious unwanted responses when the spectrum occupied by a signal is greater than twice the frequency of the first IF stage of the receiver.

**image retaining panel**—A type of electroluminescent display that records and maintains an irradiated image on its phosphor screen, provided a dc potential is applied to the screen. Used to record X-ray images, the display can retain an image for up to 30 minutes if the dc potential is maintained.

**image retention**—The vidicon pickup tube's tendency to retain an image on its target area after it has stopped scanning that image. Extreme image retention results in the image being burned into the target area.

**image storage panel**—A modified form of an image retaining panel that can be used in subdued daylight. This is achieved by the addition of a layer of zinc oxide between the panel's phosphor layer and its rear electrode. The zinc oxide cannot be made photoconductive by low-intensity daylight, but does become so when exposed to X-rays. An electroluminescent image is obtained by the application of ac voltage to the panel following its exposure to the X-rays.

**image transducer**—Any arrangement of a bundle of optical fibers that alters the shape of the image. For example, by a systematic regulation of the spacing of the fibers from the entrance end to the exit end, a distortion of the image can occur that may be used to neutralize or compensate for the distortion introduced by the lens, prism, or mirror components in an optical system.

**image-transfer constant**—See transfer constant.

**image tube**—Also called an image-converter tube. An electron tube that reproduces on its fluorescent screen an image of an irradiation pattern incident on its photosensitive surface.

**image-tube camera**—A camera system in which the image formed on the fluorescent screen of an image converter tube in the system is recorded by photography, or direct-contact printing from the face of the tube.

**imaging**—The process of creating and manipulating data for visual presentation and storage.

**imbedded layer**—A conductor layer deposited between insulating layers.

**IMD**—See intermodulation distortion.

**imitative deception**—The transmission of messages in the enemy's communication channels for the purpose of deceiving him or her.

**immediate access**—The ability of a computer to put data in storage or remove it from storage without delay.

**immediate-access store**—A store whose access time is negligible compared with other operating times.

**immediate addressing**—1. In a computer, a mode of addressing in which the operand contains the value to be operated on, and no address reference is required. 2. An addressing mode in which the data for an instruction is the next sequential byte in the instruction stream.

**immediate data**—Data that immediately follows an instruction in a memory and is used as an operand by that instruction.

**immersion plating**—1. A method of metal deposition that depends on a galvanic displacement of the metal

being plated by the substrate. Thickness of the plating is limited to 10 to 50 microinches (0.254 to 1.27  $\mu\text{m}$ ). 2. The chemical deposition of a thin metallic coating over certain base metals by a partial displacement of the base metal.

**immersion pyrometer**—An instrument for determining molten-steel temperature and normally consisting of a platinum-platinum rhodium bimetal thermocouple junction and a recording device for transposing the millivoltage into degrees of temperature.

**impedance**—A term that denotes both impedance and admittance. It is commonly applied to transmission lines, networks, and certain kinds of measuring instruments.

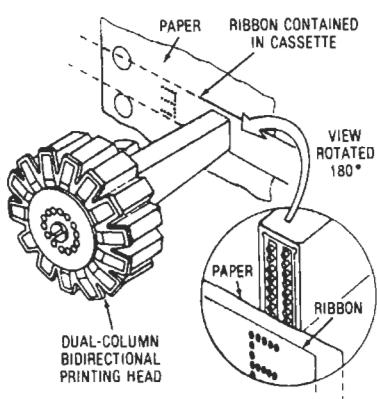
**IMOS**—See ion-implanted MOS.

**impact excitation**—The starting of damped oscillations by a sudden surge, such as by a spark discharge.

**impact modulator amplifier**—A fluidic device in which the impact plane position of two opposed streams is controlled to alter the output.

**impact predictor**—A device that can determine, in real time, the point on the earth's surface where a ballistic missile will impact if thrust is instantaneously terminated.

**impact printer**—1. Any type of printer that generates characters by using some form of stamping or inking through a ribbon by some sort of character slug, element, or hammer-needle. (Daisy-wheel printers are impact printers.) 2. Any mechanical imprinting device that forms characters by striking characters against a ribbon onto paper. 3. A mechanical printer operating at relatively low speeds—from 150 lines per minute to 1800 lines per minute. Has multiple copy capability and normally is capable of producing an original plus three copies. Impact printers are identified as letter-quality, dot-matrix, and line-printing types. No longer in common use.



*Impact printer (dot-matrix).*

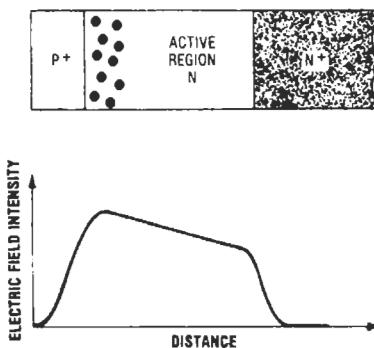
**impact printing**—Printing that is produced by the impact of a key on an inked ribbon, transferring the impression of a character onto the paper located behind the ribbon.

**impact resistance**—Resistance to fracture under shock force.

**IMPATT**—Acronym for impact avalanche and transit time.

**IMPATT diode**—Impact avalanche and transmit time diode. 1. A pn-junction diode operated with heavy back bias so that avalanche breakdown occurs in the active region. To prevent burnout, the device is so

constructed that the active region is very close to a good heat sink. For the same reason, the bias supply must be a constant-current type. 2. A device whose negative resistance characteristic is produced by a combination of impact avalanche breakdown and charge-carrier transit-time effects. Avalanche breakdown occurs when the electric field across the diode is high enough for the charge carriers (holes or electrons) to create electron-hole pairs. With the diode mounted in an appropriate cavity, the field patterns and drift distance permit microwave oscillations or amplification. 3. A semiconductor microwave diode that, when its junction is biased onto avalanche, exhibits a negative resistance over a frequency range determined by the transit time of charge carriers through the depletion region.



*IMPATT diode.*

**IMPATT oscillator**—An oscillator in which the active element is an IMPATT diode operating in a negative resistance mode. Dc to rf conversion efficiencies are normally less than 20 percent. Present devices operate above 5 GHz.

**impedance**—1. The total opposition (i.e., resistance and reactance) a circuit offers to the flow of alternating current at a given frequency; the ratio of the potential difference across a circuit or element of a circuit to the current through the circuit or element. It is measured in ohms, and its reciprocal is called admittance. Symbol:  $Z$ . 2. The combination of resistance and reactance. 3. Combined opposition to current resulting from resistance, capacitance, and inductance. 4. The sinusoidal terminal voltage of a circuit divided by the current through it. 5. A speaker's resistance to an alternating current, which varies with frequency. A speaker's rated impedance is usually the value measured at 400 Hz. 6. The opposition to alternating current in a circuit, generally categorized as either high or low, and measured in ohms. 7. The total opposition that a circuit offers to the flow of alternating current or any other varying current at a particular frequency. It is a combination of resistance,  $R$ , and reactance,  $X$ , measured in ohms.

**impedance angle**—Angle of the impedance vector with respect to the resistance vector. Represents the phase angle between voltage and current.

**impedance at the intermediate frequency**—In a mixer semiconductor diode, the impedance measured at the output terminals of a mixer circuit when the device is driven by a local oscillator under specified conditions.

**impedance bridge**—A device for measuring the combined resistance and reactance of a component part of a circuit.

**impedance characteristic**—A graph of impedance versus frequency of a circuit or component.

**impedance coil**—A coil whose inductive reactance is used to hinder the flow of alternating current in or between circuits.

**impedance compensator**—1. An electric network used with a line or another network to give the impedance of the combination a certain characteristic over a desired frequency range. 2. A circuit that ensures that a transmission line is a proper electrical load for its communicating devices. It is connected in parallel with the devices.

**impedance coupling**—A method of coupling using an impedance as the coupling device common to both the primary and secondary circuits. This type of coupling is usually limited to audio systems, where high gain and limited bandpass are required.

**impedance drop**—The vector sum of the resistance drop and the reactance drop. (For transformers, the resistance drop, the reactance drop, and the impedance drop are, respectively, the sum of the primary and secondary drops reduced to the same terms. They are usually expressed in percent of the secondary-terminal voltage.)

**impedance ground**—An earth connection made through an impedance of predetermined value usually chosen to limit the current of a short-circuit to ground.

**impedance irregularities**—Breaks or abrupt changes that occur in an impedance-frequency curve when unlike sections of a transmission line are joined together or when there are irregularities on the line.

**impedance match**—The condition in which the impedance of a component or circuit is equal to the internal impedance of the source or the surge impedance of a transmission line, thereby giving maximum transfer of energy from sources to load, minimum reflection, and minimum distortion.

**impedance matching**—1. The connection across a source impedance of another impedance having the same magnitude and phase angle. If the source is a transmission line, reflection is thereby avoided. 2. The process of adjusting the impedances of a load and of its power source so that they are equal. This permits the greatest possible transfer of power. 3. Making the impedance of a terminating device equal to the impedance of the circuit to which it is connected in order to achieve optimum signal transfer.

**impedance-matching transformer**—A transformer used to match the impedance of a source and load.

**impedance plethysmograph**—An instrument used to detect the increased blood volume in the tissues of the body during a contraction of the heart. *See also* electrical-impedance cephalography; finger plethysmograph.

**impedance transformer**—A transformer that transfers maximum energy from one circuit to another.

**impedance triangle**—A diagram consisting of a right triangle. The sides are proportional to the resistance and reactance in an ac circuit, with the hypotenuse representing the impedance.

**imperfect dielectric**—A dielectric in which part of the energy required to establish its electric field is converted into heat instead of being returned to the electric system when the field is removed.

**imperfection**—In a crystalline solid, any deviation in structure from an ideal crystal (one that is perfectly periodic in structure and contains no foreign atoms).

**implantable pacemaker**—A miniature pulse generator surgically implanted beneath the skin and provided with output leads that connect directly to the heart muscle. The electrodes may contact either the outer wall of the

## impedance characteristic — impulse excitation

heart muscle (myocardial electrodes) or the inner surface of the heart chamber (endocardiac electrodes).

**implied AND**—Also called dot AND or wired AND. A logic element in which the combined outputs are true if and only if all outputs are true. (Sometimes improperly called dot OR or wired OR.)

**implied OR**—Also called wired OR. A logic element in which the combined outputs are true if one or more of the outputs are true.

**implode**—The inward bursting of a picture tube due to its high vacuum.

**import**—To copy data created by one computer program or file into another.

**impregnant**—1. A substance, usually a liquid, used to saturate the paper dielectric of a capacitor and replace the air between its fibers, thereby increasing the dielectric strength and the dielectric constant of the capacitor. 2. A substance intended to replace the air as dielectric between the electrodes of a capacitor.

**impregnate**—1. To fill voids and air spaces (of a capacitor or transformer) with a material having good insulating properties commonly called an impregnant. 2. To fill the voids and interstices of a material with a compound. This does not imply complete fill or complete coating of the surfaces by a hole-free film.

**impregnated coils**—Coils that have been permeated with an electric grade varnish or other protective material to protect them from mechanized vibration, handling, fungus, and moisture.

**impregnating**—Complete filling of even the smallest voids in a component or closely packed assembly of parts. Low-viscosity compounds, usually liquids, are used. The process is frequently accomplished by a vacuum process in which all air is removed before introducing the impregnating material. Typical examples of impregnating are the filling of capacitors or transformer windings.

**impregnation**—1. The process of coating the insides of coils and closely packed electronic assemblies by dipping them into a liquid and letting it solidify. 2. The process of completely filling all interstices or a part or assembly with a thin, liquid, electrically insulating material. The process is best accomplished by first removing all air (creating a vacuum), then introducing the impregnant, and finally applying atmospheric or elevated pressures to completely force-fill the system.

**impressed voltage**—The voltage applied to a circuit or device.

**improvement threshold**—A characteristic of FM radio receivers that determines the minimum rf signal power required to overcome the inherent thermal noise. For increasing values of rf power above this point, an improvement of signal-to-noise ratio is obtained.

**impulse**—1. A pulse that begins and ends within so short a time that it may be regarded mathematically as infinitesimal. The change produced in the medium, however, is generally of a finite amount. 2. A current surge of unidirectional polarity. *See also* pulse.

**impulse bandwidth**—The area divided by the height of the voltage-response selectivity as a function of frequency. It is used in the calculation of broadband interference.

**impulse-driven clock**—An electric clock in which the hands are moved forward at regular intervals by current impulses from a master clock.

**impulse excitation**—Also called shock excitation. 1. A method of producing oscillatory current in which the duration of the impressed voltage is relatively short compared with that of the current produced. 2. The sudden application of a momentary steep-wavefront voltage to a resonant circuit, resulting in a damped oscillation.

**impulse frequency** — The number of pulse periods per second generated by the dial-pulse springs in a telephone as they rapidly open and close in response to the dialing of a digit.

**impulse generator** — Also called surge generator. 1. An electric apparatus that produces high-voltage surges for testing insulators and for other purposes. 2. A device that generates a broad energy spectrum by means of a very narrow impulse. Usually generated by discharging a short coaxial or waveguide transmission line. The pulses are discrete and regularly spaced, and are generally variable at a repetition rate from a few pulses per second to a few thousand pulses per second. The output of an impulse generator is specified as the rms equivalent of the peak voltage in dB above 1 microvolt per megahertz. 3. An oscillator circuit that generates electric impulses for synchronizing purposes in a television system. 4. A circuit, typically using a step-recovery diode, used to convert a sinusoidal input to a voltage impulse output. The basic circuit block in both step recovery diode multiples and comb generators.

**impulse noise** — 1. Noise due to disturbances having abrupt changes and of short duration. These noise impulses may or may not have systematic phase relationships. The noise is characterized by nonoverlapping transient disturbance. The same source may produce impulse noise in one system and random noise in a different system. 2. A type of communication-line interference characterized by high amplitude and short duration. 3. An unwanted signal characterized by a steep waveform.

**impulse-noise generator** — Equipment for generating repetitive pulses that provide random noise signals uniformly spread over a wide band of frequencies.

**impulse pay-per-view** — Abbreviated IPPV. A feature of a decoder that allows an authorized subscriber to purchase a one-time scrambled program at will. IPPV shows are selected by a button on the decoder or its remote control.

**impulse period** — *See* pulse period.

**impulse ratio** — The ratio of the flashover, sparkover, or breakdown voltage of an impulse to the crest value of the power-frequency flashover, sparkover, or breakdown voltage.

**impulse relay** — 1. A relay that stores enough energy from a brief impulse to complete its operation after the impulse ends. 2. A relay that can distinguish between different types of impulses, operating on long or strong impulses and not operating on short or weak ones. 3. An integrating relay.

**impulse response of a room** — The time sequence of signals received at some point in a room due to a sound pulse generated at some other point in the room. It defines the arrival of a sound that has transversed the direct path between source and microphone and the arrivals of the various reflections.

**impulse sealing** — A heat-sealing technique in which a pulse of intense thermal energy is applied to the sealing area for a very short time, followed immediately by cooling. It is usually accomplished by using an rf heated metal bar that is cored for water cooling, or is of such a mass that it will cool rapidly at ambient temperatures.

**impulse separator** — Normally called sync separator. In a television receiver, the circuit that separates the synchronizing impulses from the video information in the received signal.

**impulse sparkover voltage** — The highest value of spark-gap or gas-discharge tube terminal voltage prior to ionization and the flow of discharge current.

**impulse speed** — The rate at which a telephone dial mechanism makes and breaks the circuit to transmit pulses.

**impulse strength** — A measure of the ability of insulation to withstand voltage surges on the order of microseconds in duration.

**impulse timer** — A timing device electrically powered by a synchronous motor, featuring a mechanical stepping device that enables it to advance a predetermined number of degrees within a predetermined time interval, controlling a multiple number of circuits. Said circuits are controlled by individual cams, which program their activity.

**impulse train** — *See* pulse train.

**impulse transmission** — The form of signaling used principally to reduce the effects of low-frequency interference. Impulses of either or both polarities are employed for transmission, to indicate the occurrence of transitions in the signals.

**impulse-transmitting relay** — A relay in which a set of contacts closes briefly when the relay changes from the energized to the deenergized position, or vice versa.

**impulse-type telemeter** — A telemeter that employs the characteristics of intermittent electric signals, other than their frequency, as the translating means.

**impurity** — Also called dopant. 1. A material such as boron, phosphorus, or arsenic added to a semiconductor such as germanium or silicon to produce either p-type or n-type material. Impurities that provide free electrons are called donors and cause the semiconductor material to be n-type. Impurities that accept electrons are called acceptors and cause the material to be p-type. 2. A foreign material present in a semiconductor material, usually in small quantities. Some impurities are unwanted, and great pains are taken to extract them from the material. Others are intentionally added to semiconductor materials as dopants in order to modify their electrical behavior. 3. In semiconductor technology, a material such as boron, phosphorus, or arsenic added in small quantities to a crystal to produce an excess of electrons (donor impurity) or holes (acceptor impurity).

**impurity density** — The amount of impurity material diffused into a certain volume of semiconductor material used in manufacturing semiconductor devices.

**impurity ions** — An alien, electrically charged atomic system in a solid; an ion substituted for a constituent atom or ion in a crystal lattice, or located in an interstitial site in the crystal.

**impurity level** — The energy level existing in a substance because of impurity atoms.

**inaccuracy** — 1. The difference between the input quantity applied to a measuring instrument and the output quantity indicated by that instrument. The inaccuracy of an instrument is equal to the sum of its instrument error and its uncertainty. 2. The term sometimes used to indicate the deviation from an indicated or recorded value or the measure of conformity to an accepted standard.

**inactive leg** — Within a transducer, an electrical element that does not change its electrical characteristics with the applied stimulus. Applied specifically to elements that complete a Wheatstone bridge in certain transducers.

**in-band signaling** — 1. The transmission of signaling tones at some frequency or frequencies within the channel normally used for voice transmission. 2. A signaling scheme that uses the same path for both data and signaling information.

**in-band spurious transmitter output** — A spurious transmitter output that lies within the specified band of transmission.

**incandescence** — 1. The state of a body with such a high temperature that it gives off light. 2. The generation

of light caused by passing an electric current through a wire filament. The resistance of the filament to the current causes the filament to heat up and emit radiant energy, some of which is in the visible range.

**incandescent lamp**—1. An electric lamp in which electric current flowing through a filament of resistance material heats the filament until it glows. 2. A lamp that emits light when an electric current passes through a resistant metallic wire situated in a vacuum tube. 3. An electric lighting and signaling device operating on the principle of heating a fine metal wire filament to a white heat by passing an electric current through it. The filament wire has a positive temperature coefficient, which results in high inrush currents, up to 10 times the steady-state current.

**INCH**—Acronym for integrated chopper. It is a device designed to operate as a chopper, commutator, modulator, demodulator, or mixer, depending on circuit requirements.

**inching**—See jogging.

**incidence angle**—The angle between an approaching light ray or emission and the perpendicular (normal) to the surface in the path of the ray.

**incident FM**—Also called residual FM. 1. The short-term jitter or undesired FM deviation of a local oscillator. It limits resolution when it approaches the IF bandwidth in magnitude. 2. Peak-to-peak variations of a carrier frequency caused by external variations not a part of normal action of the carrier-tuned circuits. 3. In a klystron, frequency modulation of the fundamental frequency due to shot and ion noises, ac heater voltage, etc.

**incident field intensity**—The field strength of a down-coming sky wave, not including the effects of earth reflections at the receiving location.

**incident light**—The light that falls directly on an object.

**incident-light meter**—An exposure meter designed to measure the light striking an object and used at a suitable location in the scene.

**incident power**—The product of the outgoing current and voltage traveling from a transmitter down a transmission line to an antenna.

**incident ray**—A ray of light that falls on or strikes a surface of an object, such as a lens. It is said to be incident to the surface.

**incident wave**—In a medium of certain propagation characteristics, a wave that strikes a gap in the medium or strikes a medium having different propagation characteristics.

**incipient failure**—A degradation failure in its beginning stages.

**in-circuit emulation**—Abbreviated ICE. A capability provided on some microcomputer development systems that enables a system designer to use the facilities of the development system to debug prototype hardware and software. This is accomplished via an umbilical cable from the development system that plugs into the microprocessor socket in the prototype system. See also emulation.

**in-circuit emulator**—Abbreviated ICE. A microcomputer development system that can be plugged into a microcomputer system to control, alter, interrogate, and debug that system using a known good environment.

**in-circuit tester**—Also called a bed-of-nails tester or an in-situ tester. A tester that checks the individual components on a board using a fixture that provides access to each node of each component. Used to test for short and open circuits on bare boards, correct values of analog components (using a guarding technique), and correct functions of individual ICs (using a pulsing technique).

## incandescent lamp — increment

**inclination**—1. The angle between the orbital plane of a satellite and the equatorial plane of the earth. 2. The angle that a line, surface, or vector makes with the horizontal.

**inclinometer**—An instrument for measuring the magnetic inclination of the earth's magnetic field. It uses a magnetic needle that pivots vertically to indicate the inclination.

**inclusive AND**—A logic element whose output is true if all inputs are true, all inputs are false, or all inputs but one are false.

**inclusive NAND**—A logic element whose output is true if one and only one of the inputs is false.

**incoherent**—Denotes the lack of a fixed phase relationship between two waves. If two incoherent waves are superposed, interference effects cannot last longer than the individual coherent times of the waves.

**incoherent detection**—Detection wherein the information contained in the phase of the carrier is discarded.

**incoherent emitter**—A fiber-optic source of radiation that has been used for short-length optical transmission lines. Light-emitting diodes are incoherent emitters. See coherent emitter.

**incoherent scattering**—The disordered change in their direction of propagation that occurs when radio waves encounter matter.

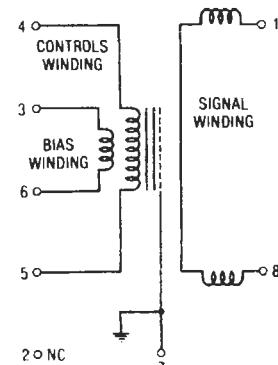
**incoherent source**—A fiber-optic light source that emits wide, diffuse beams of light of many wavelengths. The light waves emitted from an incoherent source are out of phase. Contrast coherent source.

**incoming**—Describing a telecommunication trunk that is used only for calls coming in from another office.

**incoming selector**—In a telephone central office, a selector associated with trunk circuits from another central office.

**incomplete sequencer relay**—A device that returns the equipment to the normal, or off, position and locks it out if the normal starting, operating, or stopping sequence is not properly completed within a predetermined time.

**increductor**—A controllable inductor similar to a saturable reactor, except that it is capable of operating at high frequency (e.g., up to 400 MHz).



Increductor.

**increment**—1. A small change, either positive or negative, in the value of a variable quantity. 2. See step angle.

**incremental compiler** — In a computer, a compiler capable of compiling additional statements without a complete recompilation.

**incremental computer** — 1. A computer in which the use of incremental representation of data is predominant. 2. A special-purpose computer designed specifically to process changes in the variables as well as absolute values of the variables.

**incremental digital-position transducer equalizer** — Digital-position transducer that, without absolute position reference, produces a digital signal by motion.

**incremental digital recorder** — A magnetic tape recorder that advances the tape across the recording head step by step, as in a punched-tape recorder. It is used for economical and reliable recording of an irregular flow of data.

**incremental frequency shift** — A method by which incremental intelligence may be superimposed on other intelligence by shifting the center frequency of an oscillator a predetermined amount.

**incremental hysteresis loss** — Losses in a magnetic material that has been subjected to a pulsating magnetizing force.

**incremental induction** — One-half the algebraic difference between the maximum and minimum magnetic induction at a point in a material that has been subjected simultaneously to a polarizing and a varying magnetizing force.

**incremental integrator** — A digital integrator modified so that the output signal is maximum negative, zero, or maximum positive when the value of the output is negative, zero, or positive, respectively.

**incremental permeability** — 1. The ratio of the cyclic change in magnetic induction to the corresponding cyclic change in magnetizing force when the mean induction differs from zero. For small changes in magnetizing force, the incremental permeability is approximately equal to the slope of the minor hysteresis loop generated. 2. The ratio of incremental change in flux density to the incremental change in magnetizing force at any point on the hysteresis loop.

**incremental sensitivity** — The smallest change that can be detected by a particular instrument in a quantity under observation.

**incremental tape** — Magnetic tape written one character at a time instead of the usual method of continuous recording.

**incremental tuner** — A television tuner in which antenna, rf amplifier, and rf oscillator inductors are continuous or in small sections connected in series. Rotary switches, connected to taps on the inductors, provide the portion of total inductance required for a channel, or short-circuit all remaining inductance except that required for the channel.

**independent failure** — A failure that has no significant relationship to other failures in a given device and can occur without interaction with other component parts in the equipment.

**independent load contacts** — Contacts that can control electrical loads that must be isolated from the timer clutch solenoids and motor circuit.

**independent variable** — One of several voltages and currents chosen arbitrarily and considered to vary independently.

**indeterminacy** — The time coincidence uncertainty between an external input trigger pulse and an independently clock-derived output pulse from a timing unit such as a digital delay generator. It stems from a clock pulse versus trigger pulse phase uncertainty and is usually expressed in terms of nanoseconds or microseconds. For

example, the  $\pm \frac{1}{2}$  clock pulse uncertainty of a 10-MHz source would be  $\pm 50$  ns.

**indeterminate state** — The unknown logic state (X) of a memory element caused by critical races or oscillations, or existing after power is applied and before initialization. Some simulators can model indeterminate states and typically assign an X to indicate an indeterminate state.

**index counter** — An odometer-type cumulative-digit indicator for keeping track of the amount of tape that has passed through a tape machine. The counter is generally driven by the takeup-reel turntable and thus registers rotation rather than tape footage, although the accuracy is generally good enough to allow for locating specific recorded segments according to previously noted index counter numbers.

**indexed address** — An address that is altered by the content of an index register before or during the execution of a computer instruction.

**indexed addressing** — 1. An addressing mode in which a computer finds the address of the desired memory location by referring to an index register. By successively adding or subtracting 1 to this index register, the computer can be made to step through a list or table. 2. An addressing system in which the address of the data is expressed as relative to the address stored in an index or pointer register. To obtain the absolute address, the offset address is added to the pointer address. This system is useful in processing tables or matrices of data.

**index hole** — A hole punched in a floppy disk to indicate the beginning of the first sector.

**indexing** — In a computer, a technique of address modification that is often implemented by means of index registers.

**indexing mechanism** — A mechanical device on a rotary switch to locate and to maintain each position of the rotor.

**indexing slots** — See polarizing slots.

**index matching fluid** — In fiber optics, a fluid with a refractive index the same as a fiber core; used to fill the air gap between the fiber ends at connectors.

**index matching materials** — Materials used in intimate contact between the ends of optical conductors to reduce coupling losses by reducing Fresnel loss.

**index of cooperation** — In rectilinear scanning or recording, the product of the total length of a line and the number of lines per unit length.

**index of modulation** — The modulation factor.

**index of refraction** — 1. Ratio of the speeds of light or other radiation in two different materials. This determines the amount the ray will be refracted or bent when passing from one material to the other, such as from air to water. The index of refraction of air is generally taken as unity. 2. The physical property of a material that describes the behavior of optical energy passing through it. It is defined as the ratio of the velocity of light in a vacuum to the velocity of light in the material. It varies with wavelength.

**index register** — 1. In a computer, a register that holds a quantity that may be used for modifying addresses or for other purposes, as directed by the program. 2. In a computer, a register whose contents can be added automatically to an address field contained in an instruction, when the indexing mode is specified. 3. A user-accessible register implicitly used for address computation by many instructions that reference main memory.

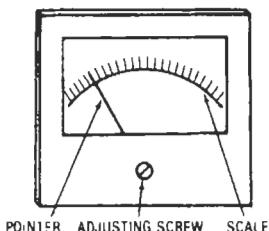
**indicating demand meter** — A meter equipped with a scale over which a pointer is advanced to indicate maximum demand.

**indicating fuse**—A protective device placed in a telephone circuit to provide visual and audible indication of a fault in the line. It consists of a fuse, pilot lamp, relay, and buzzer. When a line fault blows the fuse, the lamp lights and the buzzer sounds.

**indicating instrument**—An instrument that visually indicates only the present value of the quantity being measured.

**indicating lamp**—A lamp that indicates the position of a device or the condition of a circuit.

**indicating meter**—A meter that gives a visual indication of only the present or short-time average value of the measured quantity.



*Indicating meter.*

**indication**—The display to the human senses of information concerning a quantity being measured.

**indicator**—An instrument that makes information available but does not store it.

**indicator gate**—A rectangular voltage waveform applied to the grid or cathode circuit of an indicator cathode-ray tube to sensitize or desensitize the tube during the desired portion of the operating cycle.

**indicator tube**—An electron-beam tube that conveys useful information by the variation in cross section of the beam at a luminescent target.

**indirect-acting recording instrument**—An instrument in which the marking device is actuated by raising the level of measurement energy of the primary detector. This is done mechanically, electrically, electronically, photoelectrically, or by some other intermediate means.

**indirect address**—An address in a computer instruction that indicates a location where the address of the referenced operand is to be found.

**indirect addressing**—1. A method of computer cross reference in which one memory location indicates where the correct address of the main fact can be found. 2. A method of storage addressing in which an addressed location contains an address rather than data. Quite often several levels of indirect addressing may occur before the sought-after data item is obtained.

**indirect light**—Light from an object that has no self-luminous properties. Instead, it reflects light from another source.

**indirect lighting**—A system of lighting in which all the light is directed to the ceiling or walls, which in turn reflect it to the objects to be illuminated. Lighting by luminaries distributing 90 to 100 percent of the emitted light upward.

**indirectly controlled variable**—A variable that is related to and influenced by the directly controlled variable but is not directly measured for control.

**indirectly heated cathode**—Also called equipotential or unipotential cathode. A cathode that is heated by an independent heater.

## indicating fuse — induced environment

**indirectly heated thermistor**—A thermistor that incorporates, as part of its composite structure, an electrical heater. A thermistor whose body temperature in use is significantly higher than the temperature of its surrounding medium as a result of current passing through its heater.

**indirect material**—A type of semiconductor material in which electrons do not drop directly from the conduction band to the valence band, but drop in steps as a result of the trapping levels in the forbidden gap.

**indirect piezoelectricity**—The production of a mechanical strain in a crystal by applying a voltage to it (as opposed to the more common piezoelectric effect of applying a strain to the crystal in order to produce a voltage).

**indirect radiative transition**—See transition, 1.

**indirect scanning**—A television technique used in early mechanical systems, and today in the flying-spot scanning of films. A small beam of light is moved across the subject and then reflected to a battery of phototubes.

**indirect synthesizer**—A synthesizer employing phase-locked loops, digital dividers, and high-*Q* varactor-tuned oscillators. The discrete output frequencies are not limited to integer ratios of the reference frequency. Frequency step size or increments are primarily determined by the digital dividers. Switching speed between discrete output frequencies is usually limited by the phase-lock circuits. Applications include automatic test and satellite communications systems.

**indirect wave**—A wave reaching a given reception point by a path from the transmitting point other than the direct-line path between the two (e.g., a sky wave received after deflection from the ionosphere layers).

**individual gap azimuth**—In a magnetic-tape record or reproduce head stack, the angle of an individual gap relative to a line perpendicular to the precision-milled mounting pads in a plane parallel to the surface of the tape.

**individual line**—A subscriber line that serves one main station and optional additional stations connected to the line as extensions; the line is not arranged for discriminatory ringing with respect to the stations.

**indoor antenna**—Any receiving antenna located inside a building but outside the receiver.

**indoor transformer**—A transformer that must be protected from the weather.

**Indox**—The trade name of Indiana Steel Products Company's barium ferrite permanent magnet alloy.

**induced**—Produced by the influence of an electric or magnetic field.

**induced charge**—1. An electrostatic charge produced in one object by the electric field surrounding a nearby object. 2. An electrostatic charge produced on a conducting body when it is brought near to or connected to another body that bears an electric charge.

**induced current**—1. The current that flows in a conductor that is moved perpendicularly to a magnetic field, or which is subjected to a magnetic field of varying intensity. The former takes place in an induction-motor rotor; the latter, in the secondary winding of a transformer. 2. In induction heating, the current that flows in a conductor when a varying electromagnetic field is applied. 3. The current that results when a conductor is cut by magnetic flux lines. 4. Current that flows in a conductor because of an induced voltage.

**induced electromotive force**—Represented by  $E$ ; proportional to the rate of change of magnetic flux through the circuit ( $d\phi/dt$ ).

**induced environment**—The temperatures, vibrations, shocks, accelerations, pressures, and other conditions

imposed on a system due to the operation or handling of the system.

**induced failure** — A failure that is basically caused by a condition or phenomenon external to the item that fails.

**induced voltage** — The voltage produced in a conductor when the conductor is moved up and down through the magnetic field of a second conductor, or when the field varies in intensity and cuts across the first conductor. Even though there is no mechanical coupling between the two conductors, the one producing the field will produce a voltage in the other.

**inductance** — 1. Property of a circuit that tends to oppose any change of current because of a magnetic field associated with the current itself. Whenever an electric current changes in value—rises or falls—in a circuit, its associated magnetic field changes, and when this links with the conductor itself, an electromotive force is induced that tends to oppose the original current change. Self-inductance is the full name for this, but the term *inductance* is usually used. The unit of inductance is the henry. When a current changing at the rate of 1 ampere per second induces a voltage of 1 volt, the inductance of the circuit is 1 henry. 2. See also coil. 3. The property of a circuit or circuit element that opposes a change in current flow, thus causing current changes to lag behind voltage changes. It is measured in henrys.

**inductance bridge** — An instrument, similar to a Wheatstone bridge, for measuring an unknown inductance by comparing it with a known inductance.

**inductance coil** — See inductor.

**inductance-tube modulation** — A method of modulation employed in frequency-modulated transmitters. An oscillator control tube acts as a variable inductance in parallel with the tank circuit of the radio-frequency oscillator tube. As a result, the oscillator frequency varies in step with the audio-frequency voltage applied to the grid of the oscillator control tube.

**induction** — 1. The establishment of an electric charge or a magnetic field in a substance by the proximity of an electrified source, a magnet, or a magnetic field. 2. The setup of an electromotive force and current in a conductor by variation of the magnetic field affecting the conductor.

**induction brazing** — The electric brazing process in which heat is produced by an induced current.

**induction coil** — A device for changing direct current into high-voltage alternating current. Its primary coil contains relatively few turns of heavy wire; its secondary coil, wound over the primary, contains many turns of fine wire. Interruption of the direct current in the primary by a vibrating-contact arrangement induces a high voltage in the secondary.

**induction compass** — A compass in which the indications are produced by the current generated in a coil revolving in the magnetic field of the earth.

**induction-conduction heater** — A heating device through which electric current is conducted but is restricted by induction to a preferred path.

**induction density** — See flux density.

**induction factor** — In an alternating-current circuit, the ratio between that element of the current that does no work and the total strength of the current.

**induction field** — 1. That portion of the electromagnetic field of a transmitting antenna that acts as if it were permanently associated with the antenna, and into which energy is alternately stored and removed. 2. The electromagnetic field of a coil carrying alternating current, responsible for the voltage induced by that coil in itself or in a nearby coil. 3. The magnetic field that is predominant

in the near zone of a radio transmitting antenna and that is directly proportional to the current in the antenna.

**induction frequency converter** — A slip-ring induction machine driven by an external source of mechanical power. Its primary circuits are connected to a source of electric energy having a fixed frequency. The energy delivered by its secondary circuits is proportionate in frequency to the relative speed of the primary magnetic field and the secondary member.

**induction furnace** — A furnace heated by electromagnetic induction.

**induction hardening** — The process of hardening the surface of a casting by heating it above the transformation range by electrical induction, followed by rapid cooling.

**induction heating** — The method of producing heat by subjecting a material to a variable electromagnetic field. Internal losses in the material then cause it to heat up.

**induction instrument** — An instrument operated by the reaction between the magnetic flux set up by one or more currents in fixed windings and the currents set up by electromagnetic induction in movable conductive parts.

**induction loudspeaker** — A speaker in which the current that reacts with the steady magnetic field is induced in the moving member.

**induction motor** — 1. An alternating-current motor in which the primary winding (usually the stator) is connected to the power source and induces a current into a polyphase secondary or squirrel-cage secondary winding (usually the rotor). Currents, and therefore magnetic poles, are induced into the secondary by the rotating primary magnetic field; thus, the armature rotates at slightly slower than synchronous speed, a condition that is called slip. The amount of slip increases with an increase in mechanical loading. 2. A motor that runs asynchronously; that is, not in step with the alternations of the alternating current.

**induction-motor meter** — A meter containing a rotor that moves in reaction to a magnetic field and the currents induced into it.

**induction noise** — The noise—other than thump, flutter, cross fire, or crosstalk—produced when two circuits are inductively coupled together.

**induction-resistance welding** — Welding in which electromagnetic induction alone causes the heating current to flow in the parts being welded.

**induction-ring heater** — A core-type induction heater adapted principally for heating round objects. The core is open or can be taken off to facilitate linking the charge.

**induction soldering** — A method of soldering in which the solder is reflowed or supplied by preforms. If the work is moved slowly through the energy field, the induction process may be made continuous.

**induction speaker** — A speaker in which the current that reacts with the steady magnetic field is induced into the moving member.

**induction-voltage regulator** — A device having a primary winding in shunt and a secondary winding in series with a circuit for gradually adjusting the voltage or the phase relation of the circuit by changing the relative positions of the exciting and series windings of the regulator.

**inductive** — Pertaining to inductance or to the inducing of a voltage through mutual or electrostatic induction.

**inductive circuit** — A circuit with more inductive than capacitive reactance. A circuit having a net inductive reactance; that is, a higher value of inductance reactance than of capacitive reactance.

**inductive coordination**—Location, design, construction, operation, and maintenance of electric supply and communication systems in a manner that prevents inductive interference.

**inductive coupled circuit**—A network with two meshes having only mutual inductance in common.

**inductive coupling**—1. The association of one circuit with another through inductance common to both. When used without modifying words, the term commonly refers to coupling by means of mutual inductance, whereas coupling by means of self-inductance common to both circuits is called direct inductive coupling. 2. In inductive-coordination practice, the interrelation of neighboring electric supply and communication circuits resulting from electric and/or magnetic induction. 3. Coupling that exists between two circuits through a mutual inductance, such as that in a transformer. 4. Coupling between two circuits through an inductance that is common to the two circuits; direct inductive coupling.

**inductive feedback**—The transfer of energy from the output circuit to the input circuit of an amplifying device through an inductor or inductive coupling.

**inductive interference**—1. Interference produced in communication systems by induced voltages within the system. 2. Effect arising from the characteristics and inductive relations of electric supply and communication systems of such character and magnitude as would prevent the communication circuit from rendering service satisfactorily and economically if methods of inductive coordination were not applied.

**inductive kick**—1. The voltage, many times higher than the impressed voltage, produced by the collapsing field in a coil when the current through it is abruptly cut off. 2. A voltage surge that is induced in an inductance when the current through it is interrupted and the magnetic flux collapses suddenly.

**inductive level detector**—A level-measuring system incorporating an oscillator and electromagnetic field.

**inductive load**—Also called lagging load. A load that is predominantly inductive, so that the alternating load current lags behind the alternating voltage of the load. An electrical load that has a significant inductive reactance.

**inductive microphone**—See inductor microphone.

**inductive neutralization**—Also called shunt or coil neutralization. A method of neutralizing an amplifier, whereby the equal and opposite susceptance of an inductor cancels the feedback susceptance caused by interelement capacitance.

**inductive pickup**—Signals generated in a circuit or conductor due to mutual inductance between it and a disturbing source.

**inductive post**—A metal post or screw extended across a waveguide parallel to the  $E$  field to act as inductive susceptibility in parallel with the waveguide for purposes of tuning or matching.

**inductive reactance**—The opposition to the flow of alternating or pulsating current by the inductance of a circuit. It is measured in ohms, and its symbol is  $X_L$ . It is equal to  $2\pi$  times the frequency in hertz times the inductance in henrys.

**inductive system**—An ignition system that stores its primary energy in an inductor or coil.

**inductive transducer**—A transducer in which changes in inductance convey the stimulus information.

**inductive transduction**—The conversion of the measurand into a change in the self-inductance of a single coil.

**inductive tuning**—A method of tuning a radio by moving a core into and out of a coil to vary the inductance.

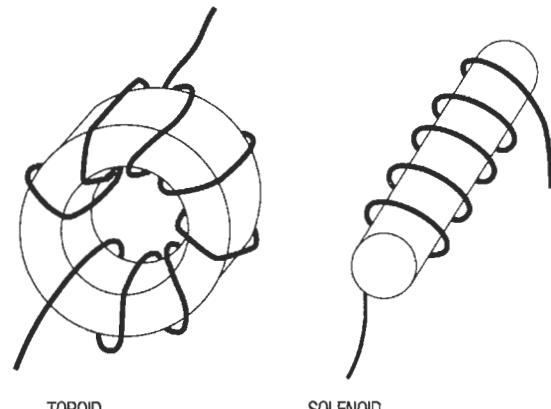
## inductive coordination — industrial television

**inductive winding**—A coil through which a varying current is sent to give it an inductance.

**inductive window**—A conducting diaphragm extended into a waveguide from one or both sidewalls to act as an inductive susceptance in parallel with the waveguide.

**inductometer**—An inductor whose inductance can be varied, sometimes by a calibrated amount.

**inductor**—Also called inductance or retardation coil. 1. A conductor used for introducing inductance into an electric circuit. The conductor is wound into a spiral, or coil, to increase its inductive intensity. 2. A passive fluidic element that, because of fluid inertness, has a pressure drop that leads flow by essentially  $90^\circ$ . 3. See coil.



*Inductors.*

**inductor microphone**—Also called inductive microphone. A microphone in which the sound waves move a conductor back and forth, cutting magnetic lines of force and producing an electrical output of the same frequency and proportional to the amplitude of the sound waves.

**inductor-type synchronous motor**—A type of synchronous motor having field magnets that are fixed in magnetic position relative to the armature conductors, the torques being produced by forces between the stationary poles and salient rotor teeth. Such motors usually have permanent-magnet field excitation, are built in fractional-horsepower frames, and operate at low speeds (300 revolutions per minute or less).

**Inductosyn**—An extremely precise transducer based on the magnetic circuit of a conductor deposited on glass for stability, and operated at a relatively high frequency. Extremely accurate, but requires much auxiliary equipment (Farrand Controls Inc.).

**industrial-grade IC**—Typically, an integrated circuit whose performance is guaranteed over the temperature range 0 to  $70^\circ\text{C}$ .

**industrial radio services**—Radiocommunication services essential to, operated by, and for the sole use of those enterprises that require radiocommunications in order to function efficiently.

**industrial television**—The cameras and related instrumentation of a closed-circuit television system. Such equipment is designed to function in the different environments found in industrial processes. Used to monitor areas that are hazardous to personnel, such as high-radiation

areas, areas that do not require steady supervision, industrial processes for surveillance or quality control, or areas requiring security measures.

**industrial timer**—A timing device, impulse or constant-speed type, used in industrial applications other than the appliance industry.

**industrial tube**—A vacuum tube designed for industrial electronic equipment.

**inelastic collision**—Collision resulting in excitation of a molecule.

**inertance**—Acoustical equivalent of inductance.

**inert gas**—See noble gas.

**inertia**—1. The tendency of an object at rest to remain at rest, or of a moving object to continue moving in the same direction and at the same speed, unless disturbed by an outside force. Resulting from mass and inhibiting change in velocity. Important in pickup mechanics. 2. The resistance to change in speed or velocity. In stepper motors, inertia does not affect the maximum stepping rate, only the time required to attain it.

**inertial guidance/navigation**—A self-contained system for navigation in which position can be computed by knowing a craft's starting point and where it has been. Changes in acceleration are detected by gyroscopes for direction and attitude and by accelerometers for velocity. These signals are integrated to determine resulting velocity and distance. The system needs no outside reference and cannot be jammed.

**inertial navigation**—1. A guidance technique in which airframe acceleration is first measured and then integrated twice with respect to time in order to determine the distance traveled. External aids such as radio and radar are not necessary. The acceleration or deceleration of the airframe is measured continuously with accelerometers oriented in some convenient frame of reference, usually corresponding to the earth's north-south, east-west coordinates. 2. A form of navigation that uses dynamic measurements of acceleration forces acting on a gyroscopically stabilized device as a basis for computing position and velocity information. This device, which is mechanized so as to be completely self-contained, has the inherent capability of providing continuously available navigation information in terms of conventional, directly usable latitude and longitude coordinates.

**inertia relay**—A relay having added weights or other modifications that increase its moment of inertia and either slow it or cause it to continue in motion after the energizing force is removed.

**inertia switch**—A switch capable of sensing acceleration, shock, or vibration. It is designed to actuate upon an abrupt change in velocity.

**inertia welding**—A forge-welding process in which stored kinetic energy is released as frictional heat when two parts are rubbed together under the proper conditions.

**infant mortality**—The occurrence of premature catastrophic-type failures of a component or equipment

at a rate substantially greater than that observed during life prior to wearout.

**infant-mortality period**—See early-failure period.

**inferential**—The kind of instrumentation, especially its signal source, in which there is sampling of an entirely different quantity from the one of interest, upon the assumption that they vary in perfect proportion. Linearity or a perfectly repeatable relationship between the two is inferred for the sake of a more convenient signal-source arrangement.

**infiltration**—The process of filling the pores of a sintered compact with a metal or alloy of lower melting point.

**infinite**—Boundless; having no limits whatsoever.

**infinite baffle**—1. An airtight speaker enclosure that completely absorbs or dissipates a speaker's rear sound waves. 2. A speaker mounting in which ideally there is no path of air between the back and front of the speaker diaphragm. An infinite baffle improves the forward radiation of sound at low frequencies and preferably should be a very large plane surface, like the wall of a room or a screen of very rigid material (e.g., 3/4-inch or 2-cm wood), on which a speaker is mounted. (In practice, truly infinite baffles are rarely accomplished except in sealed boxes, but these give rise to problems of resonance.) 3. An airtight speaker enclosure containing a bass speaker with very low open-air resonance, plus a sealed midrange speaker and tweeter.

**infinite-baffle speaker system**—A speaker in which the bass driver is located in an almost airtight enclosure.

**infinite-impedance detector**—A detector circuit in which the load is a resistor connected in parallel with an rf bypass capacitor between the cathode and ground. Since the grid is always negative with respect to the cathode, the tube presents an infinite impedance to the input.

**infinite line**—A transmission line with the same characteristics as an ordinary line that is infinitely long.

**infinite resolution**—The capability of a device to provide continuous output over its entire range.

**infinitesimal**—Immeasurably small; approaching zero.

**infinity**—1. A hypothetical amount larger than any assignable amount. 2. A number larger than any number a computer can store in any register. 3. Any distance of a subject from a lens for which the image no longer moves when the subject moves along the optical axis.

**infinity device**—Also called harmonica bug. A surreptitious listening device that uses the telephone as a sensor. Allows the bugger to listen to sounds near the phone while the phone is not in use. Does not allow him or her to hear telephone conversations.

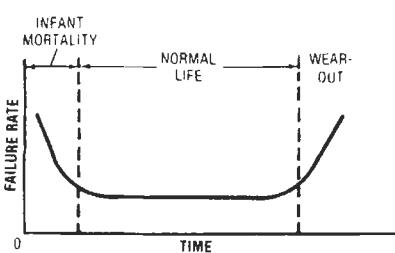
**inflection point**—The point at which a curve changes direction.

**infobond**—An automated system of point-to-point wiring on the back of a two-sided printed wiring board (the components are on the front, or other side). The No. 38 AWG copper wire used is solder-bonded to terminations by an automatic soldering gun.

**information**—1. In computing, the basic data and/or program entered into the system. 2. That property of a signal or message whereby it conveys something meaningful and unpredictable to the recipient, usually measured in bits. 3. Data that has been organized into a meaningful sequence.

**information bits**—In telecommunications, those bits originated by the data source and not used for error control by the data-transmission system.

**information center**—A facility specifically designed for storing, processing, and retrieving information



Infant mortality.

**information channel — infrared guidance**

to be disseminated at regular intervals, on demand, or selectively, according to the needs of users.

**information channel**—The transmission and intervening equipment involved in the transfer of information in a given direction between two terminals. An information channel includes the modulator and demodulator and any error-control equipment irrespective of its location, as well as the backward channel, when provided.

**information extraction**—An analysis of an image to recognize and isolate a specific feature or relationship among features.

**information feedback system**—In telecommunications, an information-transmission system in which an echo check is employed to verify the accuracy of the transmission.

**information gate**—A circuit that permits information or data pulses to pass when the circuit is triggered by an external source.

**information handling**—The storing and processing of information and its transmission from the source to the user. Information handling excludes the creation and use of information.

**information processing**—A term that encompasses both word processing and data processing. It describes the entire scope of operations performed by a computer.

**information rate**—In computers, the minimum number of binary digits per second required to specify the source messages.

**information rate changer**—A device that speeds up the playback of tape-recorded speech without pitch change or deterioration of characteristic resonances. This is accomplished by rotating the playback head in the direction of tape travel.

**information retrieval**—1. A method for cataloging vast amounts of data related to one field of interest so that any part or all of this data can be called out at any time with accuracy and speed. 2. The recovery of data that has been stored at a particular address in a memory. 3. A technique of classifying and indexing useful data in mass storage devices in a format amenable to interaction with the user(s). 4. The art of storing information so that it may be recovered easily. Branches include abstracting, locating facts of interest, and language translation.

**information-retrieval system**—A system for locating and selecting on demand certain documents or other graphic records relevant to a given information requirement from a file of such material.

**information separator**—A control character used to identify a logical boundary of information. The name of the separator is not necessarily indicative of what it separates.

**information superhighway**—The concept of a high-bandwidth network that links everyone with everyone and can transport all media types. The information superhighway links the concepts of online services, Internet, and interactive TV together.

**information system**—A group of computer-based systems and data required to support the information needs of one or more business processes.

**information theory**—1. The branch of learning that deals with the likelihood of accurate transmission of messages subject to transmission failure, distortion, and noise. 2. The mathematical theory that deals with the transmission of information and the effects of bandwidth, distortion, and noise.

**infra-**—Prefix meaning below; beneath; less than.

**infradyne receiver**—A superheterodyne receiver whose intermediate frequency is made higher than the signal frequency in order to obtain high selectivity.

**infrared**—Abbreviated IR. 1. Pertaining to or designating those radiations with wavelengths just beyond the red end of the visible spectrum, such as those emitted by a hot body. These wavelengths are longer than those of visible light and shorter than those of radio waves. 2. That section of the electromagnetic spectrum, invisible to the eye, lying between wavelengths of 750 nm and about 1 mm. Thermography utilizes waves in this region for recording changes in temperature. 3. Part of the electromagnetic spectrum between the visible light range and the radar range. 4. The electromagnetic wavelength region between approximately 0.75 and 1000 micrometers. For fiber-optic transmission, the near-infrared region between 0.75 and 1.3 micrometers is the most relevant region because glass, light sources, and detector techniques are most nearly matched in this wavelength region.

**infrared alarm systems**—A system that uses infrared detectors and related instrumentation to determine when abnormal amounts of infrared radiation, usually in the form of heat, are present in an area; used for the detection of fires or the presence of intruders in a restricted area.

**infrared binoculars**—An instrument, similar in design to regular binoculars, that can transmit and enlarge infrared images using electronic circuits.

**infrared communications set**—The collection of components necessary to operate a two-way electronic system in which infrared radiation is used to carry intelligence.

**infrared counter-countermeasures**—Action taken to employ infrared radiation equipment and systems in spite of enemy measures to counter their use.

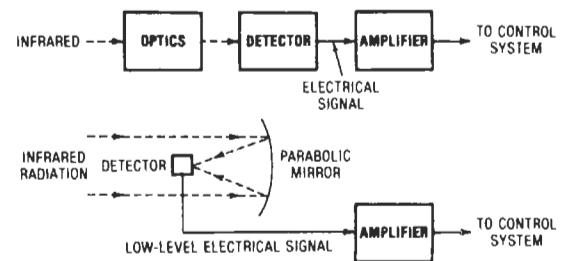
**infrared countermeasures**—Action taken to reduce the effectiveness of enemy equipment employing infrared radiation.

**infrared detector**—A transducer that is sensitive to invisible infrared radiation (wavelengths between 0.75 and 1000 micrometers), usually using a semiconductor (photon), thermocouple bolometer, or pneumatic (pressure) device to detect the radiation. Also a device used to detect radiation from the infrared region.

**infrared emitter**—See infrared light-emitting diode.

**infrared-emitting diode**—1. A semiconductor device with a semiconductor junction in which infrared radiant flux is nonthermally produced when a current flows as a result of applied voltage. 2. A pn diode in which a fraction of the injected minority carriers recombine by means of radiative transistors. When the junction is forward biased, electrons from the n region are injected into the p region, where they recombine with excess holes. In the radiative process, energy given up in recombination is in the form of photon emission. The generated photons travel through the lattice until they are either reabsorbed by the crystal or escape from the surface as radiant flux.

**infrared guidance**—A system using infrared heat resources for reconnaissance of targets or for navigation.



*Infrared guidance.*

**infrared homing**—A type of missile homing in which the guidance system tracks the target from the infrared radiation it emits. *See heatseeker.*

**infrared instruments**—Any of the photoelectric and thermal detectors, spectrographs and monochromators, thermographs, scanners, amplifier tubes, snooper-scopes, and related equipment especially developed for use with infrared radiation.

**infrared jamming**—A countermeasure used against heatseeking missiles to reduce their effectiveness. Normally it involves the emittance of infrared radiation at a level that will overload the missiles' detectors.

**infrared light**—Light rays just below the red end of the visible spectrum.

**infrared light-emitting diode**—Also called infrared emitter. An optoelectronic device containing a semiconductor pn junction that emits radiant energy in the 0.75- to 100-micrometer wavelength region when forward biased.

**infrared motion detector**—A sensor that detects changes in the infrared light radiation from parts of the protected area. Presence of an intruder in the area changes the infrared light intensity from his or her direction.

**infrared optics**—Lenses, prisms, and other optical elements for use with infrared radiation (radiation with a wavelength between 0.75 and 1000 micrometers).

**infrared ovens**—Units that dry, cure, and preheat parts directly (i.e., without heating the oven air) via infrared energy.

**infrared radiation**—1. Invisible radiation with wavelengths in the range between 7500 angstroms (red) and about 1,000,000 angstroms (microwaves). 2. The electromagnetic wavelength region between approximately 0.75 and 1000 micrometers, longer than the wavelength of visible light.

**infrared radiation sources**—Almost any warm thing, from an electric blanket to a living human being, that acts as a source for the longer wavelength end of the IR range, which generally is regarded as extending from 0.75 to 1000 micrometers. Calibrated secondary sources are usually a heated cavity (blackbody) or a carbon filament lamp rated in wattage output or in ergs per second of radiation incident on a surface at a specified distance.

**infrared sources**—Emitters of radiation with a wavelength between 0.75 and 1000 micrometers.

**infrared spectrum**—That portion of the electromagnetic spectrum between the wavelengths of 0.75 and 1000 micrometers.

**infrared thermometer**—A temperature-measuring device that detects infrared radiation from an object and converts that measurement into a reading representing the temperature of the object.

**infrared waves**—Also called black light. Invisible waves longer than the longest visible red light waves but shorter than radio-frequency waves.

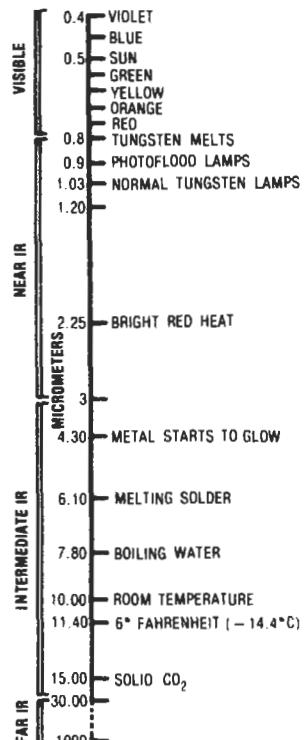
**infrared window**—A region of relatively high transmission in the infrared-frequency range.

**infrasonic**—Pertaining to frequencies below the range of human hearing, hence below about 15 hertz. Formerly called subsonic.

**infrasonic frequency**—A frequency below the audio range. Infrasonic vibrations can be felt but not heard. Replaces the obsolete term *subsonic frequency*.

**inharmonic frequency**—A frequency that is not a rational multiple of another frequency.

**inherent delay**—Delay between the insertion of information into a unit and presentation of the information at the output. For example, a delay inserted into the CRT vertical amplifier of pulse analyzers to allow the leading



Infrared spectrum.

edge of the signal triggering the sweep to be seen. *See also* insertion delay.

**inherent interference**—A type of electromagnetic interference generated within a receiver by thermal agitation, shot effect, and nonlinear impedance.

**inherent reliability**—The potential reliability of an item present in its design.

**inherited error**—In a computer, the error in the initial values, especially that error accumulated from prior steps in a step-by-step integration.

**inhibit**—To prevent an action from taking place or data from being accepted by applying an appropriate signal (generally a logic 0 in positive logic) to the proper input.

**inhibit gate**—A circuit that provides an output only when certain signals are present and other signals are not present at the inputs.

**inhibiting input**—A computer gate input which, if in its prescribed state, prevents any output which might otherwise occur.

**inhibiting signal**—A signal whose presence prevents an operation from taking place.

**inhibition gate**—A gate circuit used as a switch and placed in parallel with the circuit it is controlling.

**inhibitor**—Also called inhibition gate. In a digital computer, a logic circuit that clamps a specified output to the zero level when energized.

**inhibit pulse**—A computer drive pulse that tends to prevent certain drive pulses from reversing the flux of a magnetic cell.

**initial actuation time**—The time of the first closing of a previously open contact of a relay or the first opening of a previously closed contact.

**initial contact chatter**—That chatter caused by vibration produced by opening or closing the contacts in a relay themselves, as by contact impact in closure.

**initial differential capacitance**—The differential capacitance of a nonlinear capacitor when the capacitor voltage is zero.

**initial drain**—The current supplied at nominal voltage by a cell or battery.

**initial element**—See primary detector.

**initial erection**—The mode of operation of a vertical gyro in which the gyro is being erected or slaved initially. The initial erection rate is usually relatively fast.

**initial failure**—The first failure that occurs in use.

**initial inverse voltage**—Of a rectifier tube, the peak inverse anode voltage immediately following the conducting period.

**initial ionizing event**—Also called primary ionizing event. An ionizing event that initiates a tube count.

**initialization**—1. The process in which information (memory locations for data and results, tolerances, limits, etc.) is supplied to a computer prior to the running of a program. 2. Applying input patterns to a logic circuit so that all internal memory elements achieve a known logic state. 3. A process that takes place whenever the state of a device or program must be known at startup.

**initialize**—1. To set counters, switches, and addresses to their starting values at the beginning of a computer routine or at prescribed points in the routine. 2. To establish an initial condition or starting state; for example, to set logic elements in a digital circuit or the contents of a storage location to a known state so that subsequent application of digital test patterns will drive the logic elements to another known state. 3. To reset a computer and its peripherals to a starting state before beginning a task. Done automatically by the disk operating system.

**initializing**—1. The preliminary steps in arranging those instructions and data in a computer memory that are not to be repeated. 2. Setting flip-flops to known states prior to testing.

**initial permeability**—The slope of the normal induction curve at zero magnetizing force. Permeability at a field density approaching zero.

**initial program loader**—The procedure that results in loading of the initial part of an operating system or other program so that the program can then proceed under its own control.

**initial reversible capacitance**—In a nonlinear capacitor, the reversible capacitance at a constant bias voltage of zero.

**initial-velocity current**—A current that flows between an electrode, such as the grid of a vacuum tube, and its cathode as a result of electrons thrown off from the cathode because of heat alone. Their velocity is sufficient to allow the electrons to reach the grid unaided by an accelerating field.

**injected laser**—See diode laser.

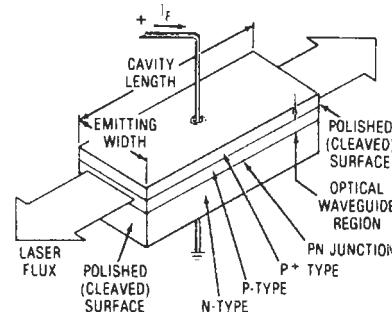
**injection grid**—A vacuum-tube grid that controls the electron stream without causing interaction between the screen and control grids. In some superheterodyne receivers, the injection grid introduces the oscillator signal into the mixer stage.

**injection laser**—Also known as a pn junction laser. 1. An optical oscillator or amplifier that has as its active medium a forward-biased semiconductor diode in which a population inversion has been established between the conduction and valence bands. Radiation is emitted in the process of recombination across the bandgap. High frequency modulation of the output beam can be achieved by modulating the input current. Usually, the optical resonator is formed by cleaving or polishing opposite faces of the diode crystal. Typical dimensions of the device are 0.1 mm × 0.1 mm × 0.5 mm. 2. A semiconductor diode carrying a high current in the forward direction. Radiation is produced as electrons recombine with holes in the

## initial differential capacitance — ink blending

junction region. For coherent emission, the current density must exceed a threshold commonly about 10,000 A/cm<sup>2</sup> for gallium arsenide diodes. 3. A solid-state semiconductor device with at least one pn junction capable of emitting coherent or stimulated radiation under specified conditions. Incorporates a resonant optical cavity. 4. A solid-state laser having at least one pn junction. Its energy level transitions are between energy bands of semiconductors and it can be tuned in frequency by temperature or pressure alterations and by the effect of a magnetic field.

**injection laser diode**—1. A coherent radiant source LED consisting of an extremely flat junction area, end mirrors, and direct bandgap semiconductors, having a Fabry-Perot optical cavity. 2. In fiber optics, a semiconductor device in which lasing takes place within the pn junction. Light is emitted from the diode edge.



Injection laser diode.

**injection-locked oscillator**—Abbreviated ILO. A free-running microwave oscillator that is stabilized by injecting a reference signal into the oscillator's resonant circuitry. The required injected signal level is determined by the output signal characteristic requirements (i.e., noise, stability, etc.) and is typically in the range of 70 to 30 dB below the output level of the ILO.

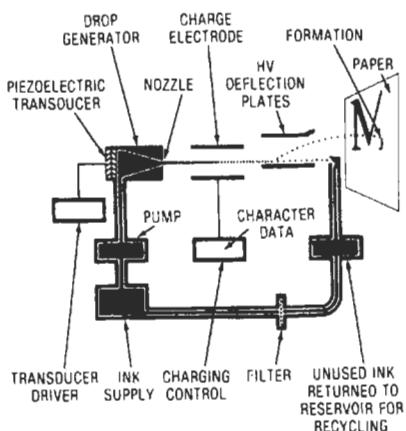
**injection luminescent diode**—1. A gallium arsenide diode, operating in either the laser or noncoherent mode, that can be used as a source of visible or near infrared light for use in triggering such devices as light-activated switches. 2. A semiconductor (gallium arsenide) diode operating in either a coherent or incoherent mode that is used as a near-infrared or visible source in triggering light-activated devices.

**injector**—An electrode on a spaciator.

**ink**—1. One of several conductive materials used for chip bonding, electrostatic shielding, corona shielding, making connections, repairing on printed circuits, attaching leads, adhesive work, ignition cable sheath coating, and making electrodes, contacts, terminations, and surfaces receptive to plating, etc. 2. Synonymous with *composition* and *paste* when relating to screenable thick-film materials, usually consisting of glass frit, metals, metal oxide, and solvents. 3. In hybrid technology, the conductive paste used on thick-film materials to form the printed conductor pattern. Usually contains metals, metal oxide, glass frit, and solvent. 4. In thick film, composition of micrometer-size polycrystalline solids suspended in a thixotropic vehicle. The solids are chosen for their electrical characteristics (i.e., metals for conductives, metals and oxides for resistives, and glasses for glazes and dielectrics).

**ink blending**—See blending.

**ink-jet printer**—A nonimpact printer that forms letters and numbers by electrostatically aiming a jet of ink onto the paper.



Ink-jet printer.

**ink-jet printing**—A nonimpact printing technique that utilizes droplets of ink to form copy images. As the print head moves across the surface of the copy paper, it shoots a stream of tiny, electrostatically charged ink drops at the page, placing them precisely to form individual print characters.

**ink-mist recording**—Also called ink-vapor recording. In facsimile, electromechanical recording in which particles of an ink mist are deposited directly onto the record sheet.

**ink recorder**—The ink-filled pen or capillary tube that produces a graphic record.

**ink recording**—A type of mechanical facsimile recording in which an inked helix marks the record sheet.

**ink-vapor recording**—See ink-mist recording.

**inleads**—Those portions of the electrodes of a device that pass through an envelope or housing.

**in-line heads**—See stacked heads.

**in-line procedures**—1. In COBOL, the procedural instructions that are part of the main sequential and controlling flow of the program. 2. Short functions whose code is inserted by the compiler at the point of call, thereby avoiding the overhead of a normal function call.

**in-line processing**—The processing of data in random sequence not subject to preliminary sorting or editing.

**in-line subroutine**—A subroutine that is inserted directly into the linear operational sequence. Such a subroutine must be recopied at each point in a routine where it is needed.

**in-line tuning**—The method of tuning the intermediate-frequency strip of a superheterodyne receiver in which all the intermediate-frequency amplifier stages are made resonant to the same frequency.

**inorganic electrolyte**—A solution that conducts electricity due to the presence of ions of substances not of organic origin.

**in phase**—Two waves of the same frequency that pass through their maximum and minimum values of like polarity at the same instant are said to be in phase.

**in-phase portion of the chrominance signal**—That portion of the chrominance signal having the same phase as, or exactly the opposite phase from, that of the

subcarrier modulated by the I signal. This portion of the chrominance signal may lead or lag the quadrature portion by 90 electrical degrees.

**input**—1. The current, voltage, power or other driving force applied to a circuit or device. 2. The terminals or other places where current, voltage, power, or driving force may be applied to a circuit or device. 3. Data to be processed. 4. The process of transferring data from an external computer storage to an internal storage. 5. The terminals, jack, or receptacle provided for the introduction of an electrical signal or electric power into a device or system.

**input admittance**—1. The reciprocal of the input impedance. 2. The admittance between the input terminals with the outputs shorted together.

**input area**—In a computer, the area of internal storage into which data from external storage is transferred.

**input bias current**—1. The current that must be supplied to each input of an IC operational amplifier to assure proper biasing of the differential-input-stage transistors. In specification sheets, this term refers to the average of the two input bias currents. 2. One-half the sum of the separate currents entering the two input terminals of a balanced amplifier. 3. The average of the two input currents of an operational amplifier.

**input block**—In a computer, a section of the internal storage reserved for receiving and processing input data.

**input capacitance**—1. The capacitance at the input terminals of a device. 2. The capacitance between gate and source terminals of a field-effect transistor at specified bias and frequency conditions, with the drain ac short-circuited to the source.

**input channel**—A channel through which a state is impressed on a device or logic element.

**input common-mode range**—The maximum input that can be applied to either input of an operational amplifier without causing damage or abnormal operation.

**input common-mode rejection ratio**—1. The ratio of the change in input voltage to the corresponding change in output voltage, divided by the open-loop voltage gain. 2. The ratio of the full differential voltage gain to the common-mode voltage gain.

**input common-mode voltage range**—The range of voltages on the input terminals of an operational amplifier for which the amplifier is operational. Note that the specifications are not guaranteed over the full common-mode voltage range unless specifically stated.

**input device**—1. The device or set of devices through which data is brought into another device. 2. A device such as a card reader or terminal keyboard that converts data from the form in which it has been received into electronic signals that can be interpreted by the computer.

**input equipment**—The equipment that introduces information into a computer.

**input error voltage**—The error voltage appearing across the input terminals of an operational amplifier when a feedback loop is applied around the amplifier.

**input extender**—A high-speed diode array used in a logic circuit when increased fan-in capability is required.

**input formatting**—The technique a system uses to put all entered data into a standard (or intelligible) format.

**input gap**—Also called buncher gap. In a microwave tube, the gap where the initial velocity modulation of the electron stream occurs.

**input impedance**—1. The impedance a transducer presents to a source. 2. The effective impedance seen looking into the input terminals of an amplifier; circuit details, signal level, and frequency must be specified. 3. The impedance that exists between the input terminals

of an amplifier or transmission line when the source is disconnected.

**input impedance of a transmission line**—The impedance between the input terminals with the generator disconnected.

**input offset current**—The difference between the input bias currents flowing into each input of an IC operational amplifier, when the output of the operational amplifier is at zero volts.

**input offset voltage**—That voltage which must be applied between the input terminals of an operational amplifier, through two equal resistances, to obtain zero output voltage.

**input/output**—Abbreviated I/O. 1. Pertaining to devices that accept data for transmission to a computer system (input) or that accept data from a computer system for transmission to a user or process. Devices that perform both functions are known as I/O devices (e.g., terminals). 2. A general term for the peripheral devices used to communicate with a digital computer, and the data involved in the communication. 3. The process of transmitting information from an external source to an equipment unit, or from an equipment unit to an external source. 4. Transferring information from an input to an accumulator, or from an accumulator to an output. 5. Interface circuits or devices offering access between external circuits and the central processing unit or memory.

**input-output bound**—See input-output limited.

**input/output connector**—A mating pair of connectors used to carry signals into and out of a panel-mounted subsystem. An example is a connector pair that interconnects the individual back panels in a large array of panels.

**input-output limited**—Also called input-output bound. Pertaining to a system or condition in which the time taken by input and output operations exceeds the time for other operations.

**input pins**—The terminals of the device to which input logic signals may be applied.

**input-power rating**—Also called coil rating. A statement of the allowable voltage, current, or power to the actuating element of a relay beyond which unsatisfactory performances will occur.

**input process**—1. The process in which a device receives data. 2. The transmission of data from peripheral equipment or external storage to internal storage.

**input recorder**—Any device that makes a record of an input electrical signal.

**input reflected current**—In dc-dc converters, the peak-to-peak ac current generated by the switching transients. The value of this current should not exceed 1 percent of the nominal input current.

**input reflected ripple**—A dc-dc converter term that describes the voltage spike resulting from switching generated transient currents as measured at the dc input source.

**input register**—In a computer, the register of internal storage able to accept information from outside the computer at one speed and supply the information to the computer calculating unit at another, usually much greater, speed.

**input resistance**—Also called differential input resistance. The small signal resistance measured between the inverting and noninverting inputs of an operational amplifier. Input capacitance is the capacitance seen between the same two inputs.

**input resonator**—The buncher resonator in a velocity-modulated tube. It modifies the velocity of the electrons in the beam.

**input sensitivity**—The input signal level that will result in rated output of a piece of amplifying equipment. In preamplifiers, it is the signal that gives the rated voltage output of the preamplifier; in power amplifiers, the signal that gives the rated power output. (In preamplifiers, the phono sensitivity is commonly 1 millivolt; high-level inputs, such as tape and tuner, are commonly 250 millivolts. In power amplifiers, common values are between 0.5 and 1.0 volt.)

**input transformer**—A transformer that transfers energy from an alternating-voltage source to the input of a circuit or device. It usually provides the correct impedance match as well.

**input uncertainty**—In an operational amplifier, the algebraic sum of all the factors, including environmental and time effects, that contribute to the nonideal behavior of the input circuit.

**input unit**—In a computer, the unit that takes information from outside the computer into the computer.

**input voltage drift**—The change in output voltage of an operational amplifier divided by the open-loop gain, the quotient expressed as a function of temperature or time.

**input voltage offset**—The dc potential difference between the two inputs of a differential amplifier when the potential difference between the output terminals is zero.

**input winding**—See signal winding.

**inquiry**—1. The withdrawal of stored information from an electronic data processing system by interrogating the contents of the storage of a computer. 2. A technique for initiating the interrogation of the contents of the storage of a computer.

**inquiry station**—A remote terminal from which an inquiry may be sent over a wire line to a computer.

**inquiry unit**—A device used to extract a quick reply to a random question regarding information in a computer storage.

**inrush**—The initial surge of current through a load when power is first applied. Lamp loads, inductive motors, solenoids, contactors, valves, and capacitive load types all have inrush or surge currents higher than the normal running or steady-state currents. Resistive loads, such as heater elements, have no inrush.

**inrush current**—1. The current in a load circuit immediately following turn-on. In capacitive and tungsten-lamp loads, this exceeds steady-state current for some period following turn-on. 2. In a solenoid or coil, the steady-state current drawn from the line with the armature in its maximum open position.

**inrush current limiting**—Protective circuit in a power supply that prevents excessively large currents through a rectifier to charge the filter capacitors. To prevent unnecessary power loss, the circuit is usually inhibited after the capacitors attain full charge.

**insert core**—An iron core used generally for adjusting an inductor to a fixed frequency. It consists of a threaded metal insert molded or cemented into one or both ends of the core.

**insert earphones**—Small earphones that fit partially inside the ear.

**insertion delay**—Also called inherent delay, intrinsic delay, and propagation delay. The interval for a circuit or instrument to respond with an output after being triggered either internally or externally. It is usually implied that the numerically expressed period is an irreducible minimum.

**insertion force**—1. Of a connector, the force needed to fully engage a connector plug and receptacle. Depending on the number, arrangement, and size of the contact pins, in addition to the strength of the springs,

their surface finish, and the rigidity of their mountings, the required mechanical insertion force will be dictated to a great extent by the life expectancy of the connectors, the intended use, the speed of insertion, and their immunity to shock and vibration. 2. The effort, usually measured in ounces, required to engage mating components.

**insertion gain** — The gain resulting from the insertion of a transducer in a transmission system is the ratio of the power delivered to that part of the system following the transducer to the power delivered to that same part before insertion. (If more than one component is involved in the input or output, the particular component used must be specified. This ratio is usually expressed in decibels.)

**insertion loss** — 1. The difference between the power received at the load before and after the insertion of apparatus at some point in the line. 2. The loss in load power resulting from the insertion of a component, connector, or device. Insertion loss is expressed in decibels as the ratio of power received at the load before insertion to the power received at the load after insertion. 3. Signal-power loss resulting from connecting communication equipment with dissimilar impedance values. 4. A power loss that results from inserting a component into a previously continuous path or creating a splice in it.

**insertion phase shift** — The change in phase of an electric structure when inserted into a transmission system.

**insertion switch** — A process by which information is inserted into a computer by the manual operation of switches.

**insertion tool** — A small, hand-held tool used to insert contacts into a connector.

**inside lead** — *See* start lead.

**inside spider** — A flexible device placed inside a voice coil to center it with the pole pieces of a speaker.

**in-situ tester** — *See* in-circuit tester.

**inspection chamber** — In a spectrophotometer, the part in which the solution to be tested is placed for analysis.

**inspectoscope** — An instrument for viewing quartz crystals, while they are immersed in oil, to determine mechanical faults, the approximate direction of the optical axis, and regions of optical twinning.

**instability** — 1. The measure of the fluctuations or irregularities in the performance of a device, system, or parameter. 2. An undesired change that occurs over a period of time and that is not related to input, operating conditions, or load.

**instantaneous automatic gain control** — Abbreviated instantaneous AGC. A portion of a radar system that automatically adjusts the gain of an amplifier for each pulse so that there is a substantially constant output-pulse peak amplitude with different input-pulse peak amplitudes. The circuit is capable of acting during the time in which a pulse is passed through the amplifier.

**instantaneous companding** — Companding that varies the effective gain in response to instantaneous values of the signal wave.

**instantaneous contacts** — Contacts that are actuated immediately when a starting signal is applied to a timer.

**instantaneous disc** — A blank recording disc that can be played back on a phonograph immediately after being cut on a recorder.

**instantaneous frequency** — The rate at which the angle of a wave changes when the wave is a function of time. If the angle is measured in radians, the frequency in hertz is the rate of change of the angle divided by  $2\pi$ .

**instantaneous overcurrent relay** — Also called rate-of-rise relay. A device that functions instantaneously on an excessive value of current or on an excessive rate

of current rise, thus indicating a fault in the apparatus of the circuit being protected.

**instantaneous power** — The power at the points where an electric circuit enters a region. It is equal to the rate at which the circuit is transmitting electrical energy into the region.

**instantaneous power output** — The rate at which energy is delivered to a load at a particular instant.

**instantaneous readout** — Readout by a radio transmitter at the instant the information to be transmitted is computed.

**instantaneous recording** — A recording intended for direct reproduction without further processing.

**instantaneous sampling** — The process of obtaining a sequence of instantaneous values of a wave. These values are called instantaneous samples.

**instantaneous sound pressure** — The total instantaneous pressure at a certain point, minus the static pressure at that point. The most common unit is the microbar.

**instantaneous speech power** — The rate at which the speaker is radiating sound energy at any given instant.

**instantaneous speed variations** — *See* ISV.

**instantaneous start-stop rate** — The maximum stepping rate that can be attained by an unloaded stepper motor from a standstill without losing synchronism with the field and without overshooting to the next step when coming to a stop.

**instantaneous value** — 1. The magnitude, at any particular instant, of a varying value. 2. The value of voltage or current at a particular instant. If the selected instant is the time when the polarity of the waveform changes, this value will be zero.

**instruction** — 1. Information that, when properly coded and introduced as a unit into a digital computer, causes the computer to perform one or more of its operations. All instructions commonly include one or more addresses. 2. A binary code applied to a logic circuit to affect its mode of operation. 3. A statement that specifies an operation and the values or locations of its operands. In this context, the term *instruction* is preferable to the terms *command* or *order*, which are sometimes used synonymously. 4. A set of bits that defines a computer operation and is a basic command understood by the CPU. It may move data, do arithmetic and logic functions, control I/O devices, or make decisions as to which instructions to execute next. 5. In a computer, a single order within a program. This order will be fetched from memory, decoded, and executed by the CPU. Instructions may be arithmetic or logical, and operate on registers, memory, I/O devices, or specify control operations. A sequence of instructions is a program. 6. A machine-language command executed by the microprocessor in a computer system.

**instructional constant** — Also called pseudoinstruction. In a computer, data stored in the program or instructional area that will be used only as a test constant.

**instruction code** — The list of symbols, names, and definitions of the instructions that are intelligible to a given computer or computing system.

**instruction counter** — A multiple-bit register that keeps track of the address of the current instruction. *See* control counter.

**instruction cycle** — The process of fetching an instruction from memory and executing it.

**instruction deck** — A set of punched cards containing a symbolic coded program to be read into a computer.

**instruction fetch** — *See* fetch.

**instruction length** — The number of words needed to store an instruction. It is one word in most computers,

but some will use multiple words to form one instruction. Multiple-word instructions have different instruction execution times depending on the length of the instruction.

**instruction modification** — A change in the operation-code portion of a computer instruction or command such that, if the routine containing the instruction or command is repeated, the computer will perform a different operation.

**instruction register** — 1. In a computer, the register that temporarily stores the instruction currently being performed by the control unit of the computer. 2. A computer storage for the binary code for the operation to be performed. Usually this instruction represents the contents of the address just designated by the program counter. However, the contents of the instruction register or the program counter may be changed by the computations. This, of course, represents one of the key ideas of a stored-program computer—instructions, as well as data, can be operated on and subsequent operations will be determined by the results.

**instruction repertoire** — The instruction set for a computer.

**instruction set** — 1. A means of describing computer capability. It consists of a listing of all the instructions the computer can execute. The basic operations that can be performed by a CPU. Necessary instructions are arithmetic, logical, test and branch, and moves. 2. The set of general-purpose instructions available with a given computer. In general, different machines have different instruction sets. The number of instructions only partially indicates the quality of an instruction set. Some instructions may only be slightly different from one another; others rarely may be used. Instruction sets should be compared using benchmark programs typical of the application to determine execution times and memory requirements.

**instruction storage** — The storage medium that contains basic machining instructions in coded form.

**instruction time** — The time required to fetch an instruction from memory and then execute it.

**instruction word** — A computer word that causes the computer to execute a particular operation. *See word.*

**instrument** — A device capable of measuring, recording, and/or controlling.

**instrument approach** — A blind landing—i.e., solely by navigational instruments, without visual reference to the terrain.

**instrument-approach system** — In navigation, a system furnishing vertical and horizontal guidance to aircraft during descent. Touchdown requires some other guidance.

**instrumentation** — 1. The use of devices to measure the values of varying quantities, usually as part of a system for keeping the quantities within prescribed limits. 2. Adding code to a program for injecting data and collecting information, usually for dynamic analysis.

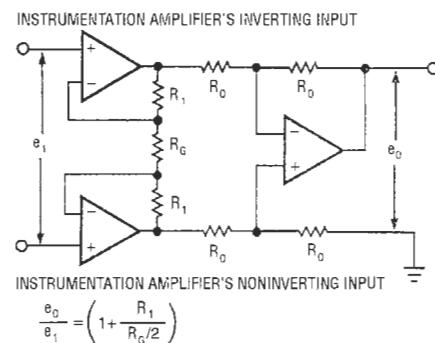
**instrumentation amplifier** — High accuracy analog amplifier with full differential inputs and gains ranging from 1 to 1000.

**instrumentation bus** — A dedicated bus tailored for the connection of measurement and control devices.

**instrument chopper** — A vibrating switch used for modulating, demodulating, and switching dc or low-frequency ac information in instrumentation. It is driven synchronously from an ac or pulsating dc source. The driven switching circuit is designed for low-level (0- to 10-volt) signal information.

**instrument driver** — Software module that converts the parameters in the object code to the specific instruction sequence needed to stimulate an instrument.

## instruction modification — insulated



Instrumentation amplifier.

**instrument error** — The inaccuracy of an instrument.

**instrument flight** — A blind flight—i.e., one in which the pilot controls the path and altitude of the aircraft solely by instrument.

**instrument lamp** — A lamp that illuminates or irradiates an instrument.

**instrument landing station** — A special radio station for aiding in landing aircraft.

**instrument landing system** — Abbreviated ILS. A radionavigation system intended to aid aircraft in landing. It provides lateral and vertical guidance, including distance from the landing point. Consists of four ground radio transmitting stations at and in the vicinity of an airport, which radiate direction and position signals to approaching aircraft that are received on an instrument in the aircraft and alert the pilot to any deviation from the safe approach path to the correct touchdown point.

**instrument landing system localizer** — System of horizontal guidance embodied in the instrument landing system that indicates the horizontal deviation of the aircraft from its optimum path of descent along the axis of the runway.

**instrument multiplier** — *See* voltage-range multiplier.

**instrument relay** — A relay that operates on the principles employed in such electrical measuring instruments as the electrodynamometer, iron-vane, and D'Arsonval meters.

**instrument shunt** — An internal or external resistor connected in parallel with the circuit of an instrument to extend its current range.

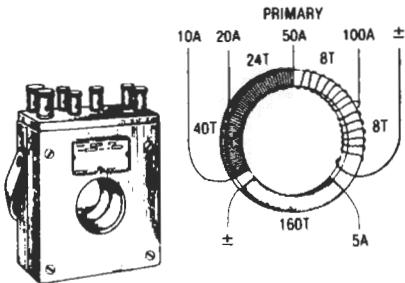
**instrument switch** — A switch disconnecting an instrument or transferring it from one circuit or phase to another.

**instrument transformer** — A transformer that reproduces, in its secondary circuit, the primary current (or voltage) with its phase relationship substantially preserved, suitable for utilization in measurement, control, or protective devices.

**instrument-transformer correction factor** — The factor by which a wattmeter reading must be multiplied to correct for the effect of the instrument-transformer ratio correction factor and phase angle.

**instrument zero** — The lower end of the measuring instrument's scale. Instrument zero may not coincide with zero value of the measured variable. Zero error is the error at instrument zero.

**insulated** — Separated from other conducting surfaces by a nonconductive material offering a high, permanent resistance to the passage of current and disruptive discharge.



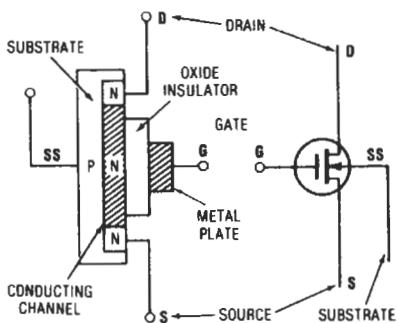
Instrument transformers.

**insulated carbon resistor**—A carbon resistor encased in fiber, plastic, or other insulation.

**insulated clip**—A clip terminating in an insulated eye through which flexible cords or wires may be run and supported.

**insulated enclosure**—A special shielded enclosure design providing insulation against weather or providing maximum temperature stability. Usually prefabricated as an exterior building panel in modular construction.

**insulated-gate field-effect transistor**—Abbreviated IGFET. In general, any field-effect transistor that has an insulated gate regardless of the fabrication process.



Insulated-gate field-effect transistor.

**insulated-substrate monolithic circuit**—An integrated circuit that may be either an all-diffused device or a compatible structure so constructed that the components within the silicon substrate are insulated from one another by a layer of silicon dioxide, instead of the reverse-biased pn junctions used for isolation in other techniques.

**insulated terminals**—Solderless terminals provided with an insulated sleeve over the barrel to prevent a short circuit.

**insulated wire**—A conductor covered with a non-conductive material.

**insulating material**—1. A material on or through which essentially no current will flow. It is used to confine the flow of current within a conductor or to eliminate the shock hazard of a bare conductor. 2. Any composition primarily adapted for preventing the transfer of electricity therethrough, the useful properties of which depend on its chemical composition or atomic arrangement.

**insulating sleeve**—Tube or tape of insulating material placed around metal-enclosed capacitors to insulate the case electrically from other components and wiring.

**insulating strength**—The measure of the ability of an insulating material to withstand electrical stress without breaking down. It is defined in terms of the voltage per unit thickness necessary to initiate a disruptive discharge and usually is measured in volts per centimeter. See also dielectric strength; electric strength.

**insulating tape**—Tape that is wrapped around joints in insulated wires or cables. It is impregnated with an insulating material and covered with adhesive on one side.

**insulating varnish**—A varnish applied to coils and windings to improve their insulation (and, at times, their mechanical rigidity).

**insulation**—1. A nonconductive material that prevents the leakage of electricity from a conductor, provides mechanical spacing or support, or protects against accidental contact. 2. The use of a material that passes negligible current to surround or separate a conductor to prevent loss of current. 3. A material that offers high electric resistance, making it suitable for covering components, terminals, and wires to prevent the possible future contact of adjacent conductors resulting in a short circuit. 4. Material used to cover electrical wires to prevent electrical leakage and short circuiting and to reduce the danger of shock.

**insulation displacement termination**—A connector that has insulated wire is forced into a channel constructed so that ridges or teeth in the channel cut through or displace the insulation and make an air-tight contact with the wire.

**insulation piercing**—A crimping method in which lances pierce wire insulation, enter into the strands, and make electrical contact without stripping the wire.

**insulation rating**—The dielectric-strength and insulation-resistance values required to ensure satisfactory performance.

**insulation resistance**—1. The resistance offered by an insulating material to the flow of current resulting from an impressed dc voltage. 2. The ratio of the voltage applied between two electrodes in contact with a specific insulator to the total current between the electrodes. 3. Industrial specifications usually call for a certain minimum value (several thousand megohms) determined with a specific voltage applied. 4. The direct current resistance between the two terminals of a capacitor, or between either or both of the terminals and the capacitor case. 5. The ratio of dc voltage impressed across a capacitor to the resultant leakage current. For a particular capacitor design, the product of insulation resistance and capacitance (megohm-microfarad) is quite constant. 6. The electrical resistance of the insulating material (determined under specified conditions) between any pair of contacts, conductors, or grounding devices in various combinations.

**insulation resistivity**—The insulation resistance per unit volume of insulation.

**insulation stress**—The molecule separation pressure caused by a potential difference across an insulator. The practical stress on insulation is expressed in volts per mil.

**insulation system**—All of the insulation materials used to insulate a particular electrical or electronic product.

**insulator**—1. A material in which the outer electrons are tightly bound to the atom and are not free to move. Thus, there is negligible current through the material when a voltage is applied. The resistivity is greater than  $10^8$  ohm-cm and generally decreases when the temperature rises. 2. A nonconducting substance such as porcelain, plastic, glass, rubber, etc. 3. A material of such low electrical conductivity that current through it can

usually be neglected. 4. A material of low electrical conductivity designed for supporting a conductor, physically and electrically separating it from another conductor or object.

**insulator arcing ring**—A circular or oval metal part placed at one or both ends of an insulator to prevent current from arcing over and damaging it and/or the conductor.

**insulator arccover**—The flow of power current over an insulator in the form of an arc following a surface discharge.

**insulazing**—See surface insulation.

**insulectrics**—The science encompassing insulating materials in electrical insulation.

**integer**—A whole number, which may be positive, negative, or zero. It does not have a fractional part. Examples of integers: 1, 2, 48, -136, etc., but not 3.7 or  $\frac{3}{4}$ .

**integral-cavity, reflex-klystron oscillator**—A reflex-klystron oscillator in which tuning is accomplished by changing the physical dimensions of the resonant cavity. It is usually referred to as a diaphragm- or grid-gap-tuned klystron, since a flexible diaphragm is used to change the cavity dimension, i.e., the gap between the cavity grids.

**integral circuit packages**—Microcircuits assembled from discrete components and all circuits created essentially in an active or passive substrate.

**integral contact**—Current-carrying member of jack, switch, or relay. Usually a flat, flexible spring or other conducting member having no separate contacts attached at point of mating.

**integral-external-cavity reflex oscillator**—A reflex-klystron oscillator in which a fixed internal cavity is tightly coupled to a permanently attached external cavity. Tuning is achieved by varying a reactance probe in the external cavity.

**integral-horsepower motor**—A motor that is built into a frame and has a continuous rating of 1 horsepower.

**integral resistor**—An internal or external resistor preconnected to the electrical element and forming an integral part of the cup assembly to provide a desired electrical characteristic of a precision potentiometer.

**integrated**—A type of design in which two or more basic components or functions are physically, as well as electrically, combined—usually on one chassis, such as an integrated amplifier.

**integrated amplifier**—Also called, occasionally, a control amplifier, since it is an amplifier with controls. 1. An amplifier that embodies in a common housing the preamplifier and control section and the power amplifier. Some early amplifiers of large power were in two separate units, one the control unit with preamplifiers and the other the power amplifier. 2. A single component combining the functions and circuitry of a power amplifier and preamplifier. See also amplifier.

**integrated circuit**—Abbreviated IC. Also called functional device. 1. An electrical network—active or passive—composed of two or more circuit elements inextricably bound on a single semiconductor substrate. To further define the nature of an integrated circuit, additional modifiers may be prefixed. Examples: dielectric-isolated monolithic integrated circuit; beam-lead monolithic integrated circuit; or silicon-chip tantalum thin-film hybrid integrated circuit. See also film integrated circuit; hybrid integrated circuit; monolithic integrated circuit; multichip integrated circuit. 2. Any electronic device in which both active and passive elements are contained in a single package. The term frequently is used for circuits other than those containing semiconductors; for example, microwave

## insulator arcing ring — integrated morphology

designers consider many types of waveguide assemblies to be integrated circuits. 3. A small chip of solid material (generally a semiconductor) upon which, by various techniques, an array of active and/or passive components has been fabricated and interconnected to form a functioning circuit. Integrated circuits, which are generally encapsulated with only input, output, power supply, and control terminals accessible, offer great advantages in terms of small size, economy, and reliability. 4. The physical realization of a number of electrical circuit elements inseparably associated on or within a continuous body of semiconductor material to perform the function of a circuit. 5. An electronic device containing several elements, active or passive, that perform all or part of a circuit function. 6. An interconnected array of conventional components—transistors, diodes, capacitors, and resistors—fabricated *in situ* within and on a single crystal of semiconductor material with the capability of performing a complete electronic circuit function. 7. An electronic circuit containing transistors, diodes, resistors, and perhaps capacitors and photocells, along with interconnecting electrical conductors processed and contained entirely within a single chip of silicon. 8. Multiple, interconnected circuit elements, contained on or in a common substrate, that function as a unit and not separately.

**integrated-circuit array**—Multiple integrated circuits formed on a common substrate and electrically interconnected during fabrication.

**integrated-circuit package**—The combined mounting and housing for an integrated circuit; the package protects the integrated circuit and permits external connections to be made to it.

**integrated communication system**—Communication system on either a unilateral or joint basis in which a message can be filed at any communications center in that system and be delivered to the addressee(s) by any other appropriate communication center in that system without reprocessing en route.

**integrated component**—A number of electrical elements comprising a single structure that cannot be divided without destroying its stated electronic function.

**integrated console**—Computer control console that is capable of controlling the operation of the switching center equipment of an integrated communications system.

**integrated data processing**—A method of transforming disjointed and repetitive paperwork tasks into a correlated and mechanized production of information for any purpose.

**integrated electronic component**—Abbreviated IEC. An assembly that consists of several integrated circuits interconnected on a single chip of silicon to provide a complete electronic function with a circuit content greater than 10 equivalent gates.

**integrated electronics**—That portion of electronic art and technology in which the interdependence of material, device, circuit, and system-design considerations is especially significant; more specifically, that portion of the art dealing with integrated circuits.

**integrated electronic system**—See integrated circuit.

**integrated equipment components**—Abbreviated IECs. Integrated-circuit chips that contain a complete logic function.

**integrated injection logic**—See I<sup>2</sup>L.

**integrated microcircuit**—See integrated circuit.

**integrated morphology**—The structural characterization of an electronic component in which the identity of the current- or signal-modifying areas, patterns, or volumes has become lost in the integration of electronic

materials, in contrast to an assembly of devices performing the same function.

**integrated optical circuit**—Abbreviated IOC. Also called optical integrated circuit. A circuit, or group of interconnected circuits, consisting of miniature solid-state optical components, such as light-emitting diodes, optical filters, photodetectors (active and passive), and thin-film optical waveguides on semiconductor or dielectric substrates.

**integrated optics**—The interconnection of miniature optical components via optical waveguides on transparent dielectric substrates, using optical sources, modulators, detectors, filters, couplers, and other elements incorporated into circuits analogous to integrated electronic circuits, for the execution of various communication, switching, and logic functions.

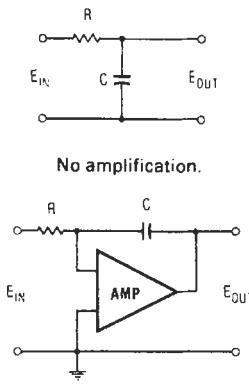
**integrated services digital network**—Abbreviated ISDN. A switched network providing end-to-end digital connectivity for simultaneous transmission of voice and data over multiplexed communications channels. *See also* ISDN.

**integrated software**—An applications software package containing programs to perform more than one function.

**integrated transducers**—Semiconductor components that change the form of energy (e.g., piezoelectric devices, photogenerators, thermistors, etc.) and that are integrated into multifunction chips.

**integrated voltage regulator**—Abbreviated IVR. An integrated structure that serves as the reference, error amplifier, and shunt elements for shunt voltage regulation. A resistive voltage divider connected to its input provides adjustment of the output voltage.

**integrating circuit**—*See* integrator, 1.



*Integrating circuits.*

**integrating meter**—A meter that adds up (integrates) the electrical energy used over a period of time. An ordinary electric watt-hour meter is an example.

**integrating motor**—A motor that maintains a constant ratio of output-shaft rotational speed to input signal.

Thus, the angle of rotation of the shaft is proportional to the time integral of the input signal.

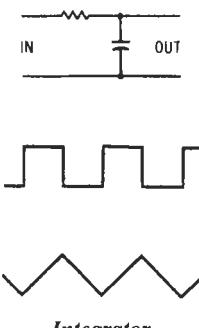
**integrating photometer**—A photometer that, with a single reading, indicates the average candlepower from a source in all directions or at all angles in a single plane.

**integrating relay**—A relay that sums up the inputs of voltage or current supplied to it and opens or closes its contacts in response to the input so integrated.

**integrating-sphere densitometer**—A photoclectric instrument that measures the density of motion-picture film or its sound track.

**integration time**—That time during which all electrons formed by impinging photons are gathered in a potential well under an energized electrode.

**integrator**—1. A device with an output proportionate to the integral of the input signal. 2. In certain digital machines, a device that numerically approximates the mathematical process of integration. 3. A device that determines on a continuous basis the total value of a quantity being measured, usually as a function of time. 4. Device for summing or totalizing counts, areas under curves, etc.



**intelligence bandwidth**—The total audio (or video) frequency bandwidths of one or more channels.

**intelligence sample**—Part of a signal taken as evidence of the quality of the whole.

**intelligence signal**—Any signal that conveys information (e.g., voice, music, code, or television).

**intelligent controller**—Device controller equipped with local interpreting functions, such as editing, input validity checks, and complex command decoding.

**intelligent instruments**—Devices that possess capabilities that raise them above the level of instruments that merely sense and display analog information. The following list presents one instrument intelligence rating system, from the lowest order of intelligence to the highest:

1. The ability to sense and display information.
2. Conversion of analog information into digital.
3. Mathematical manipulation of digital data.
4. Interpretation of results of mathematical manipulation.

5. Making of decisions on the basis of interpretation.

**intelligent robot**—A robot that can make decisions by itself through its sensing and recognizing capabilities.

**intelligent terminal**—1. An input/output device in which a number of computer processing characteristics are physically built into, or attached to, the terminal unit. 2. Programmable control terminal that drives other terminals, peripherals, floppy disks, machines, program counters, etc. 3. A programmable data service, usually

**intelligent time-division multiplexer — interactive environment**

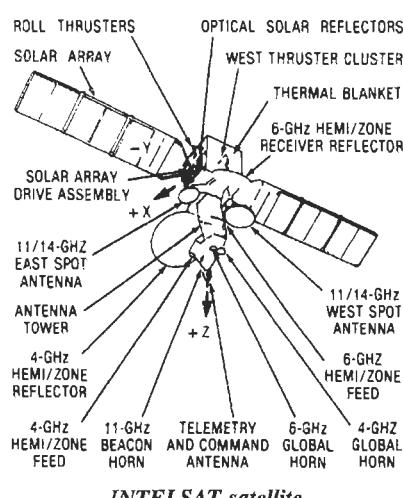
remote from the main computer, that unburdens the host computer by performing preliminary data processing such as formatting, verification, or validation. 4. A terminal that has editing and block-transmission capabilities, which allow manipulation of data in the terminal before transmission to the host computer. Some intelligent terminals can also perform checks on entered data. An intelligent terminal's programmability is restricted to formatting data on its screen. These formats can be called up through the keyboard and can have protected fields that allow entering of data (numeric, alphabetic, or alphanumeric) in the prescribed format. User programmability distinguishes the intelligent terminal from its less intelligent relatives. In addition to this programmability, an intelligent terminal has editing functions similar to those of a smart terminal. 5. An input/output device with built-in intelligence in the form of a microprocessor and able to perform functions that would otherwise require the central computer's processing power; sometimes called a stand-alone terminal. 6. A terminal with local processing power whose characteristics can be changed under program control.

**intelligent time-division multiplexer**—See **ITDM**.

**intelligent voice terminal**—Intelligent terminal operated by the human voice; software resident in the terminal is user-programmable. Best for applications suiting an intelligent terminal but where hands-free data entry is cost advantageous.

**intelligibility**—See **articulation**.

**INTELSAT**—Abbreviation for *International Telecommunications Satellite Consortium*. 1. A series of commercial communications satellites designed to relay telephony and television signals among the member INTELSAT nations. The INTELSAT global network employs an equatorial orbit above the Atlantic, Pacific, and Indian Oceans. Satellites in these three locations are capable of linking virtually all the inhabited areas of the world. 2. International (primarily noncommunist) satellite agency whose member nations lease transponder capacity on its satellite system to provide at least some TV in all parts of the world.



*INTELSAT satellite.*

**intensifier electrode**—Also called postaccelerating electrode. In some types of electrostatic cathode-ray tubes, an electrode that permits additional acceleration of the

electron beam after it has been deflected. This electrode emits greater intensity of the trace without materially reducing the deflection sensitivity of the tube.

**intensifying screen**—A thin fluorescent screen placed next to a photographic plate to increase the effect of radiation on the plate.

**intensitometer**—Also called a dosage meter or dosimeter. An instrument that estimates the amount of X-ray radiation, for determining the duration of exposure during X-ray pictures or therapy.

**intensity**—1. The strength of a quantity. 2. The relative strength, or amplitude, of electric, magnetic, or vibrational energy. 3. The brilliance of an image on the screen of a cathode-ray tube. 4. The strength of light or other electromagnetic energy being radiated or reflected per steradian. 5. The flux per unit solid angle radiating (diverging) from a source of finite area.

**intensity control**—Used with cathode-ray tubes to control the intensity of the electron beam and hence the amount of light generated by the fluorescent screen. Generally, the grid bias of the tube is regulated.

**intensity level**—Ratio of the intensity of the sound to a reference intensity of a free plane wave of 1 microwatt per square centimeter under normal conditions. Commonly expressed in decibels.

**intensity modulation**—1. The process and/or effect of varying the electron-beam current in a cathode-ray tube, resulting in varying brightness or luminance of the trace. 2. The process in which the electron beam of a cathode-ray tube is varied in intensity in accordance with the magnitude of the signals it receives. See also **Z-axis modulation**.

**intensity of radiation**—The radiant energy emitted in a specified direction per unit time, per unit area of surface, per unit solid angle.

**interaction**—The effects two or more parts, components, etc., have on each other while each is performing a function.

**interaction crosstalk**—Crosstalk resulting from mutual coupling between two paths by means of a third path. For example, if a signal on pair 1 is coupled to pair 2, and then coupled from pair 2 to pair 3, where it is measured, it is known as interaction crosstalk.

**interaction loss (of a transducer)**—Expressed in decibels, it equals 20 times the logarithm (to the base 10) of the scalar value of the reciprocal of the interaction factor.

**interaction space**—In an electronic tube, the region where the electrons interact with an alternating electromagnetic field.

**interactive**—1. Pertaining to an application in which each entry elicits a response. An interactive system may also be conversational, implying continuous dialog between the user and the system. 2. A program or system that can ask questions of the user and then take action based on his response. *Conversational* is often used to mean the same thing. 3. Refers to those applications in which a user communicates with a computer program via a terminal, entering data and receiving responses from the computer. 4. Processing of data on a two-way basis, with human intervention redirecting the processing in a predetermined manner.

**interactive debugger**—A computer system software utility that permits a user to examine his or her task while it executes by stopping it at given points (usually called breakpoints) and displaying and changing memory/register contents.

**interactive environment**—A situation in which a computer continually responds to the user on receipt of directives from his or her terminal.

**interactive graphics** — 1. The use of a large-screen, high-precision CRT and its associated circuitry—usually linked to a large-scale computer system through a small control computer—on which both alphanumeric and vector data are displayed and manipulated. By using the data entry device, two- and three-dimensional geometric designs can be created, deleted, and modified in real time to achieve desired results. 2. The use of a display terminal in a conversational or interactive mode. 3. Capability to perform graphics operations directly on the computer with immediate feedback.

**interactive operation** — Also called conversational mode. Online operation in which there is a give-and-take between person and machine.

**interactive system** — 1. A system in which it is possible for the human user or the device serviced by the computer to communicate directly with the operating program. For human users, this arrangement is termed a conversational system. 2. A system in which a computer or operating program communicates bilaterally with a user.

**interactivity** — Computer programs, online services, and interactive TV in which the user can make inputs that direct subsequent delivery of services. Channel surfing is a crude form of interactivity. Internet and online services provide simple forms of interactivity, i.e., point-and-click.

**interaxis error** — The deviation from 90° perpendicularity of one set of resolver windings when excitation is applied to one of the other windings. For rotor interaxis error, one stator winding is excited; for stator interaxis error, one rotor winding is excited.

**interbase current** — In a junction tetrode transistor, the current that flows from one base connection to the other through the base region.

**interbase resistance** — Resistance between base 2 and base 1 of a unijunction transistor measured at a specified interbase voltage with  $I_E = 0$ .

**interblock space** — See IRG.

**intercarrier noise suppression** — The means of suppressing the noise resulting from increased gain when a high-gain receiver with automatic volume control is tuned between stations. The suppression circuit automatically blocks the audio-frequency output of the receiver when there is no signal at the second detector.

**intercarrier sound system** — A television receiving system in which use of the picture carrier and the associated sound-channel carrier produces an intermediate frequency equal to the difference between the two carrier frequencies. This intermediate frequency is frequency modulated in accordance with the sound signal.

**intercellular massage** — The ultrasonic stimulation of body cells. Sometimes called micromassage.

**intercepting** — Routing of a call or message placed for a disconnected or nonexistent destination to an operator position or a specially designated terminal or machine answering device.

**intercepting trunk** — A trunk to which a call made to a vacant number, a changed number, or a line out of order is connected so that action may be taken by an operator.

**intercept operator** — The telephone operator who requests the number called, determines the reason for the intercept, and relays the information to the calling party.

**intercept receiver** — Also called search receiver. A specially calibrated receiver that can be tuned over a wide frequency range in order to detect and measure enemy rf signals.

**intercept service** — In a telephone system, a service provided to subscribers whereby calls to disconnected stations or dead lines are either routed to an intercept operator for explanation or the calling party receives a distinctive tone signal or recorded announcement to indicate that he or she has made such a call.

**intercept tape** — A tape used for temporary storage of messages intended for trunk channels and tributary stations in which there is equipment or circuit trouble.

**intercept trunk** — See intercepting trunk.

**intercharacter space** — In telegraphy, the space between characters of a word. It is equal to three unit lengths.

**intercom** — See intercommunication system.

**intercommunication apparatus** — Equipment and systems for paging and intercommunication within a building, including audio, bell systems, pillow systems, and pocket page systems.

**intercommunication system** — Also called intercom. 1. A two-way communication system without a central switchboard, usually limited to a single vehicle, building, or plant area. Stations may or may not be equipped to originate a call, but can answer any call. 2. A system that permits selective speaker voice communication via wires between any pair of several stations, usually in the same building. The stations may be either master stations, which may initiate calls to any of a group of stations, or slave stations, which may initiate calls only to their master station. 3. A communication system that bridges the gap between a regular telephone system and the public address (PA) system it locates people and permits communication with them. Most often, it is installed as an adjunct to telephone and PA systems.

**intercom wire** — Wire used to connect communications instruments, telephones, telegraph, etc.

**interconnecting wire** — 1. Wires used for connections between subassemblies, panels, chassis, and remotely mounted devices. Does not necessarily apply to the internal connection of these units. 2. The physical wiring between components (outside a module), between modules, between units, or between larger portions of a system or systems.

**interconnection** — 1. Also called tie line. A transmission line connecting two electric systems or networks and permitting energy to be transferred in either direction. Larger interconnections are often called interties, giant ties, or regional interconnections. 2. The conductive path required to achieve connection from a circuit element to the rest of the circuit. 3. Also called intraconnection. The physical wiring between components (outside a module), between modules, between units, or between larger portions of a system or systems.

**interconnection diagram** — Diagram showing the identity of all units in a piece of electronic equipment and the connections between them.

**interconnections (microelectronic)** — Those conductors and connections that are not in continuous integral contact with the substrate or circuit elements of an integrated circuit.

**interconnection system** — The electrical and mechanical interconnection of any one or all of the six levels of interconnections generally common to electronic equipment. The six levels of interconnection are intramodule, module to motherboard, intramotherboard, motherboard to back panel, backpanel wiring, and input/output.

**interdiction** — Techniques to prevent nonsubscribers access to information/programs on cable or drop cables. Interdiction electronics are outside the consumer's house and can be addressable.

**interdigital magnetron** — A magnetron with anode segments around the cathode. Alternate segments are connected together at one end, and remaining segments at the opposite end.

**interdigital transducer** — Abbreviated IDT. A number of interleaved metal electrodes whose width and spacing is equal and uniform throughout the transducer pattern. When a harmonic voltage is applied

to the transducer terminals, the IDT pattern excites a periodic electric field that penetrates into the piezoelectric substrate. The substrate responds by periodically expanding and contracting in unison with these fields. With the proper choice of substrate orientation, this piezoelectric excitation gives rise to surface acoustic waves that propagate in the two directions normal to the IDT electrodes. The electric field can be produced by applying signals of opposite potential to two parallel metal electrodes formed in films deposited on the surface of the crystal. As the field is applied, the alternating signals send an acoustic wave across its surface; this wave is reconverted to an electric signal at a second pair of similar electrodes at the other end of the crystal. In practice, the transducer consists of several pairs of interleaved parallel electrodes, which give the transducer its name. The fingers, and the space between them, must be related to the size of a wave of the frequency desired. In certain applications the transducer fingers are less than a thousandth of a millimeter wide.

**interelectrode capacitance**—The capacitance between one electron-tube electrode and the next electrode toward the anode. The capacitance between the electrodes in an electron tube.

**interelectrode coupling**—Capacitive feedback from the plate of a tube to the grid. In triodes, this limits the maximum amplification possible without starting oscillation.

**interelectrode leakage**—The undesired current that flows between elements not normally connected in any way.

**interelectrode transit time**—The time required for an electron to travel between two electrodes.

**interelement capacitance**—The capacitance caused by the pn junctions between the regions of a transistor and measured between the external leads of the transistor.

**interexchange channel**—A channel connecting two different exchange areas.

**interface**—1. A point or device at which a transition between media, power levels, modes of operation, etc., is made. 2. The two surfaces on the contact sides of mating connectors that face each other when mated. 3. A common boundary between two or more items. May be mechanical, electrical, functional, or contractual. 4. A common aspect at the boundary between two systems involving intersystem communication—e.g., the interaction between research and development, basic and applied science, or engineering and systems development. 5. The physical and space boundary surrounding the system, subsystem, equipment, or component, through which all environmental and operational stimuli essential to the device or affecting its proper operation must propagate or interact with other related devices or structures. 6. The hardware for linking two units of electronic equipment; for example, a hardware component to link a computer with its input (or output) device. 7. The means of connection between two logic elements, often elements that belong to two different "families." 8. The hardware or software required to be able to communicate with, sense, or control external equipment. 9. A circuit that controls the flow and format of data between a computer and a terminal or other peripheral. 10. An electrical connection that permits a peripheral device or communications channel to be attached to a system. 11. An electronic assembly that ties an external device to a computer. 12. A common boundary between automatic data-processing systems or parts of a single system. In communications and data systems, it may involve code, format, speed, or other changes as required. 13. The junction or point of interconnection between two systems or equipments with different characteristics. They may differ with respect to voltage, frequency, operating speed,

## interelectrode capacitance — interface system

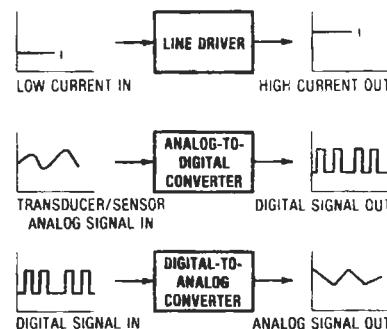
type of signal, and/or type of information coding. 14. To interconnect different systems to resolve their incompatibilities. 15. A common or shared boundary between two or more instruments, devices, or systems, which enables exchange of information among interconnecting units or systems that may not be directly compatible.

**interface adaptor**—Also called device adaptor. A unit that provides a mechanical and electrical interconnection between the tester and the device under test. It may include special stimulus, measurement, load, and switching circuitry unique to a device or family of devices but which is not provided in the tester.

**interface analysis**—Checking the interfaces between program elements (modules) for consistency and proper data transfer.

**interface card**—A device that converts a computer I/O bus into some standard I/O configuration (8- or 16-bit parallel BCD, RS-232, IEEE 488, etc.).

**interface circuit**—1. A circuit that links one type of logic family with another or with analog circuitry. 2. A circuit that allows two or more systems to be readily joined or associated. Examples include circuits that link linear and digital systems and those that enable communication between two circuits through a transmission line. 3. A circuit that links one type of device with another. Its function is to produce the required current and voltage levels for the next stage of circuitry from the previous stage. 4. An input/output circuit that permits different chips to communicate over a bus. 5. Linear or analog circuit with the prime function of supporting digital circuitry. Employed where the digital circuitry for the world of data processing and computation must meet the physical world of analog variables. Also used to mix functions from a number of digital logic families to obtain performance or economic benefits. There are at least nine different categories of interface circuits: bus interface, memory interface and control, line drivers and receivers, peripheral interface, numeric display interface, data converters, voltage reference, voltage comparators, and communications interface.



Interface circuits.

**interface connection**—Also called feedthrough. A conductor that connects patterns on opposite sides of a printed circuit board.

**interface equipment**—Equipment used between two other equipments that would otherwise be incompatible.

**interface resistance**—See cathode interface.

**interface system**—The device-independent mechanical, electrical, and functional elements of an interface necessary to effect communication among a set of devices. Cables, connector, driver and receiver circuits, signal

lines, descriptions, timing and control conventions, and functional logic circuits are typical interface system elements.

**interface unit** — A device that translates incoming signals that are incompatible with the electrical characteristics of the computer without changing the information content. Also translates outgoing signals for the benefit of associated equipment that is designed to different electrical standards.

**interfacial bond** — An electrical connection between the two faces of a substrate.

**interfacial connection** — In a printed circuit board, a conductor that connects conductive patterns on opposite faces of the base.

**interfacial junction** — The junction that is formed by the faces of the two mating halves of a connector. This junction can be tightly compressed or loose, depending on the requirements of the application of the connector.

**interfacial seal** — Sealing of a mated connector pair over the whole area of the interface to provide sealing around each contact. This is usually done by providing a soft insert material on one or both halves of the connector, which are in compression when mated.

**interfacing** — 1. The joining of members of a group (people, instruments, and so on) in such a way that they are able to function in a compatible (synchronized) and coordinated fashion. 2. Interconnecting a program counter with its application devices and data terminals through various modules and cables. Interface modules convert program counter logic levels into external signal levels, and vice versa.

**interference** — 1. Any electrical or electromagnetic disturbance, phenomenon, signal, or emission, man-made or natural, which causes or can cause undesired response, malfunctioning, or degradation of the electrical performance of electrical and electronic equipment. 2. Any signal that degrades the accuracy of a system. Interfering signals may be separated into two classes: damaging and degrading. Damaging signals cause degradation of accuracy after the signal is removed (even permanently). 3. Any undesired electrical signal induced into a conductor by electrostatic or electromagnetic means. 4. The additive process whereby the amplitudes of two or more overlapping waves are systematically attenuated and reinforced. 5. The process whereby a given wave is split into two or more waves by, for example, reflection and refraction of beam splitters, and then possibly brought back together to form a single wave. 6. Extraneous energy that tends to interfere with the desired signal. 7. Unwanted occurrences on communication channels that result from natural or human-made noises and signals.

**interference blanker** — A device used with two or more pieces of radio or radar equipment to permit simultaneous operation without confusion of intelligence, or used with a single receiver to suppress undesired signals.

**interference eliminator** — A device designed for the purpose of reducing or eliminating interference.

**interference fading** — Fading produced by different wave components traveling slightly different paths in arriving at the receiver.

**interference filter** — A device added between a source of human-made interference and a radio receiver to attenuate or eliminate noise signals. It generally contains a combination of capacitance and inductance.

**interference guard band** — See guard band.

**interference pattern** — 1. The resultant space distribution of pressure, particle velocity, or energy flux when progressive waves of the same frequency and kind are superimposed. 2. The pattern produced on a radar scope by interference signals.

**interference prediction** — Estimation of the interference level of a particular item of equipment with respect to its future electromagnetic environment.

**interference-rejection unit** — Abbreviated IFRU. A tunable filter or wave trap capable of being adjusted to reject any frequency within the LF passband of a receiver while allowing the remainder of the passband curve to remain intact. It is adjusted to reject an interference signal and thus constitutes a form of antijamming.

**interference source suppression** — Techniques applied at or near a source of radiation to reduce its emission of undesired signals.

**interference spectrum** — The frequency distribution of the jamming interference in the propagation medium external to the receiver.

**interferometer** — An apparatus that shows interference between two or more wave trains coming from the same luminous area, and also compares wavelengths with observable displacements of reflectors or other parts.

**interferometer homing** — A homing guidance system in which the direction of the target is determined by comparing the phase of the echo signal as received at more than one antenna.

**interferometer system** — A method of determining the azimuth of a target through use of an interferometer to compare the signal phases at the output terminals of two antennas receiving a common signal from a distant source.

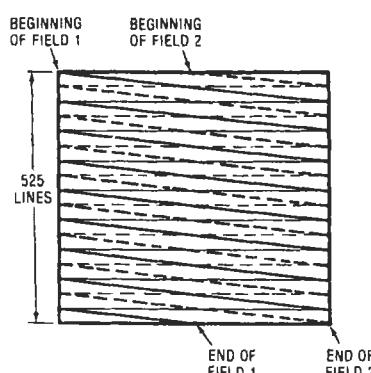
**intergranular corrosion** — A localized attack at metallic grain boundaries due to the presence of impurities and/or mechanical stress. On exposure to corrosive catalysis, the grain boundaries become anodic and the grains cathodic.

**interior label** — In a computer, a magnetically recorded sequence added to a tape to identify the contents.

**interior-wiring-system ground** — The ground connection to one of the current-carrying conductors of an interior wiring system.

**interlace** — 1. In a computer, to assign successive storage location numbers to physically separated storage locations on a magnetic drum. This serves to reduce access time. 2. To transmit different interrogation modes on successive sweeps.

**interlaced scanning** — Also called line interlace. 1. A system of scanning whereby the odd- and even-numbered lines of a picture are transmitted consecutively as two separate fields. These are superimposed to create one frame, or complete picture, at the receiver. The effect is to double the apparent number of pictures and thus reduce flicker. 2. A scanning process in which the distance from center to center of successively scanned



Interlaced scanning.

## interlace factor — intermediate-frequency transformer-lead color code

lines is two or more times the nominal line width, and in which the adjacent lines belong to different fields.

**interlace factor**—A measure of the degree of interlace of normally interlaced fields.

**interlace operation**—A type of computer operation in which data can be read out of or copied into the memory without causing interference to the other activities of the computer. *See also* interrupt; time sharing, 1.

**interlacing**—A method of scanning used in television, in which each picture is divided into two or more complete sets of interlacing lines to reduce flicker.

**interlayer connection**—An electrical connection between conductive patterns in different layers of multi-layer printed board. *See* through connection.

**interleave**—1. In a computer, to insert segments of one program into another program so that the two programs can be executed essentially simultaneously. 2. *See* interlace.

**interleaving**—1. Placing between. For example, in the transmission of a composite color signal, the bands of energy of the chrominance signal are interleaved with, or placed between, those of the luminance signal. 2. Assigning successive memory locations to different physical memory modules.

**interlock**—A device actuated by the operation of some other device with which it is directly associated, to govern succeeding operations of the same or allied devices. Interlocks may be either electrical or mechanical.

**interlock circuit**—A circuit in which a given action cannot occur until after one or more other actions have taken place. The interlocking action is generally obtained through the use of relays.

**interlocking**—The forcing of a voltage of one frequency to be in step with a voltage of another frequency.

**interlock relay**—1. A relay in which one armature cannot move or its coil be energized unless the other armature is in a certain position. 2. A relay with two sets of coils and respective armatures and contacts, so arranged that movement of one armature or energizing of its coil is dependent on the position of the other armature.

**interlock switch**—A safety switch that deenergizes a high-voltage supply when a door or other access cover is opened.

**intermediate code**—Machine input in a form between source and machine code; for example, pseudocode.

**intermediate current**—The range of current (milliamperes) at which formulation of carbonaceous material may significantly affect contact resistance.

**intermediate fluxes**—Fluxes consisting of mild organic acids and certain of their derivatives, such as the hydrohalides. As a class, they are weaker than the inorganic salt types.

**intermediate frequency**—Abbreviated IF. 1. A frequency to which a signal wave is shifted locally as an intermediate step in transmission or reception. 2. The fixed frequency resulting from heterodyning (i.e., beating or modulating to develop the sum or difference frequency signal) the incoming signal with a signal from the local oscillator. The IF used in FM tuners is commonly 10.7 MHz, and in AM tuners is 455 kHz. The IF signal is amplified in the IF channel, and it is here where most of the selectivity is introduced by tuned bandpass transformers and/or crystal or ceramic filters. 3. In superheterodyne receiving systems, the frequency to which all selected signals are converted for additional amplification, filtering, and eventual detection.

**intermediate-frequency amplifier**—1. An amplifier tuned to a fixed frequency, or capable of single-control tuning over a range of frequencies, for the purpose of selecting one of the frequency components generated in a mixer circuit. 2. The central stages of a superheterodyne radio receiver that amplify the signals after they have been converted to a fixed intermediate frequency by a mixer (frequency converter).

**intermediate-frequency harmonic interference**—Interference caused in superheterodyne receivers by the radio-frequency circuit accepting harmonics of the intermediate-frequency signal.

**intermediate-frequency interference ratio**—*See* intermediate-frequency response ratio.

**intermediate-frequency jamming**—A form of jamming in which two cw signals are transmitted at frequencies separated by an amount equal to the center frequency of the IF amplifier in the radar receiver.

**intermediate-frequency response ratio**—Also called intermediate-frequency interference ratio. In a heterodyne receiver, the ratio of intermediate-frequency signal input at the antenna to the desired signal input for identical outputs.

**intermediate-frequency strip**—Also called IF strip. A subassembly containing the intermediate-frequency stages in a receiver.

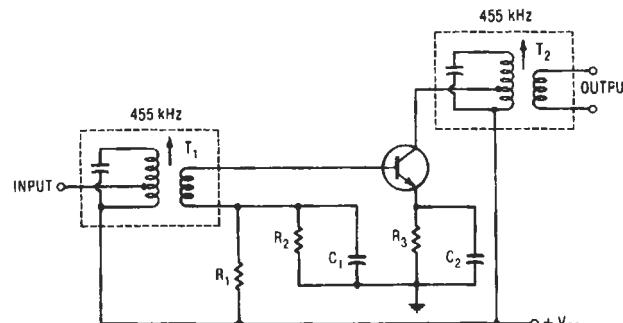
**intermediate-frequency transformer**—Also called IF transformer. A transformer designed for use in the intermediate-frequency amplifier of a superheterodyne receiver.

**intermediate-frequency transformer-lead color code**—Transformer leads in many radio receivers are identified by the following standard EIA colors:

Blue: Plate Green: Grid or diode

Red: B + Black: Grid return

Green-black: Second diode (full-wave transformers only)



*Intermediate-frequency amplifier.*

**intermediate horizon**—A screening object (such as a hill, mountain, ridge, building, etc.) similar to the radar horizon but nearer to the radar site. For example, a distant mountain range might be the radar horizon on a given azimuth, while a nearer, lower ridge might screen a valley between it and the mountain range; the ridge would be an intermediate horizon.

**intermediate means**—All system elements needed to perform distinct operations in the measurement sequence between the primary detector and the end device.

**intermediate repeater**—A repeater used other than at the end of a trunk or line.

**intermediate state**—The partial superconductivity that occurs when a magnetic field of appropriate strength is applied to a sphere of material below its critical temperature (i.e., the temperature below which the material would superconduct if no magnetic field were present).

**intermediate storage**—The portion of the computer storage facilities in which information in the processing stage usually is stored.

**intermediate subcarrier**—A carrier used for modulating a carrier or another intermediate subcarrier. It also may have been modulated by one or more subcarriers.

**intermediate switching region**—In a relay, an area between low level (including dry circuit) and power switching (including full rated load) where the contact arc does not destroy deposits that are byproducts of the switching function.

**intermediate trunk distributing frame**—A frame in which are mounted terminal blocks for connecting linefinders and first selectors.

**intermetallic bond**—The ohmic contact made when two metal conductors are welded or fused together.

**intermetallic compound**—A compound of two or more metals that has a characteristic crystal structure that may have a definite composition corresponding to a solid solution, often refractory.

**intermittent**—1. Occurring at intervals. 2. Electrical connections when conducting paths alternately open and close at some essentially uncontrolled rate. (Intermittents are undesirable since continuous connections are normally required.) 3. Not continuously present; disappearing and reappearing.

**intermittent current**—A unidirectional current that is interrupted at intervals.

**intermittent defect**—A defect that depends on variable conditions in a circuit. Hence, it is not present at all times.

**intermittent duty**—Operation for specified alternate intervals of load and no-load; load and rest; or load, no-load, and rest.

**intermittent-duty rating**—The output rating of a device operated for specified intervals rather than continuously.

**intermittent-duty relay**—A relay that must be deenergized at intervals to avoid excessive temperature, or a relay that is energized at regular or irregular intervals, as in pulsing.

**intermittent pulsing**—The transmission of short bursts of radiation at irregular intervals.

**intermittent rating**—The permissible output of a piece of apparatus when it is operated for alternate periods of load and rest that have a definite ratio to each other, or when it is run for a stated period of time that is not long enough to produce the final temperature.

**intermittent reception**—A defect in which the receiver operates normally for a while, at regular or irregular intervals.

**intermittent scanning**—One or two 360° scans of an antenna beam at irregular intervals to make detection by intercept receivers more difficult.

**intermittent-service area**—An area still receiving the ground wave of a broadcast station, but subject to interference and fading.

**intermod**—Abbreviation for intermodulation distortion (IMD). Interference that results when strong signals from a nearby transmitter mix with the desired signal in a radio receiver.

**intermodulation**—Sometimes called intermod. 1. In a nonlinear transducer element, the production of frequencies corresponding to the sums and differences of the fundamentals and harmonics of two or more frequencies transmitted through the transducer. 2. An error form that occurs in chopper-stabilized amplifiers when a beat component forms between the chopper drive frequency and normal signals that have frequencies near that of the chopper. 3. Mixing of two radio signals to produce a third signal that interferes with the reception of a desired signal.

**intermodulation distortion**—Abbreviated IMD. 1. Nonlinearity characterized by the appearance of frequencies in the output equal to the sums and differences of integral multiples of the component frequencies in the input signal. (Harmonics are usually not included.) 2. The introduction of unwanted signal energy as the result of interaction between two or more simultaneously reproduced tones, causing a smearing or veiling of the sound. All recording and amplifying equipment produces a certain amount of intermodulation distortion, but it can be held to sufficiently low levels to be below the threshold of audibility. 3. An analog-line impairment in which two frequencies interact to create an erroneous frequency, which in turn distorts the data-signal representation. 4. The production of spurious frequencies, not present in the original sound, that result from the interference or interaction of two (or more) sound signals that simultaneously occur in the original. These generally are sum and difference frequencies. For example, a 200-Hz and 75-Hz signal may occur at the same instant. If the equipment is prone to intermodulation distortion, these two may interact to produce a spurious 125-Hz tone. 5. The distortion caused by the addition of sum and difference modulation products when a complex wave (composed of two or more sine waves) passes through a nonlinear circuit. (When the modulation products are few, distortion is created; when they are many, noise is created.) 6. Distortion that results when two or more pure tones produce new tones with frequencies representing the sum and difference of the original tones and their harmonics.

**intermodulation frequencies**—The sum and difference frequencies generated in a nonlinear element.

**intermodulation interference**—The combination-frequency tones produced at the output by a nonlinear amplifier or network when two or more sinusoidal voltages are applied at the input. Generally expressed as the ratio of the root-mean-square voltage of one or more combination frequencies to that of one of the parent frequencies measured at the output.

**intermodulation noise**—Noise introduced in the channel of interest by signals being transmitted in other channels.

**internal arithmetic**—Any computations performed by the arithmetic unit of a computer, as distinguished from those performed by peripheral equipment.

**internal calibration**—Calibration by an internal voltage source (provided with the instrument) rather than an external standard.

**internal connection**—Abbreviated IC. In a vacuum tube, a base-pin connection designed not to be used for any circuit connections.

**internal correction voltage**—The voltage added to the composite controlling voltage of an electron tube.

It is the voltage equivalent of those effects produced by initial electron velocity, contact potential, etc.

**internal graticule**—A graticule whose rulings are a permanent part of the inner surface of the cathode-ray tube faceplate.

**internal input impedance**—The actual impedance at the input terminals of a device.

**internally caused contact chatter**—That chatter resulting from the operation or release of the relay. It may be classified as initial, armature-impact, armature-rebound, or armature-hesitation chatter.

**internally stored program**—A sequence of instructions (program) stored inside a computer in the same storage facilities as the computer data, as opposed to being stored externally on punched paper tape, pin boards, etc.

**internal magnetic recording**—Storage of information within the material itself, such as used in magnetic cores.

**internal memory**—Also called internal storage. The total memory or storage that is automatically accessible to a computer. It is an integral physical part of the computer and is directly controlled by it.

**internal node**—A junction between internal logic elements within an integrated circuit.

**internal output impedance**—The actual impedance at the output terminals of a device.

**internal photoelectric effect**—The creation of free electrons within a solid by the absorption of a sufficient amount of photons. The effect produces an increase in the conductivity of the solid.

**internal resistance**—1. The effective series resistance in a source of voltage. 2. The resistance of a voltage source, such as a generator, battery or power supply, which acts to reduce the terminal voltage of the source as current is drawn.

**internal storage**—Also called main memory and core memory. 1. Storage facilities in a computer forming an integral physical part of and directly controlled by the computer. 2. The total storage automatically available to the computer. *See also* internal memory.

**internal timer**—In a computer, the internal clock equipped with multiple registers that can monitor the duration of external events or generate a pulse after a fixed time.

**international broadcast station**—A station licensed for transmission of broadcast programs for international public reception. By international agreement, frequencies are allocated between 6000 and 26,600 kHz.

**international call sign**—The identifying letters and numbers assigned to a radio station in accordance with the International Telecommunications Union. The first character, or the first two, identify the nationality of the station.

**international code signal**—A code, adopted by many nations for international communication, in which combinations of letters are used in lieu of words, phrases, and sentences.

**international communication service**—A telecommunication service between offices or stations (including mobile) belonging to different countries.

**international control station**—A fixed station in the Fixed Public Control Service, directly associated with the International Fixed Public Radio Communication Service.

**international coulomb**—The quantity of electricity passing any section of an electric circuit in 1 second when the current is 1 international ampere. One international coulomb equals 0.99985 absolute coulomb.

**international farad**—The capacitance of a capacitor when a charge of 1 international coulomb produces a potential difference of 1 international volt between the

## internal graticule — international telephone address

terminals. One international farad equals 0.99952 absolute farad.

**International Fixed Public Radiocommunication Service**—A fixed service, the stations of which are open to public correspondence, intended to provide radiocommunication between the United States or its territories and foreign points.

**international henry**—The inductance that produces an electromotive force of 1 international volt when the current is changing at a rate of 1 international ampere per second. One international henry equals 1.00018 absolute henrys.

**international joule**—The energy required to transfer 1 international coulomb between two points having a potential difference of 1 international volt. One international joule equals 1.00018 absolute joules.

**International Morse code**—Also called continental code. 1. A system of dot-and-dash signals used chiefly for international radio and wire telegraphy. It differs from American Morse code in certain code combinations only. 2. The Morse code that matches the English-language alphabet.

**international ohm**—The resistance at 0°C of a column of mercury of uniform cross section 106.300 centimeters in length and with a mass of 14.4521 grams. One international ohm equals 1.00048 absolute ohms.

**International Radio Consultative Committee**—Abbreviated CCIR. An international committee that studies technical operating and tariff questions pertaining to radio, broadcast television, and multichannel video transmissions and that issues recommendations. It reports to the International Telecommunications Union.

**international radio silence**—Three-minute periods of radio silence, commencing 15 and 45 minutes after each hour, on a frequency of 500 kHz only. During this time all radio stations are supposed to listen on that frequency for distress signals of ships and aircraft.

**international system (of electrical and magnetic units)**—A system for measuring electrical and magnetic quantities by using four fundamental quantities. Resistance and current are arbitrary values that correspond approximately to the absolute ohm and the absolute ampere. Length and time are arbitrarily called centimeter and second. The international system of electrical units was used between 1893 and 1947. By international agreement, it was discarded on January 1, 1948, in favor of the mksa (Giorgi) system.

**international telecommunication service**—A telecommunication service between offices or stations in different states, or between mobile stations that are not in the same state or that are subject to regulation by different states.

**International Telecommunications Satellite Consortium**—*See* INTELSAT.

**International Telecommunication Union**—The United Nations specialized agency that deals with telecommunications. Its purpose is to provide standardized communications procedures and practices, including frequency allocation and radio regulations on a worldwide basis.

**International Telegraph Consultative Committee**—Abbreviated CCIT. An international committee responsible for studying technical operating and tariff questions pertaining to telegraph and facsimile and issuing recommendations. It reports to the International Telecommunications Union.

**international telephone address**—A code not exceeding 12 digits that specifies a unique address for any telephone in the world. It consists of (a) a country or regional identity code of one, two, or three digits; (b) a three-digit numbering plan area code; (c) a two- or

three-digit central office code; plus (*d*) a four-digit station number.

**International Telephone Consultative Committee**—Abbreviated CCIF. An international committee responsible for studying and issuing recommendations regarding technical operations and tariff questions pertaining to ordinary telephones; carrier telephones; and music, picture, television, and multichannel telegraph transmission over wire line. It reports to the International Telecommunication Union.

**international temperature scale**—A temperature scale adopted in 1948 by international agreement. Between the boiling point of oxygen ( $-182.97^{\circ}\text{C}$ ) and  $630.5^{\circ}\text{C}$  it is based upon the platinum resistance thermometer. From  $630.5^{\circ}\text{C}$  to  $1063.0^{\circ}\text{C}$  it is based on the platinum rhodium thermocouple, and above  $1063.0^{\circ}\text{C}$  on the optical pyrometer.

**international volt**—The voltage that will produce a current of 1 international ampere through a resistance of 1 international ohm. One international volt equals 1.00033 absolute volts.

**international watt**—The power expended when 1 international ampere flows between two points having a potential difference of 1 international volt. One international watt equals 1.00018 absolute watts.

**Internet**—A vast collection of many computer networks that span the entire world and communicate across dedicated high-speed phone lines using a single protocol family called TCP/IP. The network used for electronic mail, file transfers, chat services, and general data communications. It consists of a backbone connected via gateways to many smaller networks such as LANs and WANs, and thus each network can access every other network.

**Internet gateway**—An online service that allows access to the Internet.

**Internet protocol**—See IP.

**Internet service provider**—See ISP.

**internetworking**—The technique of connecting individual LANs to form a larger network.

**internode**—Communication paths that originate in one node and terminate in another.

**interoffice trunk**—The telephone channel between two central offices.

**interoperability**—The ability of computer equipment from different manufacturers to work together compatibly.

**interphase transformer**—An autotransformer or a set of mutually coupled reactors used with three-phase rectifier transformers to modify current relationships in the rectifier system and thereby cause a greater number of rectifier tubes to carry current at any instant.

**interphone**—A telephone communication system wholly contained within an aircraft, ship, or activity.

**interphone system**—An intercommunication system like that in an aircraft or other mobile unit.

**interpolate**—To estimate the values of a function that are intermediate between those already known.

**interpolation**—1. The process of finding a value of a function between two known values. Interpolation may be performed numerically or graphically. 2. The process of determining a reading falling between two adjacent gradations on an analog meter scale.

**interpole**—A small auxiliary pole placed between the main poles of a direct-current generator or motor to reduce sparking at the commutator.

**interposition trunk**—A trunk connecting two positions of a large switchboard so that a line on one position can be connected to a line on the other position.

**interpreter**—1. A system program that converts and executes each instruction of a high-level language program into machine code as it runs, before going

on to the next instruction. An interpreted program is slow—as much as 20 times slower than an assembled program—but speeds up program development because the effect of source changes can be seen immediately. 2. A computer executive routine by which a stored program expressed in pseudocode is translated into machine code as a computation progresses, and the indicated operation is performed by means of subroutines as they are translated. 3. Programs that translate an assembled program into a complete machine-code listing on a line-by-line basis. If a statement is used in a program 10 times, it will be translated 10 times. 4. In a computer, a language translator that accepts high-level language (e.g., BASIC or Pascal) input text and translates this text into a special intermediate code that is simulated (interpreted) by a system program. Usually this intermediate code cannot be directly executed on a general-purpose processor. 5. A program that calls on subroutines to execute a program. Example: add two numbers, then divide by another number. BASIC is usually implemented as an interpreter. 6. A punch-card machine that will read the information conveyed by holes punched in a card and print its translation in characters arranged in specified rows and columns on the card.

**interpreter code**—A computer code that an interpretive routine can use.

**interpretive programming**—The writing of computer programs in a pseudo machine language, which the computer precisely converts into actual machine-language instructions before performing them.

**interpretive routine**—Computer routine designed to transfer each pseudocode and, using function digits, to set a branch order that links the appropriate subroutine into the main program.

**interrecord gap**—Also called interblock space. See IRG.

**interrogate**—1. To determine the state of a device or circuit. 2. To retrieve information from computer files by use of predefined inquiries or unstructured queries handled by a high-level retrieval language.

**interrogation**—The triggering of one or more transponders by transmitting a radio signal or combination of signals.

**interrogation signal**—A pulsed or cw signal emitted to initiate a reply signal from a transponder or responder.

**interrogation suppressed time delay**—The overall fixed time that elapses between transmission of an interrogation and reception of the reply to this interrogation at zero distance.

**interrogator**—Also called challenger. A radio transmitter used to trigger a transponder.

**interrogator-responder**—A combined radio transmitter and receiver for interrogating a transponder and displaying the replies.

**interrupt**—1. A processor feature that allows the currently executing program to be deferred in favor of servicing another. 2. A special instruction from a computer that temporarily disrupts normal operation and changes the normal flow of instruction execution. 3. In a computer, a break in the normal flow of a system or routine such that the flow can be resumed from that point at a later time. The source of the interrupt may be internal or external. 4. A method of stopping a process and identifying that a certain condition exists. In graphic systems, interrupts can originate from data entry devices, the display list, the host computer, the refresh clock, and display error conditions. When an interrupt occurs, the host computer and display refresh cease until the interrupt is answered and processed. At that time, the host computer will restart the refresh—usually from where it was halted.

If a new display list is to be presented, the display starts at the beginning of the list. 5. To stop a process in such a way that it can be resumed.

**interrupted continuous waves**—Abbreviated ICW. Continuous waves that are interrupted at an audio-frequency rate.

**interrupt enable**—*See* interrupt mark.

**interrupter**—1. A magnetically operated device used for rapidly and periodically opening and closing an electric circuit in doorbells and buzzers and in the primary circuit of a transformer supplied from a dc source. 2. A device used to produce interrupted ringing cycles. It also may be employed with the release alarm to start signal alarm circuits of the switching equipment and thereby provide timed delay in the sounding of a failure alarm. 3. An electrical, electronic, or mechanical device that periodically interrupts a continuous current to produce pulses. 4. A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.

**interrupter contacts**—On a stepping relay, an additional set of contacts operated directly by the armature.

**interrupting capacity**—The maximum power in the arc that can be interrupted by a circuit breaker or fuse without the occurrence of restrike or violent failure. Rated in volt-amperes for ac circuits and in watts for dc circuits.

**interrupting rating**—1. Conditions under which the contact of a relay must interrupt with a prescribed duty cycle and contact life. 2. The amount of current that a fuse can interrupt without the fuse cartridge rupturing or showing any external sign of damage.

**interrupting time**—In a circuit breaker, the interval between the energizing of the trip coil and the interruption of the circuit, at the rated voltage.

**interrupt latency**—The delay between an interrupt request and acknowledgment of the request.

**interrupt mark**—A mechanism that allows a program to specify whether or not an interrupt request will be accepted by the computer (sometimes called interrupt enable).

**interrupt request**—A signal to a computer that temporarily suspends the normal sequence of a routine and transfers control to a special routine. Operation can be resumed from this point later. Ability to handle interrupts is very useful in communication applications, where it allows the microprocessor to service many channels.

**interrupt vector**—1. Typically, two memory locations assigned to an interrupting device and containing the starting address and processor status word for its service routine. 2. A function that facilitates fast handling of external interrupts by having the hardware supply a value corresponding to the device causing the interrupt. This value then becomes an index into the interrupt vector that contains a pointer to the appropriate interrupt service routine.

**interstage**—Between stages.

**interstage coupling**—Coupling between stages.

**interstage transformer**—A transformer that couples two stages together.

**interstation noise suppression**—Canceling of the noise that occurs when a high-gain radio receiver with automatic volume control is tuned between stations.

**interstitial site**—A position that is inside a crystal lattice but is not one of the proper sites ordinarily occupied by the atoms of the crystalline material. Impurity ions of the proper size can occupy such positions in a lattice that is otherwise regular.

**intersymbol interference**—1. In a transmission system, extraneous signal energy during one or more

keying intervals that tends to hinder the reception of the signal in another keying interval. 2. The disturbance that results from this condition.

**interties**—*See* interconnection, 1.

**intertoll trunk**—A trunk linking toll offices in different telephone exchanges.

**interval**—A period from one event to another. An interval timer controls the time a load is energized or deenergized.

**interval calibration**—*See* step calibration.

**interval circuit**—A circuit that is energized during timing only. This can be accomplished by using a timer with interval contacts, or by using a timer with delayed contacts in series with the start switch, or one with instantaneous contacts in series with delayed contacts.

**interval contacts**—In a timer, contacts that are actuated only for the duration of the preset time interval.

**interval timer**—1. A device for measuring the time interval between two actions. 2. A timer that switches electrical circuits on or off for the duration of the preset time interval. 3. A hardware or software clock that generates an interrupt after a specified period has elapsed.

**interword space**—In telegraphy, the space between words or coded groups. It is equal to seven unit lengths.

**intonation**—The slight modification of pitch, or frequency, that makes a note sound flat or sharp compared with the natural frequency of the note played.

**intracardiac**—Pertaining to instruments whose pickup element is inserted through a vein directly into the heart chambers.

**intracorrelations (microelectronics)**—1. Those conductors and connections that are in continuous integral contact with the substrate or circuit elements of an integrated circuit. 2. *See* interconnection.

**intraoftice trunk**—Telephone channel used to interconnect two customer lines within the same central office.

**intrinsically safe**—Incapable of releasing sufficient electrical energy to ignite a specific atmospheric mixture under normal conditions or such abnormal conditions as accidental damage to any part of the equipment or wiring insulation, failure of electrical components, application of overvoltage, or improper adjustment or maintenance operations.

**intrinsic-barrier diode**—A pin diode in which a thin region of intrinsic material separates the n-type and p-type regions.

**intrinsic-barrier transistor**—A pnp or npn transistor in which a thin region of intrinsic material separates the collector from the base.

**intrinsic brightness**—The luminous intensity measured in a given direction per unit of apparent (projected) area when viewed from that direction.

**intrinsic characteristics**—Characteristics of a material that depend on the material itself and do not result from impurities.

**intrinsic coercive force**—The magnetizing force that, when applied to a magnetic material in a direction opposite to that of the residual induction, reduces the intrinsic induction to zero.

**intrinsic coercivity**—The measurement (in oersteds) of the force required to reduce the intrinsic induction of the magnetized material to zero.

**intrinsic concentration**—In a semiconductor, the number of minority carriers that exceeds the normal equilibrium number.

**intrinsic conduction**—In an intrinsic semiconductor, the conduction associated with the directed movement of electron-hole pairs under the influence of an electric field.

**intrinsic contact potential difference** — The true potential difference between two spotlessly clean metals in contact.

**intrinsic delay** — *See* insertion delay.

**intrinsic detector** — A photodetector composed of a photoconductive material that, when exposed to radiation, conducts without the aid of added impurities and does not have to be cooled to the level of extrinsic material. Examples of intrinsic materials are silicon and cadmium sulfide.

**intrinsic electric strength** — The characteristic electric strength of a material.

**intrinsic flux** — The product of the intrinsic flux density and the cross-sectional area of a uniformly magnetized sample of material.

**intrinsic flux density** — In a sample of magnetic material, the excess of the normal flux density over the flux density in a vacuum for a given magnetizing field strength. In the cgs system, the intrinsic flux density is numerically equal to the difference between the ordinary flux density and the magnetizing field strength.

**intrinsic hysteresis loop** — A curve that shows intrinsic flux density as a function of magnetizing field strength, where the magnetizing field is cycled between equal values of opposite polarity. Hysteresis is indicated by the fact that the ascending and descending portions of the curve do not coincide.

**intrinsic induction** — The excess magnetic induction produced in a magnetic material by a given magnetizing force, over the induction that would be produced by the same magnetizing force in a vacuum.

**intrinsic insulation** — Any method of isolating fields or current within a semiconductor or other substrate. Among these are thermal oxidation, fabrication of an isolating layer of intrinsic semiconductor material, and creation of one or more back-based functions.

**intrinsic-junction transistor** — *See* intrinsic-region transistor.

**intrinsic layering** — The method of separating two regions of conductive semiconductor by a region of near-intrinsic semiconductor material. This material differs enough in resistivity from the adjacent regions to serve as an insulator.

**intrinsic material** — A semiconductor material in which there are equal numbers of holes and electrons, i.e., no impurities.

**intrinsic mobility** — The mobility of electrons in an intrinsic semiconductor or in a semiconductor having a very low concentration of impurities.

**intrinsic noise** — Noise that is due to the device or transmission path and is independent of modulation.

**intrinsic permeability** — Ratio of intrinsic normal induction to the corresponding magnetizing forces.

**intrinsic photoconductivity** — The absorption of a photon raising an electron across the forbidden gap from valence to conduction band of the semiconductor, whereby conductivity is increased and incident radiation may be measured.

**intrinsic photoemission** — The photoemission that would occur if a crystal were pure and its structure perfect.

**intrinsic properties** — The semiconductor properties that are characteristic of the pure, ideal crystal.

**intrinsic Q** — *See* unloaded  $Q$  (switching tubes).

**intrinsic region** — *See* i region; depletion region.

**intrinsic-region transistor** — Also called intrinsic-junction transistor. A four-layer transistor with an intrinsic region between the base and collector. Examples are npn, pnp, npip, and pnin transistors.

**intrinsic reliability** — The probability that a device will perform its specified function, determined by

statistical analysis of the failure rates and other characteristics of the parts and components the device comprises.

**intrinsic semiconductor** — 1. A semiconductor in which some hole and electron pairs are created by thermal energy at room temperature, even though there are no impurities in it. 2. A semiconductor with substantially the same electrical properties as those of the ideal crystal. 3. An element or compound that has the same electron energy band configuration as an insulator, but has a forbidden energy gap that is sufficiently narrow to permit transfer of electrons from the valence band to the conduction bands at normal temperatures. Conduction in an intrinsic semiconductor takes place via equal number of conduction band electrons and valence band holes.

**intrinsic standoff ratio** — In a unijunction transistor, the difference between the emitter voltage at the peak point with a specific interbase voltage and the forward voltage drop of the emitter junction, divided by the voltage on base 2 with respect to base 1.

**intrinsic temperature range** — The temperature range at which impurities or imperfections within the crystal do not modify the electrical properties of a semiconductor.

**intrusion alarm system** — An alarm system for signaling the entry or attempted entry of a person or an object into the area or volume protected by the system.

**Invar** — An alloy containing 63.8 percent iron, 36 percent nickel, and 0.2 percent carbon. Has a very low thermal coefficient of expansion. Used primarily as resistance wire in wirewound resistors.

**inverse beta** — The transistor gain that results when the emitter and collector loads are physically reversed in the operation of a circuit.

**inverse common base** — Transistor circuit configuration in which the base terminal is common to the input circuit and to the output circuit and in which the input terminal is the collector terminal and the output terminal is the emitter terminal.

**inverse common collector** — Transistor circuit configuration in which the collector terminal is common to the input circuit and to the output circuit and in which the input terminal is the emitter terminal and the output terminal is the base terminal.

**inverse common emitter** — Transistor circuit configuration in which the emitter terminal is common to the input circuit and to the output circuit and in which the input terminal is the collector terminal and the output terminal is the base terminal.

**inverse direction of operation** — A mode of operating a transistor in which the nominal collector region acts as an emitter and in which the net flow of minority carriers is from the nominal collector region to the base region.

**inverse electrical characteristics** — In a transistor, those characteristics obtained when the collector and emitter terminals are interchanged and the transistor is then tested in the normal manner.

**inverse electrode current** — The current flowing through an electrode in the opposite direction from that for which the tube was designed.

**inverse feedback** — *See* negative feedback.

**inverse-feedback filter** — A tuned circuit at the output of a highly selective amplifier having negative feedback. The feedback output is zero for the resonant frequency, but increases rapidly as the frequency deviates.

**inverse Fourier transform** — A mathematical operation that synthesizes a time-domain signal from its complex spectrum components. If a time-domain signal is Fourier transformed and then inverse Fourier transformed, the original time function is reconstructed.

**inverse limiter**—A transducer with a constant output for inputs of instantaneous values within a specified range. Above and below that range, the output is linear or some other prescribed function of the input.

**inverse networks**—Any two two-terminal networks in which the product of their impedances is independent of frequency within the range of interest.

**inverse neutral telegraph transmission**—A form of transmission in which zero-current intervals are used as marking signals, and current pulses of either polarity are used as spacing signals.

**inverse-parallel connection**—See back-to-back circuit.

**inverse peak voltage**—The peak instantaneous voltage across a rectifier tube during the nonconducting half-cycle.

**inverse photoelectric effect**—The transformation of the kinetic energy of a moving electron into radiant energy, as in the production of X-rays.

**inverse piezoelectric effect**—Contraction or expansion of a piezoelectric crystal under the influence of an electric field.

**inverse ratio**—The seesaw effect whereby one value increases as the other decreases or vice versa.

**inverse-square law**—1. The strength of a field, or the intensity of radiation, decreases in proportion to the square of the distance from its source. 2. The law stating that the illuminance (or irradiance) from a point source varies as the inverse square of the distance between the source and the receiver.

**inverse time**—A qualifying term applied to a relay, indicating that its time of operation decreases as the magnitude of the operating quantity increases.

**inverse voltage**—The effective voltage across a rectifier tube during the half-cycle when current does not flow.

**inverse Wiedemann effect**—See Wiedemann effect.

**inversion**—1. The bending of a radio wave because the upper part of the beam is slowed down as it travels through denser air. This may occur when a body of cold air moves in under a moisture-laden body of air. 2. The producing of inverted or scrambled speech by beating an audio-frequency signal with a fixed band of the resultant beat frequencies. The original low audio frequencies then become high frequencies and vice versa.

**inversion layer**—A layer of doped semiconductor material that has changed to the opposite type, such as a p layer at the surface of an n-doped region. Surface inversion layers may be the result of surface ions or dopant gettering by surface passivation material or the action of induced electric fields. See also channel, 6.

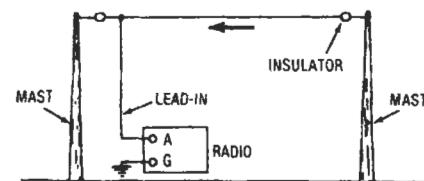
**inverted amplifier**—An amplifier stage containing two vacuum tubes. The control grids are grounded, and the driving excitation is applied between the cathodes. The grids then serve as a shield between the input and output circuits. Thus, the output-circuit capacitance is greatly reduced.

**inverted-L antenna**—An antenna consisting of one or more horizontal wires with a vertical wire connected at one end.

**inverted speech**—See scrambled speech.

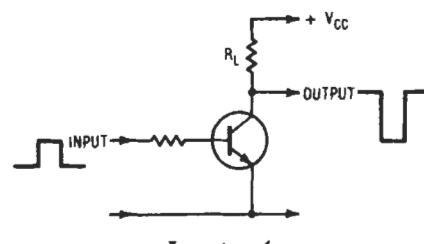
**inverter**—1. A circuit that takes in a positive signal and puts out a negative one, or vice versa. 2. A device that changes alternating current to direct current or vice versa. It frequently is used to change 6-volt or 12-volt direct current to 110-volt alternating current. 3. A device that accepts an input that is a function of the maximum voltage and changes it into an output that is a function of both the maximum voltage and time. 4. A circuit with one input and one output, and whose function is to invert the

## inverse limiter — I/O device



Inverted-L antenna.

input. When the input is high, the output is low, and vice versa. The inverter is sometimes called a NOT circuit, since it produces the reverse of the input. 5. A device or circuit that complements a Boolean function.



Inverter, 4.

**inverter circuit**—See NOT circuit.

**inverting amplifier**—An amplifier in which the output polarity is the opposite of the input polarity. Such an amplifier obtains negative feedback through a connection from the output to the input, and with high gain it is widely used as an operational amplifier.

**inverting connection**—The closed-loop connection of an operational amplifier when the forward gain is negative for dc signals. A 180° phase shift.

**inverting input**—An input terminal of a differential amplifier that produces an output signal of opposite phase (shifted 180°) than that of the input signal.

**inverting parametric device**—A parametric device whose operation depends essentially upon three frequencies: a harmonic of the pump frequency, and two signal frequencies, of which the higher signal frequency is the difference between the pump harmonic and the lower signal frequency.

**invisible file**—See hidden file.

**invister**—A high-frequency, high-transconductance unipolar structure made by means of lateral diffusion.

**inward-outward dialing system**—A dialing system by means of which calls within the local exchange area may be dialed directly to or from base private branch exchange telephone stations without the assistance of an operator at the base private branch exchange.

**inward WATS**—Inward wide area telephone service that permits a customer, for a monthly charge, to receive incoming station-to-station calls from telephones within prescribed service areas or in six interstate bands, without charge to the calling party. A telephone service similar to WATS but applicable to incoming calls only.

**I/O or i/o**—Abbreviation for input/output. 1. The components of a computer system's architecture that control the flow of data and instructions to and from the CPU. 2. Any equipment that introduces data into or extracts data from a data communications system.

**IOC**—See integrated optical circuit.

**I/O device**—Abbreviation for input/output device. 1. A disk drive, magnetic tape unit, printer, or similar

device that transmits data to or receives data from a computer or secondary storage device. 2. A general term for equipment used to communicate with a computer. 3. A device that supplies data and instructions to the computer and receives the computer's output, or a circuit that interfaces with such a device. 4. Input/output equipment used to communicate with a system.

**I/O electrical isolation**—Separation of the field wiring circuits from the logic level circuits of the PC, typically done with optical isolation.

**I/O modules**—General-purpose circuit modules that interface a microprocessor to relays, switches, and transducers. Each module contains almost all necessary interface circuitry in one package either to sense a load, control a switch, or condition a transducer signal so that practically no other interface design is required.

**ion**—1. An atom that has become charged by gaining or losing one or more orbiting electrons. A completely ionized atom is stripped of all electrons. 2. An atom or molecule with an electrostatic charge. 3. The charged particle formed when one or more electrons are taken from or added to a previously neutral atom or molecule. An atom that has gained additional electrons is thus a negative ion, whereas an atom that has lost an electron or electrons is a positive ion.

**ion charging**—In a storage tube, spurious charging or discharging caused by ions striking the storage surface.

**ion counter**—A tubular chamber for measuring the ionization of air.

**ion-exchange electrolyte cell**—A fuel cell that uses the reaction of hydrogen with oxygen from the air. It is similar to the standard hydrogen-oxygen fuel cell, except that an ion-exchange membrane replaces the liquid electrolyte. Operation is at atmospheric pressure and room temperature.

**ionic conductivity**—The transit phenomenon that occurs as a result of positive and/or negative charge movement in an electrolyte when placed in an electric field.

**ionic focusing**—Focusing the electron beam in a cathode-ray tube by varying the filament voltage and temperature to change the electrostatic focusing field automatically produced by the accumulation of positive ions in the tube.

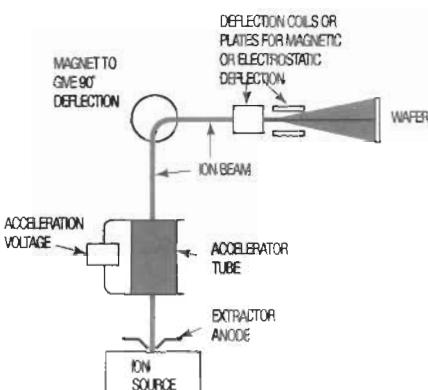
**ionic-heated cathode**—A cathode that is heated primarily by bombardment with ions.

**ionic-heated cathode tube**—An electron tube containing an ionic-heated cathode.

**ionic tweeter**—A type of speaker in which a varying electrostatic field activates a mass of air ionized by a high-voltage radio-frequency field. Ionic speakers are capable of extremely extended high-frequency response (up to 100 kHz or so) because of the extreme lightness of the ionic "diaphragm."

**ion implantation**—1. A precise and reproducible method of semiconductor doping in which selected dopants are ionized and accelerated at high velocity to penetrate the semiconductor substrate and become deposited below the surface. Charged atoms (ions) of elements such as boron, phosphorus, or arsenic are accelerated by an electric field into the semiconductor material. This technique ensures uniform, accurately controlled depth of implantation and ionic diffusion in the wafer. 2. A processing step by which standard p-channel diffused MOS devices are made directly compatible with TTL/DTL logic. It is a highly controllable process that allows the adjusting of gate threshold voltages and also allows the fabrication of both enhancement-mode and depletion-mode transistors on the same chip. 3. A process that uses accelerated atoms to implant source and drain regions in metal-oxide semiconductors. It offers higher

speed and lower threshold voltages and can also be used with PMOS, NMOS, and CMOS.



*Ion implantation.*

**ion-implanted MOS**—Abbreviated IMOS. A method for doping substrates with a stream of ionized dopant atoms. Ions are electrically shot into the substrate instead of diffusing atoms at high temperatures.

**ionization**—1. The dissociation of inert-gas atoms into positive and negative ions in an electric field, resulting in the emission of light. 2. The state of an insulator in which it facilitates the passage of current because of the presence of charged particles (usually induced artificially). 3. The electrically charged particles produced by high-energy radiation (such as light or ultraviolet rays) or by the collision of particles during thermal agitation. 4. The formation of ions. The process of giving a net charge to a neutral atom or molecule by adding or subtracting an electron. This can be accomplished by radiation or by a strong electric field.

**ionization arcover**—1. Formation of an electrical arc between terminals or contacts as a result of ionization of the adjacent air or gas. 2. Formation of an arc between the terminals of a satellite antenna as the satellite passes through the ionized regions of the ionosphere.

**ionization chamber**—1. An enclosure containing two or more electrodes between which an electric current may pass when the gas within is ionized. The current is a measure of the total number of ions produced in the gas by externally induced radiations. 2. A chamber containing a gas through which ionizing particles pass. A voltage is applied across the chamber so as to collect the ions produced and permit the ion current to be measured.

**ionization current**—The current resulting from the movement of electric charges, under the influence of an applied electric field, in an ionized medium.

**ionization energy**—Sometimes called ionization potential. The minimum amount of energy (usually expressed in electronvolts) required to eject an electron from a molecule.

**ionization factor**—The difference between percent power factors of a dielectric at two specified values of electrical stress. The lower of the two stresses is usually selected so that the effect of ionization on power factor at this stress is negligible.

**ionization gage**—1. A gage that measures the degree of a vacuum in an electron tube by the amount of ionization current in the tube. 2. A type of radiation detector that depends on the ionization produced in a gas by the passage of a charged particle through it. One

of the best known is the Geiger-Mueller counter. Cloud chambers and spark chambers can also be included in this category.

**ionization-gage tube**—An electron tube that measures low gas pressure by the amount of ionization current produced.

**ionization potential**—1. The energy, expressed in electronvolts, needed to remove one electron from a neutral atom or molecule in its ground state. 2. The amount of energy, for a particular kind of atom, required to remove an electron from the atom to infinite distance. The ionization potential is usually expressed in volts.

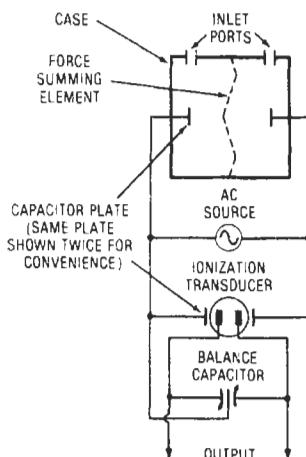
**ionization pressure**—An increase in the pressure in a gaseous discharge tube due to ionization of the gas.

**ionization resistance**—See corona resistance.

**ionization smoke detector**—A smoke detector in which a small amount of radioactive material ionizes the air in the sensing chamber, thus rendering it conductive and permitting a current through the air between two charged electrodes. This effectively gives the sensing chamber an electrical conductance. When smoke particles enter the ionization area, they decrease the conductance of the air by attaching themselves to the ions, causing a reduction in mobility. When the conductance is less than a predetermined level, the detector circuit responds.

**ionization time**—1. The time interval between the initiation and the establishment of conduction in a gas tube at some stated voltage drop for the tube. 2. The elapsed time to achieve normal glow after a voltage greater than the breakdown voltage is applied to a glow lamp.

**ionization transducer**—A transducer in which displacement of the force-summing member is sensed by the induced changes in differential ion conductivity.



*Ionization transducer.*

**ionization vacuum gage**—A gage in which the operation depends on the positive ions produced in a gas by electrons as they accelerate between a hot cathode and another electrode in a vacuum. It ordinarily covers a pressure range of  $10^{-4}$  to  $10^{-10}$  mm of mercury.

**ionization voltage (corona level)**—The minimum value of falling rms voltage that sustains electrical discharge within the vacuous or gas-filled spaces in the cable construction or insulation.

**ionize**—To free an electron from an atom or molecule (e.g., by X-ray bombardment) and thus transform the atom

## ionization-gage tube — ion spot

or molecule into a positive ion. The freed electron attaches itself to another atom or molecule, which then becomes a negative ion.

**ionized layers**—Layers of increased ionization within the ionosphere. They are responsible for absorption and reflection of radio waves and are important for communication and for tracking satellites and other space vehicles.

**ionizing event**—Any interaction by which one or more ions are produced.

**ionizing radiation**—1. Radiant electromagnetic energy and high-energy particles that cause the division of a substance into parts carrying positive and negative charges. High-energy particles can directly ionize substances, whereas electromagnetic radiation sets in motion charged particles that then produce ions. 2. Generally, any radiation having sufficient energy to dislodge electrons from atoms or molecules while traveling through a substance, thereby producing ions.

**ion migration**—1. Movement of the ions produced in an electrolyte by application of an electric potential between electrodes. 2. The movement of free ions within a material or across the boundary between two materials under the influence of an applied electric field.

**ionophone**—A high-frequency speaker in which the audio-frequency signal modulates an rf supply to maintain an arc in the mouth of a quartz tube. The resultant modulated wave acts directly on the ionized air under pressure and thus creates sound waves.

**ionosphere**—The part of the earth's outer atmosphere where sufficient ions and electrons are present to affect the propagation of radio waves.

**ionospheric absorption**—The loss of energy of a radio wave as it travels through the atmosphere, setting particles in motion. The energy needed to create this motion is equal to the loss.

**ionospheric disturbance**—1. The variation in the state of ionization of the ionosphere beyond the normal observed random day-to-day variation from the average value for the location, date, and time of day under consideration. 2. Change in the part of the earth's outer atmosphere (ionosphere) that affects transmission and reception of radio signals.

**ionospheric D scatter meteor burst**—A phenomenon in which the penetration of meteors through the D region of the ionosphere affects ionospheric scatter communications.

**ionospheric error**—Also called sky error. In navigation, the total systematic and random error resulting from reception of the navigational signal after it has been reflected from the ionosphere. It may be due to variations in the transmission path, uneven height of the ionosphere, or uneven propagation within the ionosphere.

**ionospheric prediction**—The forecasting of ionospheric conditions and the preparation of radio propagation data derived from it.

**ionospheric scatter**—See forward scatter.

**ionospheric storm**—An ionospheric disturbance associated with abnormal solar activity and characterized by wide variations from normal, including turbulence in the F region and increases in absorption. Often the ionization density is decreased and the virtual height is increased. The effects are most marked in high magnetic latitudes.

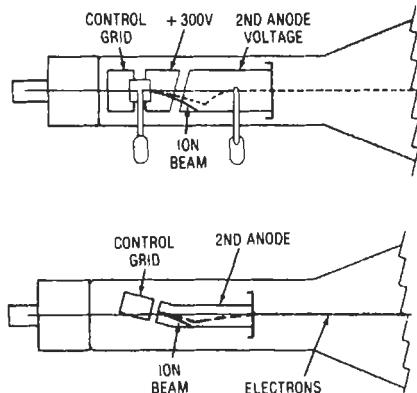
**ionospheric wave**—Also called a sky wave. A radio wave that is propagated by way of the ionosphere.

**ion sheath**—A positive-ion film that forms on or near the grid of a gas tube and limits its control action.

**ion spot**—1. In camera or image tubes, the spurious signal resulting from bombardment of the target or photocathode by ions. 2. On a cathode-ray-tube screen,

an area where the luminescence has been deteriorated by prolonged bombardment with negative ions. 3. A spot on the fluorescent surface of a cathode-ray tube that is somewhat darker than the surrounding area because of bombardment by negative ions, which reduce the sensitivity.

**ion trap** — Also called a beam bender. 1. An electron-gun structure and magnetic field that diverts negative ions to prevent their burning a spot in the screen, but permits electrons to flow toward the screen. 2. An arrangement of magnetic fields and apertures that will allow an electron beam to pass through but will obstruct the passage of ions.



*Ion trap.*

**I/O rack** — A chassis that contains I/O modules.

**I/O scan** — The time required for the PC processor to monitor all inputs and control all outputs. The I/O scan repeats continuously.

**IP** — Abbreviation for Internet Protocol. The Internet standard protocol that provides a common layer over dissimilar networks, used to move packets among host computers and through gateways if necessary.

$I_p$  — Symbol for the plate current of a vacuum tube.

**I-phase carrier** — Also called in-phase carrier. A carrier separated in phase by  $57^\circ$  from the color subcarrier.

**ips** — Abbreviation for inches per second. Used for specifying the speed of a tape traveling past the heads of a tape recorder. The most common speeds are  $1\frac{7}{8}$  ips (4.75 cm/s);  $3\frac{3}{4}$  ips (9.5 cm/s) and  $7\frac{1}{2}$  ips (19 cm/s).

**IR** — 1. Abbreviation for interrogator response. 2. Abbreviation for infrared. 3. Abbreviation for insulation resistance. That resistance offered by an insulation to an impressed dc voltage, tending to produce a leakage current through the insulation.

**$I^2R$**  — Power in watts expressed in terms of the current ( $I$ ) and resistance ( $R$ ).

**IRAC** — Acronym for Interdepartmental Radio Advisory Committee. It is composed of representatives of eleven government agencies: The FCC; Army; Navy; Air Force; Maritime Commission; and the Treasury, State, Commerce, Agriculture, Interior, and Justice Departments.

**IR compensation** — A control device that compensates for voltage drop due to current flow.

**IR drop** — 1. The voltage produced across a resistance ( $R$ ) when there is a current ( $I$ ) through the resistor. 2. The voltage drop that exists across a resistance when a current is flowing through it.

**IRE** — Abbreviation for Institute of Radio Engineers, an organization now merged with AIEE. See IEEE.

**IRED** — An infrared-emitting diode that emits photons in the infrared spectrum when forward biased. See also light-emitting diode.

**i region** — Abbreviation for intrinsic region. In silicon, a pure region of the group IV element (i.e., having neither excess holes or excess electrons, and therefore having very high resistivity).

**IRG** — Abbreviation for interrecord gap. 1. Erased area between records that allows stop/start and speed standardization when writing or reading data blocks on magnetic tape. 2. The space between records on magnetic tape caused by delays involved in starting and stopping the tape motion. This gap is used to signal that the end of a record has been reached.

**iridescence** — The rainbow exhibition of colors in a body, usually caused by interference of light of different wavelengths reflected from superficial layers in the surface of a material.

**iris** — Also called diaphragm. 1. In a waveguide, a conducting plate (or plates) that is very thin (compared with the wavelength) and occupies part of the cross section of a waveguide. When only a single mode can be supported in the waveguide, an iris appears substantially as a shunt admittance. 2. An adjustable aperture built into a camera lens to permit control of the amount of light passing through the lens.

**iris diaphragm** — A simple mechanism used to vary the diameter of an aperture. Consists of a number of thin, arc-shaped, metal blades that surround the aperture, each blade having a lower stud at one end and an upper stud at the other end. The lower studs fall into holes in a fixed ring surrounding the aperture, while the upper studs are held by radial slots in a rotatable control ring. Iris openings are measured in f-stops.

**$I^2R$  loss** — The power lost in transformers, generators, connecting wires, and other parts of a circuit because of the current  $I$  through the resistance  $R$  of the conductors.

**iron constantan** — A combination of metals used in thermocouples, thermocouple wires, and thermocouple lead wires. Constantan is an alloy of copper, nickel, manganese, and iron. The iron wire is the positive, the constantan the negative wire.

**iron-core coil** — A coil in which iron forms part or all of the magnetic circuit, linking its winding. In a choke coil, the core is usually built up of laminations of sheet iron.

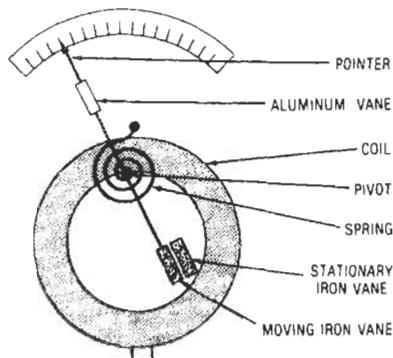
**iron-core transformer** — A transformer in which iron forms part or all of the magnetic circuit, linking the transformer windings.

**ironless rotor motor** — A motor that has a stationary permanent magnet located in the center of the rotor. The housing is made of soft steel and provides a return path for magnetic flux. Rotor coils are wound on a non-magnetic cage. The rotating member consists only of the hollow cage, the winding shaft, and commutator. Advantages include the elimination of cogging, lower starting voltages, and smoother starting and running. The motors are lightweight, hence inertia is low, providing a high torque-to-inertia ratio and high acceleration. The main disadvantage is that the complex construction is more expensive.

**iron loss** — See core loss.

**iron-vane instrument** — An indicating instrument whose operating portion consists of two iron bars, one fixed, one pivoted, placed parallel to each other inside a signal coil. Current through the coil magnetizes the bars in the same direction, and they repel each other, causing the pointer to pivot against the force of a hairspring. A damping vane may be used to slow the movement of the

pointer. Deflection is the same for ac or dc; the meter does not have polarity. The instrument has a nonlinear scale, and readings below  $\frac{1}{5}$  scale are extremely difficult to make. Because of inductance effects, use of this type of meter is limited to power-line frequencies.



*Iron-vane instrument.*

**irradiance**—The incident radiated power per unit area of a surface; the radiometric counterpart of illumination, usually expressed in watts per square centimeter.

**irradiation**—1. The application of X-rays, radium rays, or other radiation. 2. The amount of radiant energy per unit area received during a given time interval. This term is used in radiological therapy as well as in describing accidental exposure to radiation. It also can be used to denote radiant energy that ultimately passes through the skin to supply power to implanted electronic devices. 3. The exposure of a material to high-energy emissions. In insulations, done for the purpose of favorably altering the molecular structure.

**irregularity**—A change from normal.

**ISA**—Abbreviation for Industry Standard Architecture. The original bus architecture developed by IBM for its AT computer and opened up for use by other manufacturers.

**1-scan**—A radar display in which a target appears as a complete circle when the radar antenna is correctly pointed at it, the radius of the circle being proportional to the target distance.

**1-scope**—*See* 1-scan.

**ISDN**—Abbreviation for integrated services digital network. 1. A digital telephone service network that allows transmission of data, voice, and images over one phone line simultaneously. It can provide speeds of roughly 128,000 bits per second over regular phone lines. In practice, most users are limited to 56,000 or 64,000 bits per second. 2. Telephone technology that provides digital access to voice and data network services for sending speech, data, and video across one line simultaneously.

**ISHM**—The International Society of Hybrid Microelectronics.

**I signal**—Also called the fine-chrominance primary. 1. A signal formed by the combination of +.74 of an R-Y signal and -0.27 of a B-Y signal. One of the two signals used to modulate the chrominance subcarrier, the other being the Q signal. 2. Also known as the in-phase signal. The color sidebands produced by modulating the color subcarrier at a phase  $57^\circ$  removed from the burst reference phase. This signal is capable of reproducing the range of colors from orange to cyan (bluish-green).

## irradiance — isolation amplifier

**ISM equipment**—A Federal Communications Commission designation for industrial, scientific, and medical equipment.

**isobar**—1. On meteorological maps, a line denoting places having the same atmospheric pressure at a given time. 2. One of a group of atoms or elements having the same atomic weights but different atomic numbers.

**isochromatic**—Having the same color, as with the lines of the same tint in the interference figure of anisotropic crystals.

**isochrone**—On a map or chart, a line joining points associated with a constant time difference in the reception of radio signals.

**isochrone determination**—A radio location in which a position line is determined by the difference in transit times of signals along two paths.

**isochronous**—1. Equal in length of time. 2. Occurring at equal intervals of time. 3. Describes modems, terminals, and transmissions in which all bits are of equal duration. There are no start or stop bits as in asynchronous transmissions, and no clocking signals as in synchronous transmissions.

**isochronous circuits**—Circuits having the same resonant frequency.

**isochronous distortion**—A measure of a modem's dynamic operation.

**isochronous multiplexer**—A multiplexer that can interleave two time-independent data streams into one higher-speed stream independent of the master timing control required by a synchronous multiplexer.

**isoclinic line**—*See* aclinic line.

**isodynamic lines**—On a magnetic map, lines passing through points of equal strength of the earth's magnetic field.

**isoelectric**—Uniformly electric throughout or having the same electric potential, and therefore producing no current.

**isoelectronic**—Pertaining to atoms having the same number of electrons outside the nucleus of the atom.

**isolated**—Utterly cut off; refers to that condition in which a conductor, circuit, or device is not only insulated from another (or others), but the two are mutually unable to engender current, emf, or magnetic flux in each other. As commonly used, insulation is associated predominantly with direct current, whereas isolation implies additionally a bulwark against ac fields.

**isolated amplifier**—A differential amplifier in which the input-signal lines are conductively isolated from the output-signal lines and chassis ground.

**isolated I/O module**—A module that has each input or output electrically isolated from every other input or output on that module, i.e., each input or output has a separate return wire.

**isolating diode**—A diode that passes signals in one direction through a circuit but blocks signals and voltages in the opposite direction.

**isolating switch**—A switch intended for isolating an electric circuit from the source of power. It has no interrupting rating and is intended to be operated only after the circuit has been opened by some other means.

**isolation**—1. Electrical or acoustical separation between two locations. 2. The technique for producing a high electrical resistance between an integrated-circuit component and the substrate in which it is formed. 3. A reduction in the ability of a system to respond to an excitation or to generate an excitation. 4. A method for implementing electrical independence of devices integrated on the same integrated circuit.

**isolation amplifier**—Also called buffer amplifier. 1. An amplifier that is used to minimize the interaction

between the circuitry which precedes and that which follows. 2. An amplifier designed to have a galvanic discontinuity between its input and output pins. This discontinuity (called an isolation barrier) must have high breakdown voltage, low dc leakage (high barrier resistance), and low ac leakage (low barrier capacitance). Three-port isolation amplifiers have an additional isolation barrier between the power-supply connection and the signal connections that allows the user to connect power in common with either the amplifier's input or its output. Isolation amplifiers generally serve the following functions not achievable with operational or instrumentation amps: sensing small signals in the presence of very high (10 volts) or unknown common-mode voltages, protecting patients undergoing medical monitoring or diagnostic measurements, and completely breaking ground loops. The isolation amplifier, as well as offering isolation, increases accuracy because of its floating input. In contrast to the instrumentation amplifier, it not only eliminates ground loop errors but further reduces the total system error, because its isolation-mode rejection ratio is generally one or two orders of magnitude higher than the common-mode rejection of an instrumentation amplifier. 3. An amplifier with input circuitry and output circuitry designed to eliminate the effects of changes made at either on the other. 4. An amplifier that has an input circuit that is galvanically (no ohmic connection) isolated from the output stage and the power-supply terminals. This isolation is provided by magnetic, optical, or mechanical coupling techniques. Isolation amplifiers are used in applications that require accurate and safe measurement of dc and low-frequency signals. 5. A circuit that amplifies a signal without needing a galvanic path between its input and output terminal. The circuit can be used to protect individuals and equipment from high voltages and to break ground loops in measurement systems. The high resistance and low capacitance of the isolation region permit little current leakage across its barrier and it withstands a specified high voltage without breakdowns or arcs.

**isolation barrier** — See isolation amplifier.

**isolation diffusion** — 1. A technique for separation of the individual components within a monolithic silicon structure; p diffused isolation zones are used to form pn junctions that act as reverse-biased diodes. The transistors are double diffused; that is, they are processed by two diffusion steps after the isolation diffusion. 2. In monolithic integrated circuit technology, the diffusion step that generates back-to-back junctions to isolate active devices from one another.

**isolation network** — A network inserted into a circuit or transmission line to prevent interaction between circuits on each side of the insertion point.

**isolation transformer** — A transformer designed to provide magnetic coupling (flux coupling) between one or more pairs of isolated circuits, without introducing significant coupling of any other kind between them—i.e., without introducing either significant conductive (ohmic) or significant electrostatic (capacitive) coupling.

**isolator** — 1. A device that permits microwave energy to pass in one direction while providing high isolation to reflected energy in the reverse direction. Used primarily at the input of communications-band microwave amplifiers to provide good reverse isolation and minimize VSWR. Consists of microwave circulator with one port (port 3) terminated in the characteristic impedance. 2. A device that acts as a one-way valve for microwave signals to prevent stray receiver signals from leaking out past the LNA onto the antenna. 3. A device that allows the transmission of signals in one direction while blocking or attenuating them in the other.

**isolator ferrite** — A microwave device that allows rf energy to pass through in one direction with very little loss but that absorbs rf power in the other direction.

**isolith** — An integrated circuit of components formed on a single silicon slice, but with the various components interconnected by beam leads and with circuit parts isolated by removal of the silicon between them.

**isomer** — One of two or more substances composed of molecules having the same kinds of atoms in the same proportions but arranged differently. Hence, the physical and chemical properties are different.

**isoplanar** — A bipolar fabrication process that replaces conventional planar p+ isolation diffusion with an insulating oxide to provide isolation between active elements of a silicon integrated circuit. Circuit elements can be fabricated in less space than conventional isolation techniques with improved speed and power performance.

**isopulse system** — In adaptive communications, a pulse coding system in which special inserted pulses indicate the number of information pulses that are transmitted.

**isostatic** — Being subjected to equal pressure from every side.

**isothermal region** — The stratosphere considered as a region of uniform temperature.

**isotones** — A group of atoms whose nuclei have the same number of neutrons.

**isotope** — A species of matter whose atoms contain the same number of protons as some other species, but a different number of neutrons. The atomic numbers of isotopes are identical, but the mass numbers (atomic weights) differ. See radioisotope.

**isotropic** — 1. Having properties with the same values along axes in all directions. 2. Term applied to substances having certain properties that are manifest in every direction, e.g., electrical conductivity in metals. 3. The ability to react the same regardless of direction of measurement. Isotropic materials will react consistently even if stress is applied in different directions. Stress/strength ratio is uniform throughout material.

**isotropic antenna** — Also called unipole. A hypothetical antenna radiating or receiving equally in all directions. A pulsating sphere is a unipole for sound waves. In the case of electromagnetic waves, unipoles do not exist physically, but represent convenient reference antennas for expressing directive properties of actual antennas.

**isotropic gain of an antenna** — See absolute gain of an antenna.

**isotropic magnet** — A magnetic material having no preferred axis of magnetic characteristics.

**isotropic material** — 1. A material having the same magnetic characteristics along any axis. 2. A substance whose properties are similar when tested in any direction.

**isotropic radiator** — A radiator that sends out equal amounts of energy in all directions.

**ISP** — Abbreviation for Internet service provider. A general term for any company that provides a connection to the Internet for individuals or businesses.

**ISV** — Abbreviation for instantaneous speed variations. Short-term speed changes resulting from nonuniform capstan speed, tension changes caused by start/stop accelerations, and longitudinal vibrations that are caused by a magnetic tape's sliding over the heads and tape guides.

**ITDM** — Abbreviation for intelligent time-division multiplexer. Also called a statistical multiplexcr. A multiplexer that assigns time slots on demand rather than on a fixed subchannel-scanning basis.

**item** — 1. A general term denoting one of a number of similar units, assemblies, objects, etc. 2. Any unique manufactured or purchased part or assembly, that is, end product, assembly, subassembly, component, or raw material.

**iterations per second**—The number of approximations per second in iterative division in a computer; the number of times a cycle of operation can be repeated in one second.

**iterative**—1. Recurring an infinite number of times. 2. Characteristic of a network with an infinite number of identical sections, or of the impedance looking into such a network.

**iterative array**—In a computer, a large number of identical, interconnected processing modules used, with appropriate driver and control circuits, to perform simultaneous parallel operations.

**iterative division**—In computers, a method of performing division by use of addition, subtraction, and multiplication operations. A quotient of specified precision is obtained by a series of progressively closer approximations.

**iterative filter**—A four-terminal filter that provides iterative impedance.

**iterative impedance**—1. An impedance that, when connected to one pair of terminals of a four-terminal transducer, causes the same value of impedance to appear between the other two terminals. The iterative impedance of a uniform transmission line is equal to the characteristic impedance of the line. In a symmetrical four-terminal

transducer, the iterative impedances for the two pairs of terminals are equal and the same as the image impedances and the characteristic impedance. 2. The impedance that will terminate the output of a line or network such that the impedance then measured at the input of the line or network will be equal to the (iterative) terminating impedance.

**iterative process**—The calculating of a desired result by means of a repeating cycle of operations that comes closer and closer to the desired result.

**iterative routine**—A computer routine composed of repetitive computations, so that the output of every step becomes the input of the succeeding step.

**ITU**—Abbreviation for International Telecommunication Union.

**iTV**—Abbreviation for industrial television.

**i-type**—Intrinsic semiconductor.

**i-type semiconductor material**—A semiconductor material in which the electron and hole densities are effectively equal under conditions of thermal equilibrium.

**IVR**—Abbreviation for integrated voltage regulator.

**IWW**—Abbreviation for intermittent windshield wiper (General Motors, Ford Motor, and Chrysler Corp.). In an automobile, electronic control of the windshield wiper motor to vary the time interval between wipes.

# J

**J**—Letter symbol for joule.

**jack**—1. A socket to which the wires of a circuit are connected at one end, and into which a plug is inserted at the other end. 2. A type of two-way, or more, concentric contact socket for carrying audio signals. 3. A receptacle into which a mating connector may be plugged. 4. The receptacle that accepts a plug, specifically a phone plug. 5. A plug-in type terminal widely used in electronic apparatus for temporary connections or those requiring frequent connections and disconnections. A connection is made to a jack simply by plugging a probe or plug attached to a flexible insulated wire or cable into the jack. 6. Receptacle for a plug connector leading to the input or output circuit of a tape recorder or other piece of equipment. A jack matches a specific plug.

**jack bay**—Also called patch bay. A panel containing a number of signal jacks (usually standard phone jacks or mini phone jacks), commonly used in studio recording consoles and in equipment racks to provide flexibility in rerouting signals (beyond that provided by normal switches or controls). The jack bay also offers convenience when temporarily connecting certain equipment to a system, or troubleshooting and aligning equipment.

**jacket**—1. Pertaining to wire and cable, the outer sheath that protects against environment and may also provide additional insulation. 2. An outer, nonmetallic, protective covering applied over an insulated wire or cable.

**jack panel**—An assembly composed of a number of jacks mounted on a board or panel.

**jack screw**—A screw attached to one half of a two-piece, multiple-contact connector and used to draw both halves together and to separate them.

**jaff**—Slang for the combination of electronic and chaff jamming.

**jag**—In facsimile, distortion caused in the received copy by a momentary lapse in synchronism between the scanner and recorder.

**jaggies**—Irregular edges on something that should look smooth, a byproduct of the method of searching a scene and of too coarse a bit map.

**jam**—1. In punch-card machines, a condition in the card feed that interferes with the normal travel of the punch cards through the machine. 2. To interfere electronically with the reception of radio signals.

**jam input**—The presetting or loading of a counter, using inputs provided for the purpose. Also, the establishment of a desired logic state or logic line by the direct application of the appropriate voltage level to the line, regardless of the outputs of other devices connected to it.

**jammer**—An electronic device for intentionally introducing unwanted signals into radar sets to render them ineffective.

**jammer band**—The radio-frequency band where the jammer output is concentrated. It is usually the band

between the points where the intensity is 3 dB down from maximum.

**jammer finder**—Also called burnthrough. Radar that attempts to obtain the range of the target by training a highly directional pencil beam on a jamming source.

**jammers tracked by azimuth crossings**—Semi-automatic strobe processing and tracking that permits automatic detection and tracking on the basis of azimuth information obtained from the jamming signals emanating from an airborne vehicle.

**jamming**—Also called active electronic countermeasures. 1. The intentional transmission of radio signals in order to interfere with the reception of signals from another station. 2. Interference with hostile radio or radar signals for the purpose of deceiving or confusing the operator. It may be accomplished by saturating a receiver with sufficient noise to prevent detection and location of a target, or by deceiving the operator with intentionally misleading signals or false echoes without his knowing that such signals are present. 3. The deliberate radiation, reradiation, or reflection of electromagnetic energy to impair the use of electronic devices, equipment, or systems by the enemy. Equipment may consist of rudimentary cw or noise transmitters, broadband transmitters, or complex systems that generate deceptive signals.

**jamming effectiveness**—The jamming-to-signal ratio, that is, the percentage of information incorrectly received in a test message.

**JAN specification**—Joint Army-Navy specification. The forerunner of present military specifications; generally superseded by the designation MIL.

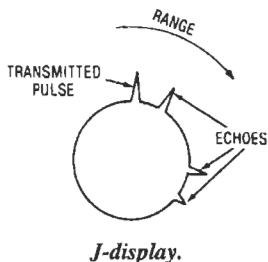
**J-antenna**—A half-wave antenna fed at one end by a parallel-wire, quarter-wave section having the configuration of a J.

**Java**—A platform-independent programming language invented by Sun Microsystems that is specifically designed for writing programs that can be safely downloaded to a computer through the Internet and immediately run without fear of viruses or other harm to the computer or to files. Using small Java programs (called applets), web pages can include functions such as animations, calculators, and other fancy tricks.

**J-carrier system**—A broadband carrier system that provides 12 telephone channels and utilizes frequencies up to about 140 kilohertz by means of four-wire transmission on a single open-wire pair.

**J-display**—Also called J-scan. In radar, a modified A-display in which the time base is a circle and the target signal appears as a radial deflection from it.

**JEDEC**—Acronym for Joint Electron Device Engineering Council. An industry-sponsored organization whose function is to provide a means of standardization for the industry. This encompasses numbering systems, testing methods and techniques, specifications uniformity,



and similar attempts on the part of the component manufacturers to assist the users of electronic components. In addition, JEDEC attempts to establish a code of ethics for the industry and to offer a set of standards for nonmilitary parts.

**JETEC** — Acronym for Joint Electron Tube Engineering Council.

**jewel bearing** — A natural or synthetic jewel, usually sapphire, used as a bearing for a pivot or other moving parts of a delicate instrument.

**jezebel** — A system for the detection and classification of submarines.

**JFET** — Abbreviation for junction field-effect transistor. A semiconductor device that operates by altering the conductivity of a region of the semiconductor (the channel) between two contacts (source and drain) by application of a voltage to a third terminal (gate). The current flow between source and drain is controlled by the gate voltage. In a JFET device, the gate voltage is applied to the channel across a pn junction, in contrast to its application across an insulator in a conventional MOSFET. JFETs are of two types: p channel and n channel, depending on whether the channel is n type or p type.

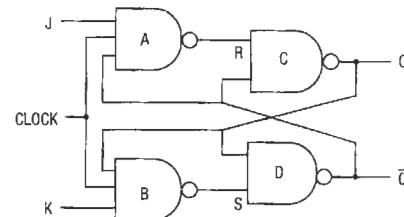
**JHG** — Abbreviation for Joule heat gradient.

**jitter** — 1. Instability of a signal in either its amplitude or its phase, or both, due to mechanical disturbances or to changes in supply voltage, component characteristics, etc. 2. In relation to cathode-ray tube displays, error in the signal amplitude, phase, or both that results in small, rapid aberrations in size or position of the image. 3. Error of synchronization between a facsimile's transmitter and receiver characterized by a raggedness in the copy. 4. An aberration of a repetitive display, indicating instability of the signal or of the oscilloscope. May be random or periodic, and is usually associated with the time axis. 5. A loss of synchronization caused by electrical or mechanical malfunctions. 6. Type of analog-communication-line distortion caused by a signal's variation from its reference timing position, which can cause data-transmission errors, particularly at high speeds. This variation can be in amplitude, time, frequency or phase. See flicker, 3; fortuitous telegraph distortion.

**jittered pulse recurrence frequency** — The random variation of the pulse-repetition period. Provides a discrimination capability against repeater-type jammers.

**J-K flip-flop** — A flip-flop with two conditioning inputs (J and K) and one clock input. If both conditioning inputs are disabled prior to a clock pulse, the flip-flop does not change condition when a clock pulse occurs. If the J input is enabled and the K input is disabled, the flip-flop will assume the 1 condition upon arrival of a clock pulse. If the K input is enabled and the J input is disabled, the flip-flop will assume the 0 condition when a clock pulse arrives. If both the J and K inputs are enabled prior to the arrival of a clock pulse, the flip-flop will complement, or assume the opposite state, when the clock pulse occurs. The J-K flip-flop is a refinement of the R-S flip-flop with the advantage that it has a determinate state when signals

appear on both input terminals; it changes state when all inputs are activated. J and K have no particular meaning, but were selected to avoid conflict with other commonly used symbols.



*J-K flip-flop.*

**job** — 1. A group of tasks specified as a unit of work for a computer. Usually by extension, a job includes all necessary programs, linkages, files, and instructions for the operating system. 2. In a computer, a collection of tasks, grouped and run together in order to perform a specific function.

**job control language** — A special computer command language designed for use in batch systems to inform the systems software and computer operator of unique requirements for the running of a computer program.

**job library** — A related series of user-identified, partitioned data sets that serve as the primary source of load modules for a given job.

**job statement** — A control statement that identifies the start of a series of job control statements for a single job.

**job step** — The carrying out of a computer program explicitly identified by a job control statement. The execution of several job steps may be specified by a job.

**jogging** — Also called inching. Quick and repeated opening and closing of a motor starting circuit to produce slight movements of the motor.

**Johnson counter** — Also called Mobius counter or twisted-ring counter. A counter composed of an  $N$ -stage shift register with the complement of the last stage returned to the input. It normally has  $2N$  states through which it cycles. It has the distinguishing characteristic that only one stage changes state at each count. See ring counter, 2.

**Johnson noise** — Also called thermal noise. 1. The noise generated by any resistor at a temperature above absolute zero. It is proportionate to the absolute temperature and the bandwidth according to the following formula:

$$N = KTB$$

where

$N$  is the noise power in watts

$K$  is Boltzmann's constant, or  $1.38047 \times 10^{-23}$

$T$  is the absolute temperature in kelvins

$B$  is the bandwidth in hertz

2. A frying or sizzling sound produced by thermal agitation voltages generated in amplifier circuits. It usually occurs in the input circuit (or front end) of an amplifier. Discovered by J. B. Johnson in the late 1920s, this thermal noise may be generated by a resistor at a temperature above absolute zero. It is random noise engendered by thermal agitation.

**joined actuator** — A multiple breaker such that when one pole trips, all trip, but whereas the faulted pole

is tripfree, the other poles may be kept maintained by a restraining actuator.

**joint** — A connection between two or more conductors, or the connecting point of two conductors.

**joint circuit** — A communication link in which there is participation by the elements of more than one service, through control, operations, management, etc.

**joint communications** — The common use of communication facilities by two or more services of the same country.

**Joint electron device Engineering Council** —

See JEDEC.

**Joint electron tube Engineering Council** — See JETEC.

**joint pole** — Pole used in common by two or more utility companies.

**joint use** — The simultaneous use of pole, line, or plant facilities by two or more kinds of utilities.

**Jones plug** — A type of polarized connector designed in the form of a receptacle and having several contacts.

**Josephson effect** — 1. The phenomenon described by Brian Josephson to explain the action of currents through and voltages across hairlike gaps in superconductors. On the basis of theoretical considerations, it is predicted that if two superconductors would be brought close enough together, a current could be made to flow across the gap between them. Under certain conditions, a voltage appears across the gap, and high-frequency radiation emanates from it. This predicted radiation would have a frequency precisely equal to  $2eV/h$ , where  $V$  is the measured voltage across the gap. 2. Characteristic of radiation detectors that produce energy that is similar to the energy of superconductive gaps when interacting with photons.

**joule** — 1. The work done by a force of 1 newton acting through a distance of 1 meter. The joule is the unit of work and energy in the mksa system. 2. The energy required to transport 1 coulomb between two points having a potential difference of 1 volt. The joule is  $10^7$  ergs. The kilowatt-hour is  $3.6 \times 10^6$  joules. 3. A unit of energy of work  $CV^2/2$  equal to 1 wattsecond. Energy stored in a capacitor is equal to  $CV^2/2$  joules or wattseconds, where  $C$  is capacitance in farads and  $V$  is voltage in volts at the capacitor's terminals. The letter symbol for joule is  $J$ .

**Joule effect** — In a circuit, electrical energy is converted into heat by an amount equal to  $I^2R$ . Half of this heat flows to the hot junction and the other half to the cold junction.

**Joule heat** — The thermal energy produced as a result of the Joule effect.

**Joule heat gradient** — Abbreviated JHG. The rate at which the thermal heat produced by the Joule effect increases or decreases.

**Joule's law of electric heating** — The amount of heat produced in a conductor is proportional to the resistance of the conductor, the square of the current, and the time.

**joystick** — 1. A control device consisting of a handle with freedom of motion in all directions of a plane, connected to potentiometers or other control devices through suitable linkage permitting natural human input of positioning or other information. The term is derived from the joystick of aircraft. 2. A data-entry device used to manually enter coordinate values in special X-, Y-, and Z-input registers. The device consists of a vertically mounted stick or column that can be moved and twisted. When it is moved backward or forward or sideways, coordinate values are stored in the X- and Y-input registers. The Z-input register is varied whenever the

joystick is twisted clockwise and counterclockwise. These registers must be scanned by the host computer since joysticks normally do not generate interrupts when they are activated. Usually the joystick is used to move a cursor and/or tracking symbol on the face of the CRT screen. Used mainly for computer games. 3. A type of four-channel pan potentiometer that has a shaft with a handle that can be moved forward and back, left and right, or anywhere in between to direct a single input signal to any of four output channels.

**J-scan** — See J-display.

**J-scope** — Also called class J oscilloscope. A cathode-ray oscilloscope that presents a J-display.

**J/S ratio** — A ratio, normally expressed in dB, of the total interference power to the signal-carrier power in the transmission medium at the receiver.

**juice** — Slang for electric current.

**jump** — 1. To cause the next instruction to be selected from a specific storage location in a computer. 2. A departure from the normal one-step incrementing of the program counter. By forcing a new value (address) into the program counter, the next instruction can be fetched from an arbitrary location (either further ahead or back). For example, a program jump can be used to go from the main program to a subroutine, from a subroutine back to the main program, or from the end of a short routine back to the beginning of the same routine to form a loop. 3. Transfer of program logic flow by bypassing a number of instructions. The jump can be forward over a positive number of bytes or backward by expressing a negative number of bytes. The jump can be conditional on the status of the accumulator or other registers.

**jumper** — 1. A short length of wire used to complete a circuit temporarily or to bypass a circuit. 2. A direct electrical connection, which is not a portion of the conductive pattern, between two points in a printed circuit. 3. An electrical connection between two points on a printed board added after the intended conductive pattern is formed. 4. A short length of cable used to make electric connections within, between, among, and around circuits and their associated equipment. 5. A length of conductor used to establish connections (often temporary) between two points or to provide a path around a break in a circuit. A jumper can interconnect board to connector, board to board, or power supply to black box unit. 6. A direct electrical connection between two points on a film circuit. Jumpers are usually portions of bare or insulated wire mounted on the component side of the substrate. 7. A patch cable or wire used to establish a circuit, often temporarily, for testing or diagnostics.

**jumper cable** — A short flat cable interconnecting two printed wiring boards or devices.

**junction** — 1. A connection between two or more conductors or two or more sections of a transmission line. 2. A contact between two dissimilar metals or materials (e.g., in a rectifier or thermocouple). 3. A region of transition between p- and n-type semiconductor material. The controllable resultant asymmetrical properties are exploited in semiconductor devices. There are diffused, alloy, grown, and electrochemical junctions. 4. A joining of two different semiconductors or of semiconductor and metal. 5. Optical interface.

**junction barrier** — The opposition to the diffusion of majority carriers across a pn junction due to the charge of the fixed donor and acceptor ions.

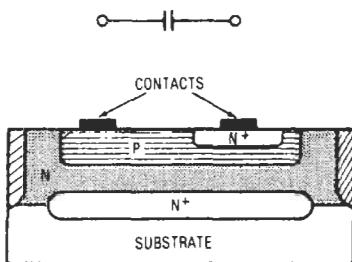
**junction battery** — A nuclear type of battery in which radioactive strontium 90 irradiates a silicon pn junction.

**junction box** — 1. A box for joining different runs of raceway or cable, plus space for connecting and branching the enclosed conductors. 2. An enclosed distribution panel

for connecting or branching one or more corresponding electric circuits without the use of permanent splices.

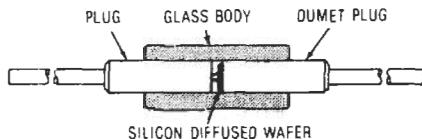
**junction capacitance**—The total small-signal capacitance between the contacts of an uninstalled semiconductor die.

**junction capacitor**—A capacitor in which the capacitance is that of a reverse-biased pn junction.



Junction capacitor.

**junction diode**—1. A two-terminal device containing a single crystal of semiconducting material that ranges from p type at one terminal to n type at the other. It conducts current more easily in one direction than in the other and is a basic element of the junction transistor. Such a diode is the basic part of an injection laser; the region near the junction acts as a source of emitted light. When fabricated in a suitable geometrical form, the junction diode can be used as a solar cell. 2. A pn junction characterized by slower switching speed and higher operating voltage and temperature than the Schottky diode. The fast recovery version of the junction diode turns off faster than the conventional pn junction diode, usually in hundredths of a nanosecond. 3. A semiconductor diode having the property of conducting current more easily in one direction than the other. This device may be made by diffusion of an impurity into a semiconductor crystal to form a junction. Such diodes are the basic elements of an injection laser. Light is emitted from the area near the junction.



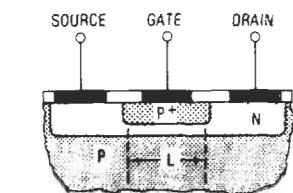
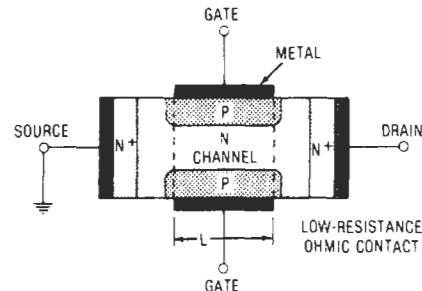
Junction diode assembly.

**junction FET**—A field-effect transistor having one or more gates that form pn junctions with the channel. *See also* junction field-effect transistor.

**junction field-effect transistor**—Abbreviated JFET. 1. A transistor made up of a gate region diffused into a channel region. The gate element is a region of semiconductor material (ordinarily, the substrate) insulated by a pn junction from the channel, which is material of opposite polarity. When a control voltage is applied to the gate, the channel is depleted or enhanced, and the current between source and drain is thereby controlled. There is no current when the channel is pinched off. 2. A field-controlled majority carrier

## junction capacitance — justification

device where the conductance in the channel between the source and the drain is modulated by a transverse electric field. The field is controlled by a combination of gate-source bias voltage,  $V_{GS}$ , and the net drain-source voltage,  $V_{DS}$ .



Junction field-effect transistor.

**junction filter**—A combination of a high-pass and a low-pass filter that is used to separate frequency bands for transmission over separate paths. For example, junction filters are used to separate voice and carrier frequencies at the junction between open-wire and cable so that the carrier frequencies and voice frequencies can be sent over nonloaded and VF-loaded cable pairs, respectively.

**junction-gate field-effect transistor**—A field-effect transistor having one or more gate regions that form pn junction(s) with the channel.

**junction loss**—1. In telephone circuits, that part of the repetition equivalent that can be assigned to interactive effects originating at trunk terminals. 2. The transmission loss due to the mismatch of impedance between two types of transmission facilities. *See* repetition equivalent.

**junction point**—*See* node, 1.

**junction pole**—Pole at the end of a transposition section of an open-wire line or the pole common to two adjacent transposition sections.

**junction station**—A microwave relay station that joins a microwave radio leg or legs to the main, or through, route.

**junction transistor**—A transistor having three alternate sections of p-type or n-type semiconductor material. *See also* npn transistor; pnp transistor.

**junction transposition**—Transposition located at the junction pole between transposition sections of an open-wire line.

**juncter**—In crossbar systems, a circuit extending between frames of a switching unit and terminated in a switching device on each frame.

**justification**—1. The act of adjusting, arranging, or shifting digits to the left or right so that they conform to a prescribed pattern. 2. The automatic inserting of blank spaces within text to make the right margin even on a page.

**justify**—To align data about a particular reference or to produce a text with flush left and right margins (a more printlike appearance).

**just-operate value**—Also called dropout value. The measured functioning value at which a particular relay operates. *Contrast* just-release value.

**just-release value**—The measured functioning value at which a particular relay releases.

**just scale**—A musical scale formed by three consecutive triads (those in which the highest note of one is the lowest note of the other), each having the ratio 4:5:6 or 10:12:15.

**jute**—Cordage fiber (such as hemp) saturated with tar and used as a protective layer over cable.

**jute-protected cable**—A cable having its sheath covered by a wrapping of tarred jute or other fiber.

# K

**K**—1. Symbol for cathode or dielectric constant. 2. Letter symbol for kelvin or kilo. 3. Abbreviation for luminosity factor. 4. In a calculator, a fixed number (a constant) that can be used repetitively. 4. Symbol for  $10^3$ . When referring to bits or words,  $K = 1024$ . A 4 K chip is a 4 K-bit chip. A 4 K memory is a 4 K-word memory (typically 4 K bytes). 5. When referring to memory storage capacity,  $2^{10}$ ; in decimal notation, 1024.

**k**—Letter symbol for kilo-.

**KA**—Letter symbol for kiloampere.

**Ka band**—The frequency band from 18 to 31 GHz.

**Karnaugh map**—A display of a truth table in a way such that reduction (simplification) of a Boolean expression is facilitated. It consists of a rectangular or square array (depending on the number of variables) of "locations" whose coordinates correspond to truth-table inputs.

**KB or Kb**—Abbreviation for kilobyte. 1024 bytes (8192 bits).

**K-band**—A radio frequency band extending from 11 to 36 GHz and having wavelengths of 2.73 to 0.83 cm.

**Kbps**—Abbreviation for kilobits per second. A standard measurement of data rate and transmission capacity. One Kbps equals 1024 bits per second.

**kc**—Abbreviation for kilocycle. Now obsolete. Replaced by kHz.

**K-carrier system**—A broadband carrier system that provides 12 telephone channels and utilizes frequencies up to about 60 kHz by means of four-wire transmission on cable facilities.

**K-display**—Also called K-scan. Modification of a type-A scan, used for aiming a double-lobe system in bearing or elevation. The entire range scale is displaced toward the antenna lobe in use. One signal appears as a double deflection from the range and relative scales. The relative amplitudes of these two pips indicate the amount of error in aiming the antenna.

**keep-alive anode**—An auxiliary electrode that maintains a dc discharge in a mercury-pool tube. It has the disadvantage of reducing the peak inverse voltage rating.

**keep-alive circuit**—In a tr or anti-tr switch, a circuit for producing residual ionization in order to reduce the time for full ionization when the transmitter fires.

**keep-alive voltage**—A dc voltage that maintains a small glow discharge within one of the gap electrodes of a tr tube. This allows the tube to ionize more rapidly when the transmitter fires, thus preventing damage to the receiver.

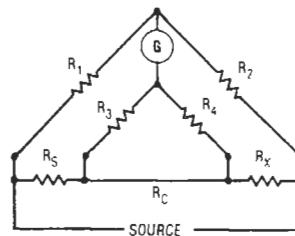
**keeper**—A magnetic conductor, placed over the ends of a permanent magnet, used to complete the magnet circuit of a permanent magnet to protect it against demagnetizing influences.

**Kel-f**—Polymonochlorotrifluoroethylene—a plastic used as a high-temperature insulation ( $-55^\circ\text{C}$  to  $+135^\circ\text{C}$ ).

**kelvin**—Formerly degree Kelvin. A unit of absolute temperature equal to  $1/273.16$  of the Kelvin scale temperature of the triple point of water. Letter symbol: K.

**Kelvin balance**—An instrument for measuring current. This is done by sending a current through a fixed and a movable coil attached to one arm of a balance. The resultant force between the coils is then compared with the force of gravity acting on a known weight at the other end of the balance arm.

**Kelvin bridge**—Also called a double or Thompson bridge. A seven-arm bridge for comparing the resistances of two 4-terminal resistors or networks. Their adjacent potential terminals are spanned by a pair of auxiliary resistance arms of known ratio, and they are connected in series by a conductor joining their adjacent current terminals.



*Kelvin bridge.*

**Kelvin scale**—Also called absolute scale. A temperature scale using the same divisions as the Celsius scale, but with the zero point established at absolute zero ( $-273^\circ\text{C}$  or  $-459^\circ\text{F}$ ), theoretically the lowest possible temperature (the temperature at which all molecular motion stops).

**Kendall effect**—A spurious pattern or other distortion in a facsimile record. It is caused by unwanted modulation produced by transmission of a carrier signal. Such modulation appears as a rectified baseband that interferes with the lower sideband of the carrier.

**Kennelly-Heaviside layer**—See Heaviside layer.

**kenopliotron**—A diode-triode vacuum tube within one envelope. The anode of the diode also serves as the cathode of the triode.

**kenotron**—Also called a valve tube. 1. A term used primarily in industrial and X-ray fields for a hot-cathode

vacuum tube. 2. A high-vacuum, high-voltage thermionic diode, used primarily as a high-voltage rectifier.

**Keplerian elements (Keps)** — A collection of data relating to the position of a satellite in its orbit at any given time. This information is interpreted by satellite tracking programs to predict time and duration of satellite passes and directions in which to point antennas. Named for the 19th-century scientist Johannes Kepler.

**keraunophone** — A radio circuit device for audibly demonstrating the occurrence of distant lightning flashes.

**kerf** — The slit or channel or "L" cut in a resistor during trimming by a laser beam or abrasive jet.

**kernel** — 1. A line within a current-carrying conductor along which the magnetic intensity due to the current is zero. 2. The most basic portion of an operating system, usually supporting only task synchronization, scheduling, communication, and the most rudimentary of memory allocation capabilities. It implements software processes and furnishes the means of interprocess communication; usually written in assembly language. 3. The central portion of a program, containing the bulk of its calculations, that consumes the most execution time.

**Kerr cell** — A container filled with a transparent material that, when subjected to a strong electric field, exhibits double refraction. Because the two polarized components of an incident light beam have different phase velocities in the medium, this device can rotate the plane of polarization. When placed between crossed polarizers, the Kerr cell, usually containing nitrobenzene, can act as an extremely high-speed shutter for light beams.

**Kerr effect** — 1. An electro-optical effect in which certain transparent substances become double refracting when subjected to an electric field perpendicular to a beam of light. 2. The conversion of plane into elliptically polarized light when reflected from the polished end of a magnet.

**Kettering ignition system** — Inductive system commonly used for internal combustion engines. Employs induction coil, breaker contacts, capacitor, and a suitable power supply, such as a battery.

**keV** — Letter symbol for kiloelectronvolt.

**key** — 1. A hand-operated switching device for switching one or more parts of a circuit. It ordinarily consists of concealed spring contacts and an exposed handle or push button. 2. A projection that slides into a mating slot or groove so as to guide two parts being assembled and assure proper polarization.

**keyboard** — 1. In a calculator, keys for digits 0 through 9, plus additional keys for various functions, such as add, multiply, divide, subtract, clear, memory, etc. 2. That portion of a terminal used to generate the character stream to the computer or other communications device. 3. An array of push-button switches with related functions. Keyboards use standard push-button contact switches, Hall-effect switches, capacitive switches, and many others. Any type of momentary-contact switch suitable in terms of size, current switching capacity, etc., may be used. The electrical signal generated by switch closure is routed to the appropriate circuitry where the action indicated by closure of the keyboard switch is initiated. 4. A series of switches, usually in the form of a typewriter keyboard, that a computer operator uses to communicate with the computer.

**keyboard computer** — A computer whose input employs a keyboard, e.g., an electric typewriter.

**keyboarding** — Entering information (to a word processor) via a keyboard.

**keyboard-operated transmission** — *See KOK.*

**keyboard perforator** — A mechanism that punches a paper tape from which messages are automatically transmitted by a transmitter distributor. The keyboard is

similar to that of a typewriter and can be operated by any trained typist after a few hours' instruction. As each key is depressed, the tape is punched with corresponding code symbols.

**keyboard send/receive** — A combination teletypewriter transmitter and receiver with transmission capability from a keyboard only. *See KSR.*

**key cabinet** — A case installed on a customer's premises and providing facilities so that different lines to the control office can be connected to various telephone stations. It has signals that indicate originating calls and busy lines.

**key click** — A transient signal sometimes produced when the key of a radiotelegraph transmitter is opened or closed. The transient is heard in a speaker or headphone as a click.

**key-click filter** — Also called a click filter. A filter that attenuates the surges produced each time the keying circuit of a transmitter is opened or closed.

**keyed adapter** — A device that detects a modulated signal and produces a dc output signal whose amplitude varies in accordance with the modulation. In radio facsimile transmission, it is used to provide the keying signal for a frequency-shift exciter unit.

**keyed AGC** — Abbreviation for keyed automatic gain control.

**keyed automatic gain control** — Abbreviated keyed AGC. A television automatic gain control in which the AGC tube is kept cut off except when the peaks of the positive horizontal-sync pulse act on its grid. The AGC voltage is therefore not affected by noise pulses occurring between the sync pulses.

**keyed clamp** — A clamping circuit in which a control signal determines the time of clamping.

**keyed interval** — In a periodically keyed transmission system, an interval that starts from a change in state and has a length equal to the shortest time between changes in state.

**keyed rainbow generator** — A color television test instrument that displays the individual colors of the spectrum, separated by black bars, on the picture tube.

**keyed rainbow signal** — A 3.563795-MHz (3.56-MHz) continuous sine-wave signal from a color-bar generator that is pulsed on and off. This signal creates a series of different color bars on the screen of the color picture tube. A typical pulse rate (for 10 color bars) is 12 times per 1 horizontal line.

**keyer** — 1. In telegraphy, a device that breaks up the output of a transmitter or other device into the dots and dashes that are used in the code. 2. A radar modulator.

**keying** — 1. The forming of signals, such as those employed in a telegraph transmission, by an abrupt modulation of the output of a director by an alternating-current source (e.g., by interrupting it or by suddenly changing its amplitude, frequency, or some other characteristic). 2. Mechanical arrangement of guide pins and sockets, keying plugs, contacts, bosses, slots, keyways, inserts, or grooves in a connector housing, shell, or insert that allows connectors of the same size and type to be lined up without the danger of making a wrong connection.

**keying chirps** — Sounds accompanying code signals when the transmitter is unstable and shifts slightly in frequency each time the sending key is closed.

**keying frequency** — In facsimile, the maximum number of times a second a black-line signal occurs while scanning the subject copy.

**keying plug contact** — A component that is inserted into a cavity of a connector housing or insert to ensure engagement of identically matched components.

**keying wave** — Also called marking wave. The emission that takes place in telegraphic communication

while the information portion of the code characters is being transmitted.

**keyless ringing**—A type of machine ringing on a manual switchboard. Ringing is started automatically when the calling plug is inserted into the jack of the called line.

**keypad**—Device with a matrix of keys enabling a user to input (usually numeric) information into another device, as in dialing a touch-tone telephone.

**key pulse**—A telephone signaling system in which numbered keys are depressed instead of a dial being turned.

**key pulsing**—A switchboard arrangement using a nonlocking keyset for the transmission of pulse signals corresponding to the key depressions.

**key-pulsing signal**—The signal that indicates a circuit is ready for pulsing, in multifrequency and direct-current key pulsing.

**keypunch**—A keyboard-operated device that punches holes in punch cards to represent data to be input to a computer by a card reader.

**keyshelf**—A shelf on which are mounted the keys by means of which the operator of a manual telephone switchboard performs switching of one or more of the switchboard circuits.

**key signal**—A pseudorandom sequence of two-level pulses used to accomplish enciphering or deciphering processes.

**key station**—The master station from which a network radio or television program originates.

**keystone distortion**—The distortion produced when a plane target area not normal to the average direction of the beam is scanned rectilinearly with constant-amplitude sawtooth waves.



*Keystone distortion.*

**keystone shaped**—Wider at the top than at the bottom, or vice versa.

**keystoning**—The keystone-shaped scanning pattern produced when the electron beam in the television camera tube is at an angle with the principal axis of the tube. See also keystone shaped.

**keyswitch**—In an organ, the switch that is closed to allow a tone from the tone generator to sound when a key is depressed.

**key telephone**—Also called key telephone set. Telephone set having six button keys and used with relay equipment to provide call holding, multiline pickup, signaling, intercommunication, and conference services.

**key telephone set**—A desk telephone with six (illuminated) push-button keys across the set below the dial. The keys may be connected to hold, pick up a central office line, or pick up an intercom line.

**key telephone system**—A versatile station switching system located on a customer's premises, consisting of one or more multibutton telephone sets and associated equipment. Permits mutual access and control of a number of central office lines, as well as pickup, hold, signal, and intercommunication capability.

**key up**—To turn on a repeater by transmitting on its input frequency.

**keyway**—The mating slot or groove in which a key slides.

**keyword**—1. Characteristic word in a computer file used to retrieve its contents. 2. A word (with a special meaning) that is recognized by the computer or program.

**kHz**—Abbreviation for kilohertz. A unit of frequency measurement equivalent to 1000 cycles per second; formerly expressed as kilocycles per second, or kc/s.

**kickback**—The voltage developed across an inductance by the sudden collapse of the magnetic field when the current through the inductance is cut off.

**kickback power supply**—See flyback power supply.

**kick-sorter**—British term for pulse-height analyzer.

**kidney joint**—A flexible joint, or air-gap coupling, located in the waveguide and near the transmitting-receiving position of certain radars.

**Kikuchi lines**—A series of spectral lines obtained by the scattering of electrons when an electron beam is directed against a crystalline solid. The pattern may be interpreted to yield information on the structure of the crystal and its mechanical perfection.

**killer circuit**—1. The vacuum tube or tubes and associated circuits in which are generated the blanking pulses used to temporarily disable a radar set. 2. In a transponder, a logic circuit that kills replies to side-lobe interrogations.

**killer pulse**—See suppression pulse.

**kilo-**—A prefix representing  $10^3$ , or 1000. Letter symbol: k.

**kiloampere**—1000 amperes. Letter symbol: kA.

**kilobaud**—Abbreviated kBd. One thousand baud.

**kilobit**—1024 bits.

**kilobyte**—1. A standard quantity measurement for disk and diskette storage and semiconductor circuit capacity: 1 kilobyte of memory equals 1024 bytes (8-bit characters) of computer memory. 2.  $2^{10}$ , or 1024, bytes. Commonly thought of as 1000 bytes. Abbreviated K and used as a suffix to describe memory size.

**kilocycle (kc)**—1000 cycles. Generally interpreted as meaning 1000 cycles per second. Obsolete term; replaced by kilohertz (kHz).

**kiloelectronvolt**—1000 electron volts. The energy acquired by an electron that has been accelerated through a voltage difference of 1000 volts. Letter symbol: keV.

**kilogauss**—1000 gauss.

**kilogram**—Unit of mass. The mass of a particular cylinder of platinum-iridium alloy, called the international prototype kilogram, that is preserved in a vault at Sevres, France, by the International Bureau of Weights and Measures. Letter symbol: kg.

**kilohertz**—1000 hertz. Letter symbol: kHz.

**kilohm**—1000 ohms. Abbreviated k or kohm.

**kilohmmeter**—A meter designed for measuring resistance in kilohms.

**kilomega (kM)**—Obsolete prefix for giga- (G), representing  $10^9$  or 1,000,000,000.

**kilomegacycle**—Now called gigahertz. One billion cycles per second.

**kilometer**—One thousand meters, or approximately 3280 feet.

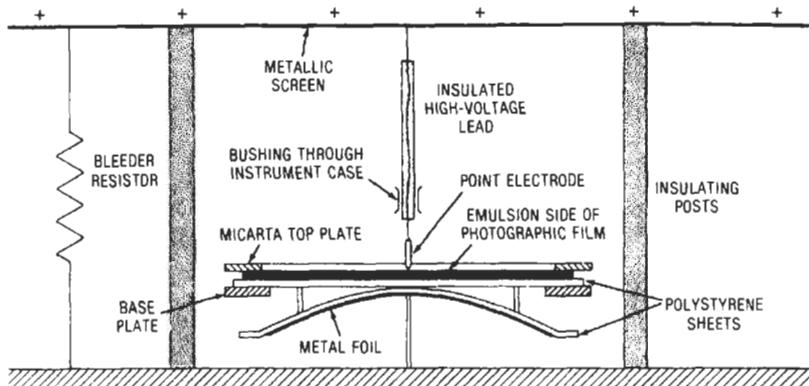
**kilometric waves**—British term for electromagnetic waves between 1000 and 10,000 meters in length.

**kilosecond**—1000 seconds.

**kilovar**—One reactive kilovoltampere, or 1000 reactive voltamperes. Letter symbol: kvar.

**kilovar-hour**—1000 reactive volt-amperehours.

**kilovolt**—1000 volts. Letter symbol: KV.



Klydonograph gradient recorder.

**kilovoltampere** — 1000 voltamperes. Letter symbol: kVA.

**kilovoltmeter** — A voltmeter that reads thousands of volts.

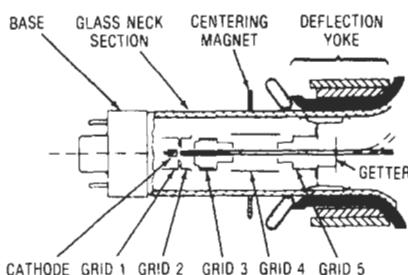
**kilowatt** — 1000 watts. Letter symbol: kW.

**kilowatthour** — The equivalent energy supplied by a power of 1000 watts for 1 hour. Letter symbol: kWh.

**Kine** — Slang term for kinescope recording.

**Kine-klydonograph** — An instrument that records the current-time characteristics of a lightning stroke. The instrument records a series of Lichtenberg figures in a manner similar to that of the field gradient recorder.

**Kinescope** — 1. A cathode-ray tube that serves as a picture tube in a television receiver. The signal representing the picture intensity is transmitted to the electron gun grid so that the beam intensity varies with the intensity of the original scene. Deflecting voltages sweep the beam horizontally and vertically until it is synchronized with the scanning of the camera tube. The electron beam then strikes the fluorescent end screen of the tube and the scene is reproduced. 2. A film recording made from a television program on a picture tube and used as a permanent record or for subsequent rebroadcasting.



Kinescope, 1.

**Kinescope gun** — The electron gun in the kinescope.

**Kinescope recorder** — A camera that photographs television images directly from the picture tube onto motion-picture film.

**kinetic energy** — Energy that a system possesses by virtue of its motion.

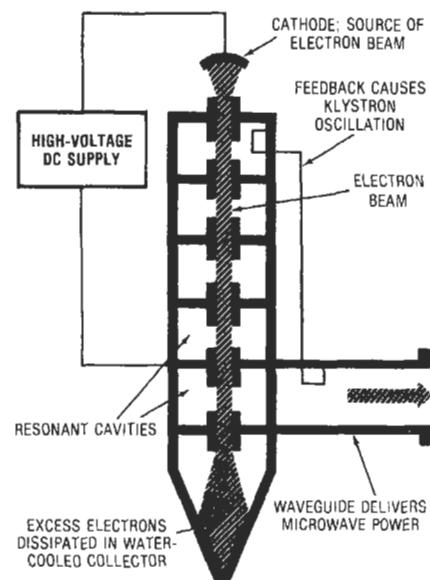
**Kirchhoff's laws** — 1. The current flowing to a given point in a circuit is equal to the current flowing away from that point. 2. The algebraic sum of the voltage drops in

any closed path in a circuit is equal to the algebraic sum of the electromotive forces in that path. (Laws 1 and 2 are also called laws of electric networks.) 3. At a given temperature, the emissive power of a body is the same as its radiation-absorbing power for all surfaces.

**kit** — A prepared package of parts with instructions for assembly and/or wiring a component or chassis (also a small accessory item).

**klydonograph** — A field gradient recording instrument that registers voltages on photographic film in the form of Lichtenberg figures.

**klystron** — An electron tube used as an oscillator or amplifier at ultrahigh frequencies. The electron beam is velocity modulated (periodically bunched) to accomplish the desired results.



Klystron.

**klystron control grid** — An electrode that controls the emission, or beam current, of a klystron or other velocity-modulated tube.

**klystron frequency multiplier**—A two-cavity klystron that has the output cavity tuned to a multiple of the fundamental frequency.

**klystron generator**—A klystron tube used as a generator. Its cavity feeds energy directly into a waveguide.

**klystron oscillator**—An oscillator employing a klystron tube to generate radio-frequency power.

**klystron repeater**—A klystron tube operated as an amplifier and inserted directly into a waveguide in such a way that incoming waves velocity-modulate the electron stream emitted from a heated cathode. A second cavity converts the energy of the electron clusters into waves of a much higher amplitude and feeds them into the outgoing guide.

**KM**—Abbreviation for kilomega (an obsolete term). Replaced by giga.

**KMc**—Abbreviation for kilomegacycle. Now replaced by gigahertz.

**knee**—1. An abrupt change in direction between two relatively straight segments of a curve, such as the region of a magnetization curve near saturation or the top bend of a vacuum-tube characteristic curve. 2. A section between two comparatively straight segments of a curve in which the magnitude of curvature, although of the same sign, is relatively high. 3. The region of maximum curvature.

**knife-edge diffraction**—In radio-wave propagation, an effect by which the atmospheric attenuation of a signal is reduced when the signal is diffracted as it passes over a sharp obstacle such as a mountain ridge.

**knife-edge pointer (of a meter)**—A pointer whose end is flattened and turned edgewise so the smallest dimension or edge is seen. Usually used with mirror-backed scales to eliminate parallax and increase the accuracy of reading.

**knife switch**—1. A form of air switch in which a moving element is sandwiched between two contact clips. The moving element is usually a hinged blade; when it is not, it is removable. 2. A form of switch in which the moving element, usually a hinged blade, enters or embraces stationary contact clips.

**knob**—A round, polygonal, or pointer-shaped part that is fastened to one end of a control shaft so that the shaft can be turned more easily. The knob sometimes indicates the degree of rotation also.

**knocker**—A term used with some fire-control radars to indicate a subassembly comprising synchronizing and triggering circuits. It drives the rf pulse-generating equipment in the transmitter and also synchronizes the cycle of operation with the transmitted pulse in range units and indicators.

**knockout**—A removable portion in the side of a box or cabinet. During installation it can be readily taken out

## klystron frequency multiplier — kymograph

with a hammer, screwdriver, or pliers so the raceway, cables, or fittings can be attached.

**knot**—One nautical mile (6,080.20 feet, 1852 meters, or 1.15 statute miles) per hour.

**Kooman antenna**—A vertical array of horizontal full-wave dipoles that are driven by transposed two-conductor line and backed by a parasitic reflecting curtain or horizontal dipoles.

**Kovar**—An iron-nickel-cobalt alloy with a coefficient of expansion similar to that of glass and silicon and thermal characteristics similar to those of alumina. It is used as a material for headers and in glass-to-metal seals. Kovar/glass packages are used extensively in hybrid construction to preserve hermetic sealing.

**KOX**—Acronym for keyboard-operated transmission. A station equipped with a KOX system can turn on the transmitter and turn off the receiver simply by typing on the station's keyboard. When the operator ceases typing, the transmitter automatically turns off, and the receiver turns on after some preset delay.

**kraft paper**—Relatively heavy, high-strength sulfate paper used for electrical insulating material. (Capacitor tissue is kraft paper of normal thickness equal to 0.002 inch, or 50  $\mu\text{m}$ , or less.)

**K-scan**—See K-display.

**K-series**—A series of frequencies in the X-ray spectrum of an element.

**KSR**—Abbreviation for keyboard send-receive unit. A combination transmitter and receiver with transmission capability from the keyboard only (teletypewriter term). Refers to a terminal device (teletype or similar) having only a keyboard for sending and a printer for receiving, i.e., no paper or magnetic tape equipment, but which is useful for conversational time-sharing and inquiry-response applications.

**Ku band**—1. A band of microwave frequencies between 11 and 13 GHz. 2. Also called K band. A band of frequencies that extends from 11.7 to 12.7 GHz. The band is separated into two portions: 11.7 to 12.2 GHz (fixed satellite services—intended for point-to-point services) and 12.2 to 12.7 GHz (for broadcasting satellite service or DBS). 3. The frequency band from 10.9 to 17 GHz.

**kurtosis**—The degree of curvature of the peak of a probability curve.

**kV**—Letter symbol for kilovolt.

**kVA**—Letter symbol for kilovoltampere.

**kvar**—Letter symbol for kilovar.

**kW**—Letter symbol for kilowatt.

**kWh**—Letter symbol for kilowatthour.

**kymograph**—An instrument for recording wavelike oscillations of varying quantities for medical studies.

# L

**L**—Symbol for coil, lambert, or inductance.

**label**—1. A code name used to identify or classify a name, term, phrase, or document. 2. One or more characters that serve to identify an item of data. 3. A numerical value or a memory location in the programmable system of a computer. The specific absolute address is not necessary since the intent of the label is a general destination. Labels are a requisite for jump and branch instructions. 4. A number or letter or a name given to a program statement so that the computer can find it later. 5. A name used in source code to identify an instruction or executable statement in computer programs. 6. A block at the beginning or at the end of a volume or file that identifies, characterizes, and/or delimits that volume or file. A label is not considered to be part of a file.

**label group**—A collection of continuous label sets of the same label type.

**labile oscillator**—A local oscillator whose frequency is remote controlled by a signal received from a radio or over a wire.

**laboratory power supply**—A regulated dc source having (a) less than 10-kV output at up to 500 W, (b) output adjustable over a wide range, usually down to zero, (c) regulation on the order of  $\pm 0.01$  percent static line and load.

**labyrinth**—Speaker enclosure with absorbing air chambers at the rear to eliminate acoustic standing waves. A mazelike construction extends the air column. Resonances are tamed by heavy damping material.

**labyrinth loudspeaker**—Loudspeaker mounted in an acoustic baffle having air chambers designed to prevent acoustic standing waves.

**lacing**—A network of fine wire surrounding or covering an area to be protected, such as a safe, vault, or glass panel, and connected into a closed-circuit system. The network of wire is concealed by a shield, such as concrete or paneling, in such a manner that an attempt to break through the shield breaks the wire and initiates an alarm.

**lacing and harnessing**—Also called bundling. A method of grouping wires by securing them in bundles or designated patterns.

**lacing cord or twine**—Cord used for lacing and tying cable forms, hookup wires, cable ends, cable bundles, and wire harness assemblies. Available in various materials and impregnants.

**lacing tape**—Flexible, flat, fabric tape for tying harnesses and wire bundles, securing of sleeves and other items, and general lacing and tying applications.

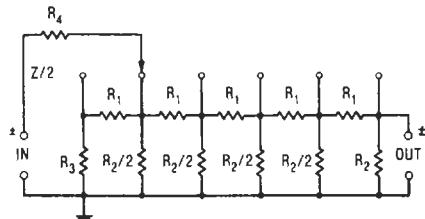
**lacquer disc**—Also called cellulose-nitrate disc. A mechanical recording disc, usually made of metal, glass, or paper and coated with a lacquer compound often containing cellulose nitrate.

**lacquer master**—See lacquer original.

**lacquer original**—Also called lacquer master. An original recording made on a lacquer surface to be used as a master.

**lacquer recording**—Any recording made on a lacquer medium.

**ladder attenuator**—A series of symmetrical sections used in signal generators and other devices in which voltages and currents must be reduced in known ratios. They are designed so that the required ratio of voltage loss per section is obtained with image-impedance operation. The impedance between any junction point and common ground in a ladder attenuator is half the image impedance.



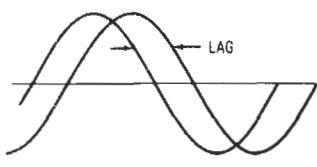
*Ladder attenuator.*

**ladder diagram**—1. A diagram that shows actual component symbols and the basic wiring configuration of a relay logic circuit (as opposed to a logic diagram). 2. An industry standard for representing control logic relay systems. 3. Electrical engineering technique to schematically illustrate functions in an electrical circuit (relays, switches, timers, etc.) by diagramming them in a vertical sequence resembling a ladder. 4. See contact symbology diagram.

**ladder network**—Also called series-shunt network. 1. A network composed of H-, L-, T-, or pi networks connected in series. 2. A series of film resistors with values from the highest to the lowest resistor reduced in known ratios.

**LAFOT**—Coded weather broadcasts issued by the U.S. Weather Bureau for the Great Lakes region. They are broadcast every 6 hours by marine radiotelephone broadcasting stations on their assigned frequencies.

**lag**—1. The displacement in time, expressed in electrical degrees, between two waves of the same frequency. 2. The time between transmission and reception of a signal. 3. In a television camera tube, the persistence of the electrical-charge image for a time interval equal to a few frames. 4. A time difference between the occurrence of two events.



Lag, 1.

**lagged-demand meter**—A meter in which there is a characteristic time lag, by either mechanical or thermal means, before maximum demand is indicated.

**lagging current**—The current flowing in a circuit that is mostly inductive. If the circuit contains only inductance, the current lags the applied voltage by 90°. Because of the characteristics of an inductance, the current does not change direction until after the corresponding voltage does.

**lagging load**—A predominantly inductive load—i.e., one in which the current lags the voltage.

**lag-lead**—Also called lead-lag. A circuit whose response includes lag components and their derivatives.

**lambda**—Greek letter  $\lambda$ , used to designate wavelength measured in meters.

**lambda diode**—A simple two-terminal device consisting of a pair of complementary depletion-mode junction field-effect transistors that can be fabricated more easily than conventional negative-resistance devices. It can be integrated on a single chip or with bipolar and MOS devices on the same chip. Unlike tunnel diodes, which are limited to a narrow negative-resistance range, lambda diodes can be produced with a wide range of characteristics.

**lambda wave**—An electromagnetic wave propagated over the surface of a solid that has a thickness comparable to the wavelength of the wave.

**lambert**—A unit of luminance (photometric brightness) equal to  $1/\pi$  candela per square centimeter and, therefore, equal to the uniform luminance of a perfectly diffusing surface emitting or reflecting light at the rate of 1 lumen per square centimeter. The lambert also is the average luminance of any surface emitting or reflecting light at the rate of 1 lumen per square centimeter. For the general case, the average must take account of variation of luminance with angle observation, also of its variation from point to point on the surface considered. Letter symbol: L.

**lambertian**—A radiance distribution that is uniform in all directions of observation.

**Lambert's law of illumination**—The illumination of a surface on which the light falls normally from a point source is inversely proportional to the square of the distance of the surface from the source. If the normal to the surface makes an angle with the direction of the rays, the illumination is proportional to the cosine of that angle.

**laminar flow**—A directed stream of filtered air moved constantly across a clean work station, usually parallel to the workbench surface.

**laminate**—A product made by bonding together two or more layers of material.

**laminated**—Made of layers.

**laminated contact**—A switch contact made up of a number of laminations, each making contact with an opposite conducting surface.

**laminated core**—An iron core for a coil, transformer, armature, etc. It is built up from laminations to minimize the effect of eddy currents. The sheet iron or steel laminations are insulated from each other by surface oxides or by oxides and varnish.

## lagged-demand meter — landless hole

**laminated record**—A mechanical recording medium composed of several layers of material (normally a thin face of material on each side of a core).

**lamination**—A single stamping of sheet material used in building up a laminated object such as the core of a power transformer.

**Lamont's law**—The permeability of steel at any flux density is proportional to the difference between the saturation value of the flux density and its value at the point in question. This law is only approximately accurate and is not true for the initial part of the magnetization curve.

**lamp**—1. A generic term for a human-made source of light. By extension, the term is also used to denote sources that radiate in regions of the spectrum adjacent to the visible range. 2. A device for producing light.

**lamp bank**—An arrangement of incandescent lamps commonly used as a resistance load during electrical tests.

**lamp cord**—1. A twin conductor, either twisted or parallel, used for connecting floor lamps and other electric appliances to wall outlets. 2. Flexible stranded conductor cord, rubber or plastic insulated, used in wiring of lamps, household fans, and similar appliances. Not subject to hard usage.

**lamp holder**—A lamp socket.

**lamp housing**—A device designed to concentrate and direct a light source by enclosing the source in it and using a concave reflector to direct the light through its only opening.

**lamp jack**—Special electronic electromechanical component having a frame that holds a lamp and has the contact springs and terminals for applying power to the lamp. Used extensively in jack panels and other types of telephone equipment as a visual-indicating signal device.

**Lampkin oscillator**—A variation of the Hartley oscillator. Its distinguishing feature is that an approximate impedance match is effected between the tank and grid-cathode circuits.

**lamp receptacle**—A device that supports an electric lamp and connects it to a power line.

**LAN**—Abbreviation for local area network. 1. A data communications network spanning a limited geographical area, such as an office, an entire building, or industrial park. It provides communication between computers and peripherals. 3. A baseband or broadband interactive bidirectional communication system for voice, video, or data use on a common cable medium. The network uses some type of switching technology and does not use common-carrier circuits, although it may have gateways or bridges to other public or private networks.

**land**—1. The surface between two adjacent grooves of a recording disc. 2. Also called boss, pad, terminal point, blivet, tab, spot, donut. In a printed circuit board, the conductive area to which components or separate circuits are attached. It usually surrounds a hole through the conductive material and the base material. 3. A portion of a conductive pattern usually, but not exclusively, used for the connection and/or attachment of components. 4. Widened conductor area on the major substrate used as an attachment point for wire bonds or the bonding of chip devices.

**Landau damping**—The damping of a space-charge wave by electrons moving at the phase velocity of the wave.

**landing beacon**—The radio transmitter that produces a landing beam for aircraft. See also landing beam.

**landing beam**—A highly directive radio signal projected upward from an airport to guide aircraft in making a landing during poor visibility.

**landless hole**—A plated-through hole without a land(s).

**landline** — A telegraph or telephone line passing over land, as opposed to submarine cables.

**landline facilities** — Domestic communications common-carrier's facilities that are within the continental United States.

**landmark beacon** — Any beacon other than an airport or airway beacon.

**land mobile service** — A radio service in which communication is between a base station and land mobile stations or between land mobile stations.

**land mobile station** — A two-way mobile station that operates solely on land.

**land radio positioning station** — A station in the radio positioning service, not intended to be operated while in motion.

**land return** — Radiation reflected from nearby land masses and returned to a radar set as an echo.

**lands** — Bonding points used in the manufacture of microelectronic circuits.

**landscape** — In word processing, printing a page horizontally across the width of the paper.

**land station** — A permanent, or fixed, station.

**land transportation radio services** — Radio-communication services whose transmitting facilities include fixed, land, or mobile stations, operated by and for the sole use of certain land transportation carriers.

**Langevin ion** — An electrified particle produced in a gas by an accumulation of ions on dust particles or other nuclei.

**Langmuir dark space** — The nonluminous region surrounding a negatively charged probe inserted into the positive column of a glow or arc discharge.

**language** — 1. A set of computer symbols, with rules for their combination. They form a code to express information with fewer symbols and rules than there are distinct expressible meanings. 2. A format for computer programs. Ultimately, computers receive their instructions in machine language, binary codes whose meanings are specific to each computer. Machine codes are usually written in hex or octal for easier use by humans. High-level languages, such as BASIC, allow programs to be written in fairly human terms (such as PRINT "NOW IS THE TIME") that are then translated into a sequence of machine codes. 3. A system for representing information and communicating it between people, or between people and machines. 4. A definition of the elements and syntax within which a computer program must be encoded. 5. The means by which people communicate with a computer.

**language converter** — A data-processing device designed to change one form of data, i.e., microfilm, strip chart, etc., into another (punch card, paper tape, etc.).

**language translation** — The process performed by an assembler, compiler, or other routine that accepts statements in one language and converts them to equivalent statements in another language.

**language translator** — A computer system program that translates text written in one language to another language. Assemblers, interpreters, and compilers are examples of language translators.

**L-antenna** — An antenna consisting of an elevated horizontal wire to which a vertical lead is connected at one end.

**lanyard** — A device that is attached to certain quick-disconnect connectors and that permits uncoupling and separation of connector halves by a pull on a wire or cable.

**lap** — 1. A rotation plate covered with liquid abrasive, used for grinding quartz crystals. 2. A fire-resistant, untwisted, ribbonlike form of asbestos felt made from

slivers of asbestos fiber blended with cotton or other organic fibers. Used as a wrapping on wire and cable.

**LAP** — Abbreviation for Link Access Protocol. The data link layer protocol that is used in X.25-based networks in setting up channels between data termination equipment and data communication equipment.

**lap computer** — A battery-operated computer, small and light enough to be operated on the user's lap.

**lap dissolve** — In motion pictures or television, simultaneous transition in which one scene is faded down and out while the next scene is faded up and in.

**lapel microphone** — A microphone worn on the user's clothing.

**lap joint** — The connecting of two conductors by placing them side by side so that they overlap.

**Laplace's law** — The strength of the magnetic field at any given point due to any element of a current-carrying conductor is directly proportional to the strength of the current and the projected length of the element, and is inversely proportional to the square of the distance of the element from the point in question.

**Laplace transform** — A mathematical substitution whose use permits the solution of a certain type of differential equation by algebraic means.

**lapping** — 1. Bringing quartz crystal plates up to their final frequency by moving them over a flat plate over which a liquid abrasive has been poured. 2. Grinding and polishing such products as semiconductor blanks in order to obtain precise thicknesses or extremely smooth, flat, polished surfaces.

**laptop** — A small portable computer. Sometimes distinguished as larger than a notebook computer, but sometimes also used as a synonym for notebook computer.

**lap winding** — An armature winding in which opposite ends of each coil are connected to adjoining segments of the commutator so that the windings overlap.

**lap wrap** — Tape wrapped around an object in an overlapping condition.

**large-scale integrated circuit** — An integrated circuit that contains 100 gates or more in a single chip, resulting in an increase in the scope of the function performed by a single device.

**large-scale integration** — Abbreviated LSI. 1. The simultaneous achievement of large-area circuit chips and optimum density of component packaging for the express purpose of cost reduction by maximization of the number of system interconnections made at the chip level. 2. Monolithic integrated circuits of very high density. Such circuits typically have on a single chip the equivalent of about 200 to thousands of simple logic circuits. The term sometimes describes hybrid ICs built with a number of MSI or LSI chips. 3. A classification of ICs by size, applicable to chips containing more than 100 gates or circuits of equivalent complexity. 4. The technology that produces microcircuits with at least 100 active devices on a single chip. Functional blocks that include several op amps and other devices are examples of LSI devices.

**large-signal characteristics** — The characteristics of an amplifier when rated (full) output signals are produced.

**large-signal dc current gain** — The dc output current of a transistor with the dc output circuit shorted, divided by the dc input current producing the dc output current.

**large-signal power gain** — The ratio of the ac output power to the ac input power under specified large-signal conditions. Usually expressed in decibels (dB).

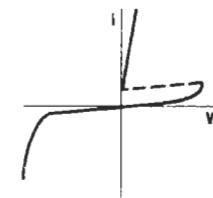
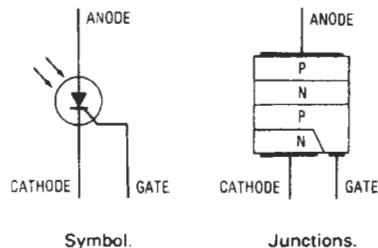
**large-signal short-circuit forward-current transfer ratio** — In a transistor, the ratio under specified test conditions of a change in output current to the corresponding change in input current.

**large-signal voltage gain**—The ratio of the output voltage swing of an operational amplifier to the change in input voltage required to drive the output from zero to this voltage.

**Larmor orbit**—The path of circular motion of a charged particle in a uniform magnetic field. The motion of the particle is unimpeded in the direction of the magnetic field, but motion perpendicular to the direction of the field is always accompanied by a force perpendicular to the direction of motion and the field.

**laryngaphone**—Also called a throat microphone. A microphone applied to the throat of a speaker to pick up voice vibrations directly. It is very useful in noisy locations because it picks up only the speaker's voice—no outside noises.

**LASCR**—Abbreviation for light-activated silicon-controlled rectifier. 1. A pnpn device in which incident light performs the function of gate current; three of the four semiconductor regions are available for circuit connections. A photoswitch. 2. A semiconductor device that is triggered into conduction when the light falling on the base-collector photodiode junction exceeds a given threshold level. Operation of the LASCR is similar to the silicon-controlled rectifier, with the major difference being that an external resistance between gate and cathode (in addition to bias voltage and current) determines light sensitivity. A positive electrical signal applied to the gate can be used to trigger the LASCR, as well as to modify the light sensitivity.



Anode characteristic.

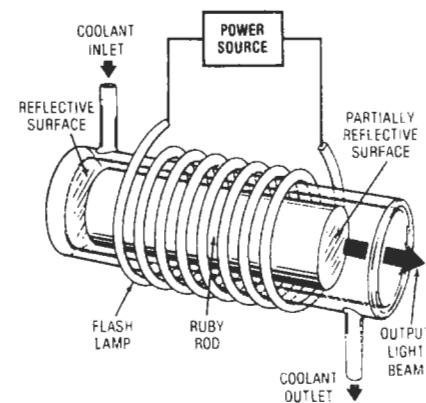
### LASCR.

**LASCS**—Abbreviation for light-activated silicon-controlled switch. 1. A device similar to an LASCR, except that all four semiconductor regions are accessible. 2. A semiconductor device that combines the LASCR and the planar silicon photoswitch (PSPS). Having four terminals, the LASCS can be triggered by light positive signals (at the gate terminal) and negative signals (at the anode gate terminal).

**laser**—1. A device for transforming incoherent light of various frequencies of vibration into a very narrow, intense beam of coherent light. The name is derived from the initial letters of "light amplification by stimulated emission of radiation." In the emission of ordinary light, the molecules or atoms of the source emit their radiation

### large-signal voltage gain — laser diode coupler

independently of each other, and consequently there is no definite phase relationship among the vibrations in the resultant beam. The light is incoherent. The laser, by means of an optical resonator, forces the atoms of the material of the resonator to radiate in phase. The emitted radiation is stimulated by the excitation of atoms to a higher energy level by means of energy supplied to the device. In the microwave region, the corresponding device is called a maser, and hence the laser is also known as a light maser. 2. A device for producing light by emission of energy stored in a molecular or atomic system when stimulated by an input signal. 3. A mechanically designed semiconductor junction that will optically pump (amplify light) short pulses of high-energy coherent radiation. 4. A device that produces a coherent monochromatic (single wavelength) collimated beam of concentrated light in which the subatomic particles that constitute the beam, known as photons, travel on a parallel axis. Scientists believe that a beam produced by a 5-megawatt laser would be able to melt objects in space at distances exceeding 5000 miles (8045 km).



Laser.

**laser basic mode**—The primary or lowest-order fundamental transverse propagation mode for the emitted light wave of a laser, the emitted energy normally having Gaussian (bell-shaped) distribution in space and being in a single beam, with no side lobes.

**laser bonding**—1. A process that forms a metal-to-metal fastened union, using a laser heat source to join conductors. 2. Effecting a metal-to-metal bond of two conductors by welding the two materials together using a laser beam for a heat source.

**laser cavity**—An optically resonant and hence mode-selecting low-loss structure in which laser action occurs through the buildup of electromagnetic field intensity upon multiple reflection.

**laser diode**—Abbreviated LD. A junction diode, consisting of positive and negative carrier regions with a pn transition region (junction), that emits electromagnetic radiation (quanta of energy at optical frequencies) when injected electrons under forward bias recombine with holes in the vicinity of the junction. In certain materials, such as gallium arsenide, there is a high probability of radiative recombination producing emitted light, rather than heat, at a frequency suitable for optical waveguides. Some light is reflected by the polished ends and is trapped to stimulate more emission. See diode laser; injection laser diode.

**laser diode coupler**—A coupling device that enables the coupling of light energy from a laser diode

(LD) source to an optical fiber or cable at the transmitting end of an optical fiber data link. The coupler may be an optical fiber pigtail epoxied to the LD. Synonym: LD coupler.

**Laserdisc**—A laser-read optical video disc system that can hold thousands of video images and hours of sound. A 12-inch plastic disc used to store video, audio, and other data for playback on a video disc player and video monitor.

**laser Doppler velocimeter**—A laser device utilizing either optical heterodyning or scanning interferometry to measure flow velocities by means of the Doppler shift.

**laser drill**—A system that uses a laser as the source in the evaporation of localized areas as small as 0.00025 cm in diameter of hard materials such as gemstones and tungsten. A pulsed ruby laser is most commonly used in this type of system.

**laser dyes**—Class of organic dyes that emit coherent radiation over a wide spectral range.

**laser fiber-optic transmission system**—A system consisting of one or more laser transmitters and associated fiber-optic cables. During normal operation the laser radiation is limited to the cable.

**laser head**—A module containing the active laser medium, resonant cavity, and other components within one enclosure, not necessarily including a power supply.

**laser holographic camera**—A camera system that has a laser, usually of the pulsed ruby type, as a light source; holographic optics; a plate; and a plate holder. It is used often in the laboratory or in production areas for analysis and detection. The laser's nanosecond exposure time is most efficient in freezing moving particles in a permanent hologram for convenient analysis.

**laser linewidth**—In the operation of a laser, the frequency range over which most of the laser beam's energy is distributed.

**laser printer**—A printer whose images are formed by laser light impinging on a light-sensitive drum like that of a photocopy machine; where the light strikes the drum, it will hold xerographic ink for transfer to a sheet of paper.

**laser protective housing**—A protective housing for a laser to prevent human exposure to laser radiation in excess of an allowable established or statutory emission limit for the appropriate class. Parts of the housing that can be removed or displayed and not interlocked may be secured in such a way that removal or displacement of the parts requires the use of special tools.

**laser pulse length**—Also called laser pulse width. The time duration of the burst of electromagnetic energy emitted by a pulsed laser. It is usually measured at the half-power points, i.e., on a plot of pulse power developed versus time, the time interval between the points that are at 0.5 of the peak of the power curve.

**laser pulse width**—See laser pulse length.

**laser rangefinder**—A portable instrument that measures the distance between itself and its target by determining the amount of time it takes for a pulsed laser beam to travel to the target and be reflected back to the instrument. A telescope is used to aim the beam, and a photomultiplier detects the reflected pulse.

**laser ranger**—A device similar to conventional radar but using high-intensity light rather than microwaves.

**laser soldering**—A selective soldering technique employing a programmable laser system. The system automatically makes and places solder preforms on one panel while simultaneously laser soldering pins on a second panel. The laser soldering system is effective for high-volume selective soldering of wire-wrapping pins to backplanes, power planes, and PCBs.

**laser trim**—The adjustment (upward in resistance) of a film resistor value by applying heat from a focused laser source to remove material, i.e., to cut a kerf.

**laser trimming**—An IC trimming technique that involves focusing a laser on the die to disconnect resistors.

**laser welder**—A system, similar to a laser drill, that uses the heat from a pulsed laser to weld metals. Because of the rapidity and localization with which the welding takes place, metals of vastly dissimilar melting points can be welded with this system.

**laser welding**—Process in which thermal energy released by a laser impinging on the surface of a metal is conducted into the bulk of the metal workpiece by thermal conduction, bonding component leads to highly conductive materials, such as copper printed circuitry.

**lasing**—1. The phenomenon that occurs when resonant frequency controlled energy is coupled to a specially prepared material, such as a uniformly doped semiconductor crystal that has free-moving or highly mobile, loosely coupled electrons. As a result of resonance and the imparting of energy by collision or close approach, electrons are raised to highly excited energy states; when they move to lower states, they cause quanta of high-energy electromagnetic radiation to be released as coherent light waves. This action takes place in a laser. 2. A unique mode of light production by stimulated emission from excited atoms. The uniqueness of the lasing process is that the light thereby generated tends to be a single frequency, coherent in time and space.

**lasing condition or state**—The condition of an injection laser corresponding to the emission of predominantly coherent or stimulated radiation.

**latch**—1. A feedback loop used in a symmetrical digital circuit (such as a flip-flop) to retain a state. 2. A simple logic storage element. The most basic form consists of two cross-coupled logic gates that store a pulse applied to one logic input until a pulse is applied to the other input; thus, the complementary information is stored in the latch. 3. A name commonly used to refer to a flip-flop (usually a D type) when used for data storage, as opposed to counting and logic functions. 4. To lock into a certain location or state.

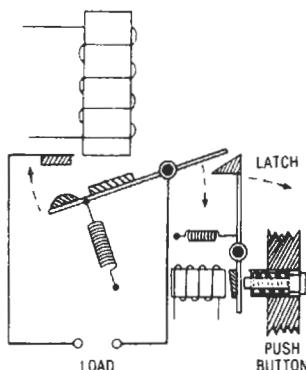
**latching**—A technique for storing an event such as the momentary breaking of a perimeter circuit. The fact that the event has occurred will be available until the latched circuit has been reset. See alarm hold.

**latching current**—The minimum value of principal current required to maintain a thyristor in the on state after switching from the off state to the on state has occurred and the trigger signal has been removed.

**latching relay**—Also called bistable relay. 1. A relay with contacts that lock in either the energized or deenergized position, or both, until reset either manually or electrically. 2. A relay with two separate coils, one of which must be energized to change the state of the relay, which will remain in either state without the need for external power. 3. A relay that includes a means of holding the state of the relay in the last or latched position. In effect, the relay has a memory, because the contacts remain open or closed when the coil is not actuated. To change state, the latching relay coil must be reenergized.

**latching sensor**—A solid-state Hall-effect sensor that has a plus (south pole) maximum and minimum operate point, and a minus (north pole) maximum and minimum release point. Thus, when the sensor is operated with a south pole, it will stay in the operated condition even with removal of the south pole magnet and will release only in the presence of a north pole.

**latch-in relay**—Also called locking relay. A relay with contacts that remain energized or deenergized until reset manually or electrically.

**Latch-in relay.**

**latch mode**—A mode of operation for a storage circuit in which all encoder contact closures, even momentary ones, are latched “on.”

**latch-up**—1. A condition in which the collector voltage in a given circuit does not return to the supply voltage when a transistor is switched from saturation to cutoff. Instead, the collector finds a stable operating point in the avalanche region of the collector characteristics. 2. An unintended stable circuit mode that will not revert to a previous intended circuit mode after removal of a stimulus such as a spurious signal or radiation. The effect is usually caused by parasitic circuit elements. 3. The characteristic of some op amps to remain in positive or negative saturation after their maximum differential input voltage is exceeded. 4. The switching of an electronic circuit to an unintended mode by improper voltage application. 5. An undesirable phenomenon in which either a pnpn or an npnp thyristor-type parasitic structure suddenly turns to an on state, thereby bypassing or shorting out portions of an IC.

**latch voltage**—The effective input voltage at which a flip-flop changes states.

**late contacts**—In a relay, contacts that open or close after other contacts when the relay operates.

**latency**—1. In a serial storage computer system, the time necessary for the desired storage location to appear under the drum heads. 2. In computers, the time required to establish communication with a specific storage location, not including transfer time, i.e., access time less word time. 3. A state of seeming inactivity, such as that occurring between the instant of stimulation and the beginning of response. 4. A delay encountered in a computer when waiting for a specific response. Latency is caused by propagation delays and the queuing of disks or tapes when randomly addressed.

**latency time**—The time required to shift to any given bit (word) in a serial memory, such as in CCDs and bubble memories.

**latent image**—A stored image (e.g., the one contained in the charged mosaic capacitance in an iconoscope).

**lateral chromatic aberration**—Aberration that affects the sharpness of images off the axis. This occurs because different colors produce different magnifications.

**lateral compliance**—The force required to move the reproducing stylus from side to side as it follows the modulation on a laterally recorded record.

**lateral-correction magnet**—In a three-gun picture tube, an auxiliary component used for positioning the blue beam horizontally so that beam convergence will

be obtained. It operates on the principle of magnetic convergence and is used in conjunction with a set of pole pieces mounted on the focus element of the blue gun.

**lateral forced-air cooling**—A method of heat transfer that employs a blower to produce side to side circulation of air through or across the heat dissipators.

**lateral loss**—A power loss, expressed in decibels, due to the deviation from optimum coaxial alignment of the ends of separable optical conductors.

**lateral recording**—A mechanical recording in which the groove modulation is perpendicular to the direction of motion of the recording medium and parallel to its surface.

**latex**—Rubber material used for insulation of wire.

**lattice**—1. In navigation, a pattern of identifiable intersection lines placed in fixed positions with respect to the transmitters that establish them. 2. The geometrical arrangement of atoms in a crystalline material.

**lattice network**—A network composed of four branches connected in series to form a mesh. Two nonadjacent junction points serve as input terminals, and the remaining two as output terminals.

**lattice structure**—In a crystal, a stable arrangement of atoms and their electron-pair bonds.

**lattice-wound coil**—See honeycomb coil.

**launch angle**—In an optical fiber or fiber bundle, the angle between the input radiation vector, i.e., the input light chief ray, and the axis of the fiber radiation vector, i.e., the axis of the fiber or fiber bundle. If the ends of the fibers are perpendicular to the axis of the fibers, the launch angle is equal to the angle of incidence when the ray is external and the angle of refraction when initially inside the fiber.

**launch complex**—The entire launch, control, and support system required for launching rockets.

**launching**—The transferring of energy from a coaxial cable or shielded paired cable in a waveguide.

**lavaliere microphone**—A microphone with acoustical and vibration-isolation properties suiting it to use for speech pickup from a position on the speaker's chest. Lavaliere mikes are fitted with a band or strap for hanging around the neck, and are frequently used when it is important that the mike not be conspicuously visible (as to a TV audience). The use of this mike frees the speaker's hands and allows a certain amount of freedom to move about.

**lawn mower**—1. In facsimile, a term often used when referring to a helix-type recorder mechanism. 2. A type of rf preamplifier used with a radar receiver.

**law of electric charges**—Like charges repel; unlike charges attract. See also Coulomb's law.

**law of electromagnetic induction**—See Faraday's laws, 3.

**law of electromagnetic systems**—Every electromagnetic system tends to change its configuration so that the flux of magnetic induction will be a maximum.

**law of electrostatic attraction**—See Coulomb's law.

**law of magnetism**—Like poles repel; unlike poles attract.

**law of normal distribution**—The Gaussian law of the frequency distribution of any normal, repetitive function. It describes the probability of the occurrence of deviants from the average.

**law of reflection**—The angle of reflection is equal to the angle of incidence—i.e., the incident, reflected, and normal rays all lie in the same plane.

**laws of electric networks**—See Kirchhoff's laws, 1 and 2.

**lay**—1. Pertaining to wire and cable, the axial distance required for one cable conductor or conductor strand

to complete one revolution about the axis around which it is cabled. 2. The distance between successive points where the same strand (or insulated conductor) when twisted with one or more strands (or insulated conductors) presents itself in the same position. 3. The length measured along the axis of a wire or cable required for a single strand (in stranded wire) or conductor (in cable) to make one complete turn about the axis of the conductor or cable.

**layer**—1. The consecutive turns of a coil lying in a single plane. 2. One of several films in a multiple-film structure on a substrate.

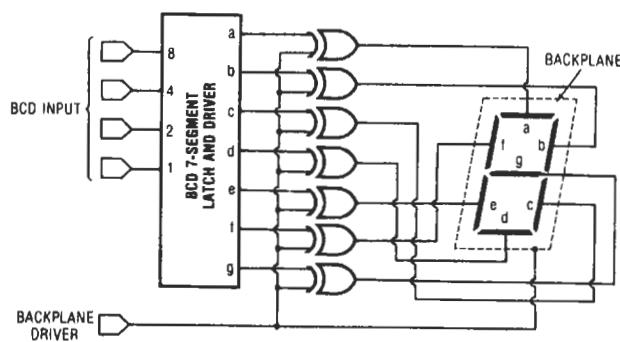
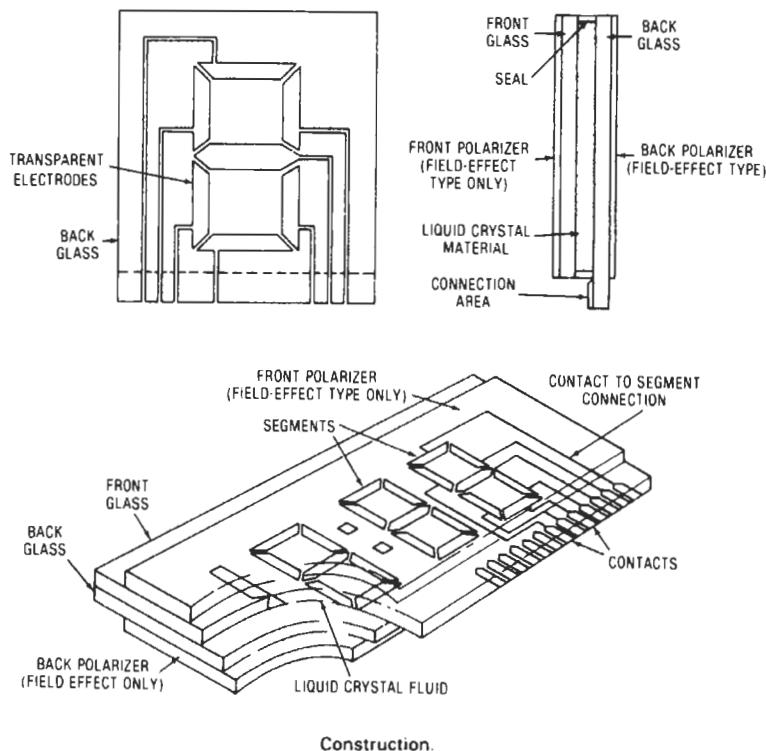
**layer-to-layer adhesion**—The tendency for adjacent layers of recording tape in a roll to adhere, particularly after prolonged storage under conditions of high temperature and/or humidity.

**layer-to-layer signal transfer**—The magnetization of a layer of tape in a roll by the field from a nearby recorded layer. The magnitude of the induced signal tends to increase with storage time and temperature, and to decrease after the tape is unwound. These changes are a function of the magnetic instability of the oxide.

**layer-to-layer spacing**—The thickness of dielectric material between adjacent layers of conductive circuitry in a multilayer printed board.

**layer winding**—A coil-winding method in which adjacent turns are placed side by side and touch each other. Additional layers may be wound over the first and are usually separated by sheets of insulation.

**layout**—1. Diagram indicating the positions of parts on a chassis or panel. 2. The actual positions of the parts themselves. 3. The topological arrangement of conductors



Drive electronics.

**LCD.**

and components in the design of integrated circuits. It precedes the artwork. 4. A visual representation of a complete physical entity, usually to scale.

**layout wiring drawing** — A type of circuit diagram, made to show explicitly each wire, its gage, color coding, and terminations.

**lay-up** — The technique of registering and stacking layers of a multilayer board before the laminating cycle.

**L-band** — 1. Microwave band in which the wavelengths are at or near 23.5 cm. 2. A radio-frequency band of 390 to 1550 MHz and corresponding wavelengths of 77 to 19 cm. Used for mobile communications.

**L-carrier system** — A telephone carrier system employed on coaxial-cable systems and microwave line-of-sight and tropospheric-scatter radio systems. It occupies a frequency band extending from 68 kHz to over 8 MHz.

**LCC** — Abbreviation for leadless chip carrier. A surface-mounted package having metallized contacts (terminals) at its periphery. Usually made of ceramic material.

**LCD** — Abbreviation for liquid crystal display. 1. A seven-segment (typically) display device consisting basically of a liquid crystal hermetically sealed between two glass plates. One type of LCD (dynamic scattering) depends on ambient light for its operation, while a second type depends on a backlighting source. The readout is either dark characters on a dull white background or white on a dull black background. LCDs have very low power requirements. 2. A display whose segments or elements consist of transparent electrodes etched on glass separated by a liquid that has some crystalline properties, including orderly molecular alignment. Voltage applied to opposing electrodes alters the alignment in the liquid between them, affecting the passage of light through the region (reflected or transmitted), rendering the segments visible by contrast. 3. An optically passive device, in that it does not generate light to produce contrast, whose operation depends on the ability of the liquid crystal to rotate plane-polarized light relative to a pair of crossed polarizers attached to the outside of the display. Rotation of the plane of polarization is a function of the applied field and decreases with increasing field or voltage.

**LC product** — Inductance ( $L$ ) in henrys multiplied by capacitance ( $C$ ) in farads. *See* figure on p. 416.

**L/C ratio** — Inductance in henrys divided by capacitance in farads.

**LCS** — Abbreviation for loudness-contour selector.

**L cut** — A trim notch in a film resistor that is created by the cut starting perpendicular to the resistor length and turning 90° to complete the trim parallel to the resistor axis, thereby creating an L-shaped cut.

**LD** — *See* laser diode.

**LD coupler** — *See* laser diode coupler.

**LDCS** — Abbreviation for long-distance control system. A computer-based communication management system (Datapoint Corporation) that routes long-distance calls over least-cost lines and maintains accounting data on calls.

**L-display** — Also called L-scan. A radar display in which the target indication appears as two horizontal blips, one extending to the right and one to the left from a vertical time base. Azimuth pointing error is indicated by relative blip amplitude, and range is indicated by the position of the signal along the base line.

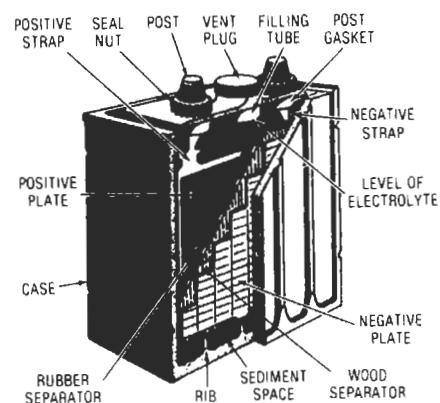
**leaching** — The process of dissolving and removing impurities and soluble components from plated items, tank materials, and the like.

**lead** — 1. A wire to or from a circuit element. 2. To precede (the opposite of lag). 3. A wire, with or without

## layout wiring drawing — lead frame

terminals, that connects two points in a circuit. 4. A conductive path that is usually self-supporting.

**lead-acid cell** — Also called lead cell. A cell in an ordinary storage battery. It consists of electrodes (plates) immersed in an electrolyte of dilute sulfuric acid. The electrodes contain certain lead oxides that change their composition as the cell is charged or discharged.



*Lead-acid cell.*

**lead-acid storage cell** — A storage cell in which both plates are lead-antimony or lead-calcium grids filled with spongy lead for the negative plate and lead peroxide for the positive plate. During discharge, the material in both plates is converted to lead sulfide. The electrolyte is a solution of sulfuric acid with a specific gravity of 1.200. The cell voltage is nominally 2 volts but rises to 2.15 volts on float and drops to 1.85 volts on discharge.

**lead cell** — *See* lead-acid cell.

**lead-covered cable** — A cable with a lead sheath. The sheath offers protection from the weather and mechanical damage to the wires contained therein.

**lead dress** — The placement or routing of wire and component leads in an electrical circuit.

**leader** — 1. Special nonmagnetic tape that can be spliced to either end of a magnetic tape to prevent damage and possible loss of recorded material and to indicate visually where the recorded portion of the tape begins and ends. 2. Tough, nonmagnetic tape spliced ahead of the recorded material on a tape that is expected to receive rough or frequent handling. Usually has one matte-finished surface for writing on, and often available in a variety of colors for coding purposes.

**leader cable** — A navigational aid in which the path to be followed is defined by a magnetic field around a cable.

**leader tape** — Also called timing tape. Plain non-magnetic tape for splicing to either end of magnetic tape to facilitate threading and preserve recorded material, or for splicing between recorded tapes to separate selections or provide pauses.

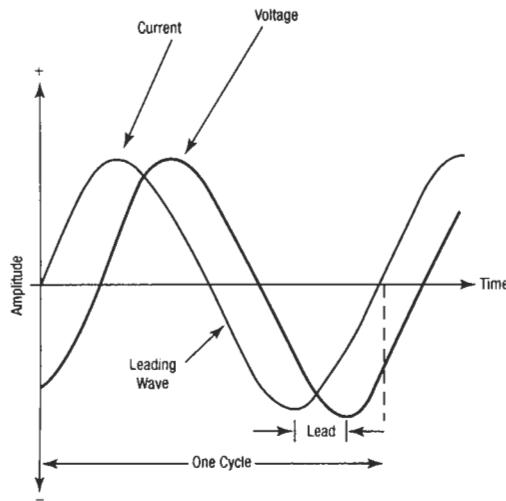
**lead frame** — 1. A metal frame that holds the leads of a plastic encapsulated package (DIP) in place before encapsulation and is cut away after encapsulation. 2. The metal part of a solid-state device package that achieves electrical connection between the die and other parts of the system of which the IC is a component. Large-scale integrated circuits are welded onto lead frames in such a way that leads are available to facilitate making connections to and from the various solid-state devices

to the packages. 3. The metallic portion of the device package that completes the electrical connection path from the die or dice and from ancillary hybrid circuit elements to external circuits.

**lead-in** — The conductor that provides the path for rf energy between the antenna and the radio/television receiver or transmitter.

**leading blacks** — Also called edge effect. In a television picture, the condition in which the edge preceding a white object is overshadowed toward black (i.e., the object appears to have a preceding, or leading, black border).

**leading current** — 1. Current that reaches maximum before the voltage that produces it does. A leading current flows in any predominantly capacitive circuit. 2. In an alternating-current circuit in which the net reactance is capacitive, a current wave that precedes in phase the voltage wave that produces it.



*Leading current.*

**leading edge** — That transition of a pulse which occurs first.

**leading-edge pulse time** — The time required by a pulse to rise from its instantaneous amplitude to a stated fraction of its peak amplitude.

**leading ghost** — A twin image appearing to the left of the original in a televised picture.

**leading load** — A predominantly capacitive load — i.e., one in which the current leads the voltage.

**lead-in groove** — Also called a lead-in spiral. A blank spiral groove around the outside of the record. Its pitch is usually much greater than the other grooves and is used to quickly lead the needle into the beginning of the recorded groove.

**leading whites** — Also called edge effect. In a television picture, the condition in which the edge preceding a black object is shaded toward white (i.e., the object appears to have a preceding, or leading, white border).

**leading zeros** — Zeros placed in front of a number to use up all blanks spaces in a data field.

**lead-in insulator** — A tubular insulator through which cables or wires are brought inside a building.

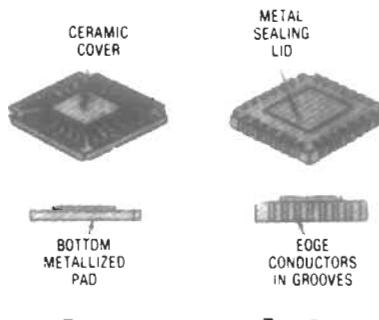
**lead-in spiral** — See lead-in groove.

**lead-in wires** — Wires that carry current into a building (e.g., from an antenna). See down lead.

**lead-length compensation** — In dc ammeters for use with external shunts, the leads that connect to the shunt become an integral part of the total instrument. An adjustable resistor is often included to compensate for the resistance of the leads and to improve overall accuracy.

**leadless chip carrier** — See LCC.

**leadless inverted device** — Abbreviated LID. A shaped metallized ceramic form used as an intermediate carrier for semiconductor chip devices, especially adapted for attachment to conductor lands of a thick- or thin-film network by reflow solder bonding.



*Type A.* *Type B.*

*Leadless inverted devices.*

**lead network** — A network, either ac or dc, designed to provide error-rate damping in the controlling device of a servo system.

**lead-out groove** — Also called a throw-out spiral. A blank spiral groove on the inside of a recording disc, next to the label. It is generally much deeper than the recording groove and is connected to either the locked or eccentric groove.

**lead-over groove** — Also called a crossover spiral. On disc records containing several selections, the groove in which the needle travels as it crosses from one selection to the next.

**lead polarity of transformer** — Also called polarity. A designation of the relative instantaneous directions of currents in the leads of the transformer. Primary and secondary leads are said to have the same polarity when, at a given instant, the current enters the primary lead in question and leaves the secondary lead in question in the same direction as though the two leads formed a continuous circuit.

**lead screw** — 1. In a recording, a threaded road that guides the cutter or reproducer across the surface of a disc. 2. In facsimile, a threaded shaft that moves the scanning mechanism or drum lengthwise.

**lead selenide (PbSe) cell** — A thin-film photoconductive cell that is sensitive to the infrared region. The photosensitive material of the cell is composed of lead selenide, and the cell is used in the detection of infrared radiation.

**lead sulfide (PbS) cell** — A photoconductive cell having its greatest sensitivity in the infrared region. The photosensitive material of the cell is lead sulfide, which is deposited on a glass plate.

**lead time** — In the display of a random sampling oscilloscope, the interval represented that occurs immediately before trigger recognition.

**lead wires** — Wire conductors for intraconnections or input/output leads.

**leaf insulator** — Leaf-spring-shaped insulator located in a switch stack adjacent to a contact spring or actuator spring to keep that spring from making electrical contact with an adjacent spring or other metallic surface.

**leak** — A condition that causes current to be shunted away from its destination through a low resistance.

**leakage** — 1. Undesired flow of electricity over or through an insulator. 2. The portion not utilized most effectively in a magnetic field (e.g., at the end pieces of an electromagnet).

**leakage coefficient** — Ratio of total to useful flux produced in the neutral section of a magnet.

**leakage current** — 1. An undesirable small-value stray current that flows through (or across the surface of) an insulator or the dielectric of a capacitor. 2. A current that flows between two or more electrodes in a tube other than across the interelectrode space. 3. Current prior to switching at a specified voltage. 4. Undesirable flow of current through or over a surface of an insulating material or insulator. 5. All currents, including capacitively coupled currents, that may be conveyed between energized parts of a circuit and ground or other parts. 6. The conduction current through a capacitor when a direct voltage is applied.

**leakage flux** — The flux that does not pass through the air gap, or useful part, of the magnetic circuit.

**leakage inductance** — A self-inductance due to the leakage flux generated in the winding of a transformer.

**leakage power** — In tr and pre-tr tubes, the radio-frequency power transmitted through a fired tube.

**leakage radiation** — Spurious radiation in a transmitting system — i.e., radiation from other than the system itself.

**leakage rate** — A laboratory procedure used to determine the amount and duration of resistance of an article to a specific set of destructive forces or conditions.

**leakage reactance** — 1. The reactance represented by the difference in value between two mutually coupled inductances when their fields are aiding and then opposing. 2. That portion of the reactance of a transformer primary which is due only to leakage flux.

**leakage resistance** — The normally high resistance of the path over which leakage current flows.

**leakance** — The reciprocal of insulation resistance.

**leaktight** — See hermetic.

**leaky** — Usually applied to a capacitor in which the resistance has dropped so far below normal that objectionably high leakage current flows.

**leaky waveguide** — A waveguide with a narrow longitudinal slot, permitting a continuous energy leak.

**leaky waveguide antenna** — An antenna constructed from a long waveguide with radiating elements along its length. It has a very sharp pattern.

**leapfrogging** — The process of phasing, or delaying, the ranging pulse of a tracking radar in order to move or shift (on the scope presentation) the tracking gate (at target blip) past the target blip from another radar.

**leapfrog test** — A computer check routine using a program that calls for performing a series of arithmetical or logical operations on one section of memory locations, transferring to another section, checking correctness of transfer, and repeating the series of operations. Eventually, all storage positions are checked by this process.

**learning curve** — The improvement that occurs in manufacturing processes with experience.

**leased line** — Also called dedicated or private line. A semipermanent leased telephone circuit that connects two or more points and is continuously available to the subscriber. *See also* dedicated line.

**least maximum deviation** — A manner of expressing nonlinearity as a deviation from a straight line for which the deviations for proportional or normal linearity are minimized.

**least mechanical equivalent of light** — The radiant power that is contained in 1 lumen at the wavelength of maximum visibility. It is equal to 1.46 milliwatts at a wavelength of 555 nanometers.

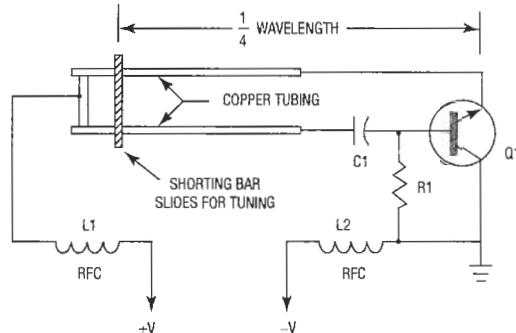
**least significant bit** — Abbreviated LSB. 1. In a system in which a numerical magnitude is represented by a series of binary (i.e., two-valued) digits, that digit (or bit) that carries the smallest value or weight; usually the rightmost bit. 2. The lowest-order bit or the bit with the least weight. Binary digit having a weight of  $2^0$ , or 1. 3. 3. Smallest value that can be digitized; lowest-order digital output.

**least significant digit** — Abbreviated LSD. 1. The digit that has the lowest place value in a number; usually the rightmost digit. 2. Number at the extreme right of a group of numbers. Example: 6937. Digit 7 is the LSD.

**least voltage coincidence detection** — Abbreviated LVCD. A system that provides protection against interfering signals by blocking all signals except those having a pulse-repetition frequency the same as or some exact multiple of the radar-set pulse-repetition frequency.

**Lecher line** — *See* Lecher wire.

**Lecher oscillator** — A device for producing standing waves on two parallel wires called Lecher wires.



Lecher oscillator.

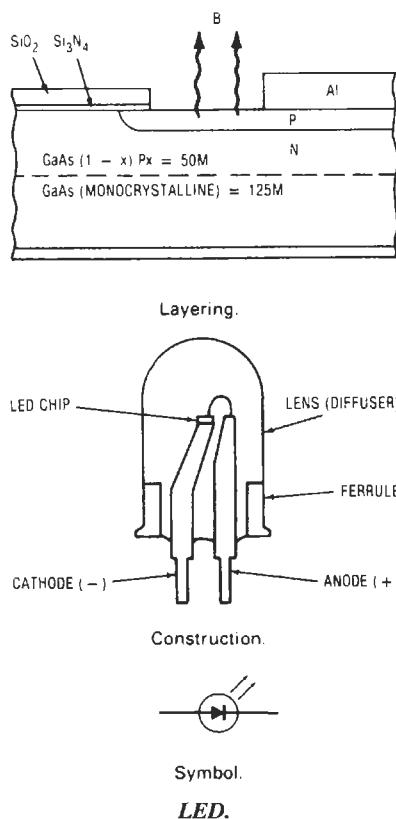
**Lecher wire** — 1. A type of transmission line used to measure wavelength, consisting of a pair of wires whose electrical length is adjustable. If a source of radio frequency is coupled to one end of the line and the line is adjusted until a set of standing waves is formed, the wavelength may be determined by measurement of the distance between adjacent nodes. 2. Two parallel wires with a movable shunt that are connected to the output of a radio-frequency source and are used mainly to measure wavelengths shorter than about 10 meters.

**Leclanche cell** — 1. Type of dry cell comprising a positive carbon pole contained in a porous vessel filled with manganese dioxide, the whole assembly standing in a container of an ammonium chloride solution that also contains the negative zinc pole. The electromotive force generated by a cell of this type is approximately 1.5 volts. 2. An ordinary dry cell. It is a primary cell with a positive electrode of carbon and a negative electrode of zinc in an electrolyte of sal ammoniac and a depolarizer of manganese dioxide.

**LED** — Abbreviation for light-emitting diode. 1. A pn junction semiconductor device specifically designed to

emit light when forward biased. This light can be one of several visible colors—red, amber yellow, or green—or it may be infrared and thus invisible. Electrically, a LED is similar to a conventional diode in that it has a relatively low forward voltage threshold. Once this threshold is exceeded, the junction has a low impedance and conducts current readily. This current must be limited by an external circuit, usually a resistor. The amount of light emitted by a LED is proportional to the forward current over a broad range, thus it is easily controlled, either linearly or by pulsing. The LED is extremely fast in its light output response after the application of forward current. Typically, the rise and fall times are measured in nanoseconds. LEDs are constructed in either a multisegment (typically seven segments) display format or a dot-matrix display format. Red is used most often because of its lower cost.

2. A diode that operates similar to a laser diode, with the same output power level, the same output limiting modulation rate, and the same operational current densities, i.e., thousands of amperes per square centimeter, which causes catastrophic and graceful degradation, but with greater simplicity, tolerance, and ruggedness and about ten times the spectral width of its radiation.



**ledger balance**—A facility used with message switching equipment to ensure that no messages are lost within the center. It involves comparing the number of addresses received with the number of addresses transmitted.

**left-handed polarized wave**—Also called counterclockwise-polarized wave. An elliptically polarized transverse electromagnetic wave in which the electric intensity

vector rotates counterclockwise (looking in the direction of propagation).

**left-hand rule**—See Fleming's rule, 1.

**left-hand taper**—The greater resistance in the counterclockwise half of the operating range of a rheostat or potentiometer than in the clockwise half (looking from the shaft end).

**left (or right) signal**—The electrical output of a microphone or combination of microphones placed so as to convey the intensity, time, and location of sound originating predominantly to the listener's left (or right) of the center of the performing area.

**left (or right) stereophonic channel**—The left (or right) signal as electrically reproduced in the reception of FM stereophonic broadcasts.

**leg**—A section or branch of a component or system (e.g., one of the windings of a transformer).

**legend**—A table of symbols or other data placed on a map, chart, or diagram to assist the reader in interpreting it.

**Lenard rays**—Cathode rays that emerge from a special vacuum tube through a thin glass window or metallic foil.

**Lenard tube**—An electron tube in which the beam can be taken through a section of the wall of the evacuated enclosure.

**length of a scanning line**—1. The length of the path traced by the scanning or recording spot as it moves from line to line. 2. On drum-type equipment, the circumference of the drum. 3. The spot speed divided by the scanning-line frequency.

**lens**—1. An optical device that focuses light by refraction. 2. An electrical device that focuses microwaves by refraction or diffraction. 3. An acoustic device that concentrates sound waves by refraction. 4. An electronic optical device that focuses electrons. 5. A transparent optical component consisting of one or more pieces of optical glass with surfaces so curved (usually spherical) that they serve to converge or diverge the transmitted rays of an object, thus forming a real or virtual image of that object.

**lens antenna**—A microwave antenna with a dielectric lens placed in front of the dipole or horn radiator so that the radiated energy is concentrated into a narrow beam.

**lens disc**—A television scanning disc having a number of openings arranged in a spiral, with a lens set into each opening.

**lens speed**—Refers to the ability of a lens to transmit light, represented as the ratio of the focal length to the diameter of the lens. A fast lens would be rated f/1.2; a much slower lens might be designated as f/8. The larger the f-number, the slower the lens.

**lens turret**—On a camera, an arrangement that accommodates several lenses and can be rotated to facilitate their rapid interchange.

**Lenz's law**—The current induced in a circuit due to a change in the magnetic flux through it or to its motion in a magnetic field is so directed as to oppose the change in flux or to exert a mechanical force opposing the motion. If a constant current flows in a primary circuit A and if, by motion of A or the secondary circuit B, a current is induced in B, the direction of the induced current will be such that, by its electromagnetic action on A, it tends to oppose the relative motion of the circuits.

**LEO**—Abbreviation for low earth orbit. Any orbit around the earth substantially below the geostationary satellite orbit, generally within several hundred kilometers above the earth's surface and usually inclined to the equatorial plane.

**Lepel discharger**—A quenched spark gap used in early radiotelegraph transmitters employing shock excitation.

**letter quality**—Resembling the output of a typewriter.

**letter-quality printer**—A machine that prints like a typewriter, by pressing complete characters through a ribbon onto paper.

**letters shift**—In the Baudot code, a control character following which all characters are interpreted as being in the group containing letters (lower case).

**let-through current**—The current that actually passes through a circuit breaker under short-circuit conditions.

**level**—1. The magnitude of a quantity in relation to an arbitrary reference value. Level normally is stated in the same units as the quantity being measured (e.g., volts, ohms, etc.). However, it may be stated in units that express the ratio to a reference value (e.g., decibels). 2. A voltage that remains constant over a long period of time. 3. In describing codes or characters, a bit or element. 4. The intensity of an electrical signal.

**level above threshold**—Also called sensation level. The pressure level of a sound in decibels above its threshold of audibility for the individual listener.

**level compensator**—1. An automatic gain control that minimizes the effect of amplitude variations in the received signal. 2. A device that automatically controls the gain in telegraph-receiving equipment.

**level indicator**—A device for showing visually the level of the audio signal, as a means of establishing the optimum amount of signal being fed to the tape.

**level shifting**—The process of changing a differential signal input to a single-ended output within an operational amplifier.

**level translator**—A circuit that accepts digital input signals at one pair of voltage levels and delivers output signals at a different pair of voltage levels. For example, a circuit to translate the -0.8-V "zero" and 1.6-V "one" of ECL to the -0.8-V "zero" and -4.2-V "one" suitable for COS/MOS.

**level-triggered flip-flop**—A flip-flop that responds to the voltage level rather than the rate of change of an input signal.

**lever switch**—Commonly referred to as a key lever or lever key. 1. A hand-operated switch for rapidly opening and closing a circuit. 2. A switch having a lever (toggle), whose movement results either directly or indirectly in the connection or disconnection of the switch terminations in a specified manner.

**Lewis antenna**—A microwave scanning antenna consisting of a lensed flat horn that tapers to a narrow rectangular opening across which a waveguide feed can be moved to scan the beam. The horn is folded by the incorporation of a 45° reflecting strip, and the thin rectangular end is formed into a circular annulus, around which the feed can be rotated. The deformed parallel-plate region that results has a conical shape with the feed circle as base.

**Leyden jar**—The original capacitor. It consists of metal foil sheets on the inside and outside of a glass jar. The foil serves as the plates and the glass as the dielectric.

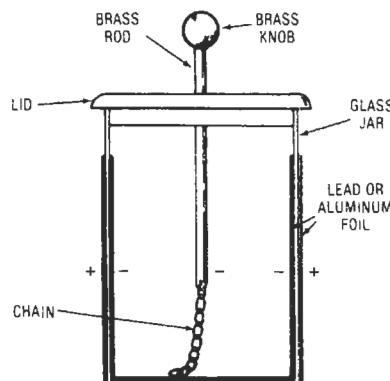
**LF**—Abbreviation for low frequency (i.e., between 30 and 300 kHz).

**LFM**—A VHF fan-type marker. It is low powered (5 watts) and has a range of only 10 miles or less.

**librarian**—A system program that is responsible for creating, editing, and deleting software libraries.

**library**—1. A collection, usually stored on magnetic tape, of computer programs or subroutines for special purposes. 2. A group of standard, proven computer routines

## Lepel discharger — lifetime



Leyden jar.

that can be incorporated into larger routines. 3. A collection of system and/or user tasks that may be executed by other tasks in the system. The major reason for libraries is to prevent software redesign each time a function is needed by a task. 4. A set of frequently used programs or program pieces.

**LIC**—Abbreviation for linear integrated circuit.

**Lichtenberg figure camera**—Also called klydonograph or surge-voltage recorder. A device for indicating the polarity and approximate crest value of a voltage surge by the appearance and dimensions of the Lichtenberg figure produced on a photographic plate or film. The emulsion coating of the plate or film contacts a small electrode coupled to the circuit in which the surge occurs. The film is backed by an extended plane electrode.

**LID**—See leadless inverted device.

**lie detector**—Also called a polygraph. An electronic instrument that measures the blood pressure, temperature, heart action, breathing, and skin moisture of the human body. Abrupt or violent changes in these variables are said to indicate that the subject is not telling the truth.

**LIF connector**—Abbreviation for low insertion force connector. Type of printed circuit board connector unit in which mating and unmating forces are reduced 70 to 90 percent. Typical engaging and separating forces in these devices are 0.5 oz/contact, contrasted with the 8 to 16 oz required for conventional printed circuit board connectors.

**life**—1. The expected number of full excursions over which a transducer would operate within the limits of the applicable specification. 2. The number of performance hours, days, years, or actual operations an item is designated to meet.

**life aging**—1. Burn-in test that moderates the elevation of temperature and extends the time period in order to test the overall device quality as opposed to infant mortality. 2. Long-period operation of items, components, or devices to test the consistency of device finality.

**life cycle**—A test that indicates the time span before failure; the test occurs in a controlled, usually accelerated environment.

**life test**—The test of a component or unit under the conditions that approximate, or simulate by acceleration, a normal lifetime of use. The test is performed to determine life expectancy or reliability throughout a predetermined life expectancy.

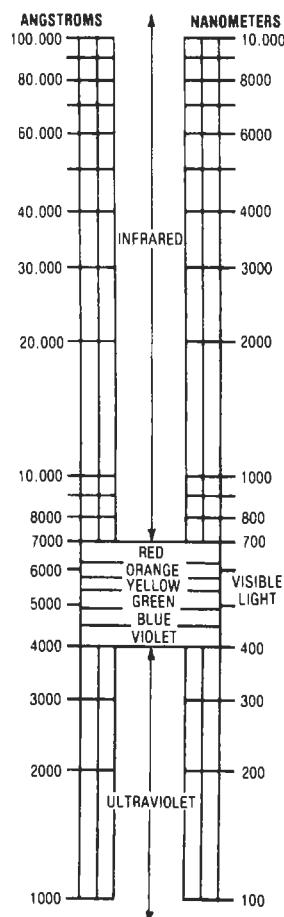
**lifetime**—1. The average time interval between the introduction and recombination of minority carriers in a semiconductor. 2. The time it takes a thermally generated or photogenerated electron-hole pair to recombine.

**LIFO**—Last in, first out; method of storing and retrieving data in a stack, table, or list. *Compare FIFO.*

**lifter**—In a tape recorder, a movable rod or guide that draws the tape away from the heads during fast-forward or rewind modes to eliminate needless head wear. Lifters work automatically on most machines in either high-speed mode.

**lifting magnet**—A powerful electromagnet used on the end of a crane to lift iron and steel objects, which can be dropped instantly by merely cutting off the current.

**light**—1. Radiant energy within the wavelength limits perceptible by the average human eye (roughly, between 400 and 700 nanometers). Although ultraviolet and infrared emissions will excite some types of photocells, they are usually not considered light. 2. In combination with other terms, a device used as a source of luminous energy (e.g., a pilot light). 3. Radiant energy transmitted by wave motion with wavelengths from about 0.3  $\mu\text{m}$  to 30  $\mu\text{m}$ ; this includes visible wavelengths (0.38  $\mu\text{m}$  to 0.78  $\mu\text{m}$ ) and those wavelengths such as ultraviolet and infrared, which can be handled by optical techniques used for the visible region. In more restricted usage, radiant energy within the limits of the visual spectrum.



Light, I (spectrum).

**light-activated silicon-controlled rectifier**—*See LASCR.*

**light-activated silicon-controlled switch**—*See LASCS.*

**light-activated switch**—A semiconductor diode that is triggered into conduction by light irradiation of a light-sensitive part of the semiconductor pellet.

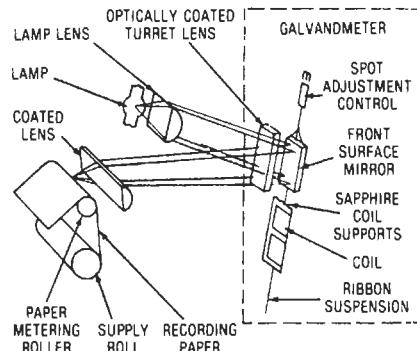
**light amplifier**—A device that serves to emit light of the same wavelength as the input light, only with an increase in intensity. It may be a solid-state device comprised of photoconductive and luminescent layers contained between two electrodes.

**light-beam cathode-ray-tube recorder**—Recorder using an electron beam to make multiple traces on a CRT screen. Traces are reflected from a fixed plane mirror onto moving photosensitive paper via an optical system.

**light-beam galvanometer**—A modified form of the D'Arsonval meter movement in which a small mirror is cemented to a moving coil mounted in the field of a permanent magnet. Current through the coil causes the coil to be deflected angularly, and the mirror reflects a beam of light onto a moving strip of photographic paper. The developed chart shows the waveform of the current through the coil.

**light-beam instrument**—An instrument in which a beam of light is the indicator.

**light-beam oscilloscope**—Recorder using a mirror on a galvanometer to achieve recording response to 5 kHz.



Light-beam oscilloscope.

**light-beam pickup**—A phonograph pickup utilizing a beam of light as a coupling element of the transducer.

**light chopper**—A device for interrupting a light beam. It is frequently used to facilitate amplification of the output of a phototube on which the beam strikes.

**light current**—The current that flows through a photosensitive device, such as a phototransistor or a photodiode, when it is exposed to illumination or irradiance.

**light-dimming control**—A circuit, often employing a saturable reactor, used to control the brightness of the lights in theaters, auditoriums, etc.

**light-emitting diode**—Abbreviated LED. A pn junction that emits light when biased in the forward direction. *See LED.*

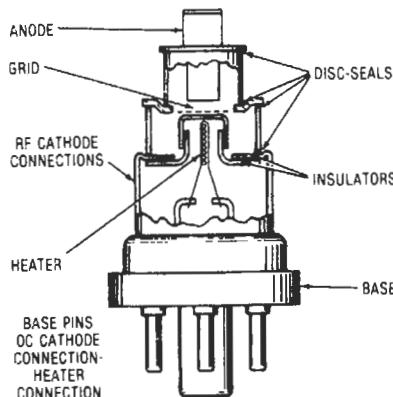
**light-emitting diode coupler**—Abbreviated LED coupler. A coupling device that enables the coupling of light energy from a light-emitting diode (LED) source to an optical fiber or cable at the transmitting end of an optical fiber data link. The coupler may be an optical fiber pigtail epoxied to the LED.

**light flux**—See luminous flux, 1.

**light guide**—1. An assembly of optical fibers and other optical elements mounted and finished in a component that is used to transmit light. 2. A conduit made up of fibers randomly collected or bunched in a group; it conducts light and images.

**light gun**—A photoelectric cell used by computer operators to take specific actions in assisting and directing computer operation. So called because of its gun-like case.

**lighthouse tube**—An ultrahigh-frequency electron tube shaped like a lighthouse and having disc-sealed planar elements. See also disc-seal tube.



Lighthouse tube (cutaway view).

**lighting outlet**—An outlet for direct connection of a lamp holder, lighting fixture, or pendant cord termination in a lamp holder.

**light intensity cutoff**—In a photoelectric alarm system, the percent reduction of light that initiates an alarm signal at the photoelectric receiver unit.

**light level**—The amount of (or intensity of) light falling upon a subject.

**light load**—A fraction of the total load the device is designed to handle.

**light meter**—An electron device that contains a photosensitive cell and calibrated meter for the measurement of light levels.

**light microsecond**—The unit for expressing electrical distance. It is the distance over which light travels in free space in 1 microsecond (i.e., about 983 feet, or 300 meters).

**light modulation**—Variation in the intensity of light, usually at audio frequencies, for communications or motion-picture sound purposes.

**light modulator**—The device for producing the sound track on a motion-picture film. It consists of a source of light, an appropriate optical system, and a means for varying the resulting light beam (such as a galvanometer or light valve).

**light negative**—Having a negative photoconductivity when subjected to light.

**lightning arrester**—A device to prevent damage to electrical equipment by transient overvoltages whether from lightning or switching. Spark gaps that can only be bridged by voltages above those used in the equipment allow the higher voltages to be discharged to ground.

**lightning generator**—A generator of high-voltage surge (e.g., for testing insulators).

**lightning rod**—A pointed metal rod carried above the highest point of a pole or building, and connected to earth by a heavy copper conductor, for the purpose of carrying a direct lightning discharge directly to earth without damage to the protected structure.

**lightning surge**—A transient disturbance in an electric circuit caused by lightning.

**lightning switch**—A switch for connecting a radio antenna to ground during electrical storms.

**light pen**—1. A light-sensitive device used with a computer-operated CRT display for selecting a portion of the display for action by the computer. 2. A photosensor placed in the end of a penlike probe. It is used in conjunction with a CRT display for drawing, erasing, or location characters. Operation is by comparison of the time it senses a light pulse to the scanning time of the display. 3. A hand-held data-entry device used only with refresh displays. It consists of an optical lens and photocell, with associated circuitry, mounted in a wand. Most light pens have a switch on the barrel that makes the pen sensitive to light from the screen. An activated light pen, when pointed at a vector or character on the screen, will generate an interrupt. It is then possible to identify the vector or character since the display stopped refreshing when the item was drawn that caused the interrupt. The most common uses of light pens are light-button selection and tracking.

**light pencil**—A narrow cone of light rays that diverges from a point source or converges to an image point.

**light pipe**—1. A bundle of transparent fibers that can transmit light around corners with small losses. Each fiber transmits a portion of the images through its length, reflection being caused by the lower refractive index of the surrounding material, usually air. 2. Transparent matter that usually is drawn into a cylindrical or conical shape through which light is channeled from one end to the other by total internal reflections. Optical fibers are examples of light pipes.

**light positive**—Having positive photoconductivity—i.e., increasing in conductivity when subjected to light.

**light-powered telephone**—Technology that relies on a highly efficient photodetector that can detect incoming light signals at one frequency and transmit outgoing signals at another, thus permitting the sending and receiving of light signals over one fiber with a single device.

**light ray**—1. A very thin beam of light. 2. A line, perpendicular to the wavefront of light waves, indicating their direction of travel and representing the light wave itself.

**light relay**—A photoelectric device that opens or closes a relay when the intensity of a light beam changes.

**light-sail**—A method of spacecraft propulsion using a giant sail to catch the solar wind, a nonfictional stream of ionized gas particles constantly emitted from the sun at speeds of up to 2 million miles an hour (3.2 million kilometers per hour).

**light sensitive**—Exhibiting a photoelectric effect when irradiated (e.g., photoelectric emission, photoconductivity, and photovoltaic action).

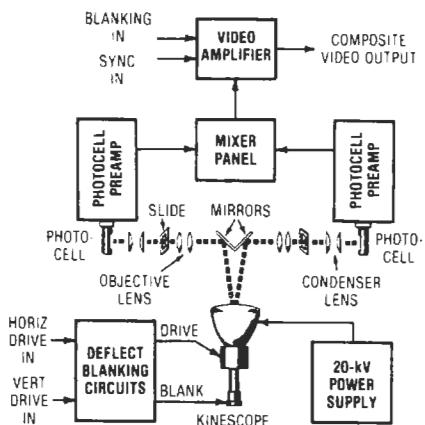
**light-sensitive Darlington amplifier**—Two stages of transistor amplification in one light-detector device. Darlings give much higher gain than single transistors.

**light-sensitive tube**—A vacuum tube that changes its electrical characteristics with the amount of illumination.

**light source**—Any object capable of emitting light. (In fiber optics, the light source is normally either an LED or a laser.)

**light source power**—The electrical power used to stimulate any light source. Power supplies may be step-up or stepdown transformers; rectifiers to convert ac to dc; ammeters and voltmeters to observe the input to the source; and regulators and variable resistors, for maintaining constancy of input.

**light-spot scanner**—Also called a flying-spot scanner. A television camera in which the source of illumination is a spot of light that scans the scene to be televised. The picture signal is generated in a phototube, which picks up light either transmitted through the scene or reflected from it.



Light-spot scanner.

**light valve**—A device whose light transmission can be varied in accordance with an externally applied electrical quantity such as voltage, current, an electric or magnetic field, or an electron beam.

**lightwave communications**—Also called optical communications. 1. In fiber optics communications, using light, instead of an electric current, to carry the information. 2. That aspect of communications and telecommunications devoted to the development and use of equipment that uses electromagnetic waves in or near the visible region of the spectrum for communication purposes. Lightwave communication equipment includes sources, modulators, transmission media, detectors, converters, integrated optic circuits, and related devices, used for generating and processing light waves. The term *optical communications* is oriented toward the notion of optical equipment, whereas the term *lightwave communications* is oriented toward the signal being processed.

**light-year**—1. The distance traveled by light in one year, or about 5,880,000,000,000 miles or 9,500,000,000,000 km, roughly 6 trillion miles (9.5 trillion kilometers). A parsec (parallax second) is equal to 3.26 light-years. Both are units of distance, not time.

**limit bridge**—A form of Wheatstone bridge used for rapid routine production testing. Conformity with tolerance limits, rather than exact value, is determined.

**limit cycle**—A mode of control system operation in which the controlled variable cycles between extreme limits, with the average near the desired value.

**limited continuous word/speech**—Voice recognition capability for certain sets of words uttered without pause (typically digits such as part numbers or postal zip codes), which can be trained into user-programmable

voice equipment designed with proper recognition processing algorithms.

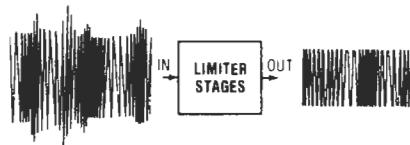
**limited signal**—In radar, a signal that is intentionally limited in amplitude by the dynamic range of the system.

**limited space-charge accumulation**—A mode of oscillation for gallium arsenide diodes.

**limited space-charge accumulation diode**—See LSA diode.

**limited stability**—The property of a system that remains stable only as long as the input signal falls within a particular range.

**limiter**—1. A device in which some characteristic of the output is automatically prevented from exceeding a predetermined value—e.g., a transducer in which the output amplitude is substantially linear (with regard to the input) up to a predetermined value and substantially constant thereafter. 2. A radio-receiver stage or circuit that limits the amplitude of the signals and hence keeps interfering noise low by removing excessive amplitude variations from the signals. 3. A device that reduces the intensity of very short duration peaks (transient peaks) in the audio signal without audibly affecting dynamic range. 4. A feedback element that acts to restrain a variable by modifying or replacing the function of the primary element when predetermined conditions have been reached.



Limiter action.

**limiting**—The restricting of the amplitude of a signal so that interfering noise can be kept to a minimum.

**limiting resolution**—In television, the number of TV lines per picture height that can just be resolved by visual inspection of a televised pattern. Wedge patterns are often used for this subjective test. These charts include five areas (center and four corners) for resolution measurement. Each area includes two identical sets of mutually orthogonal wedge patterns calibrated (up to 16) in hundreds of TV lines per picture height. 2. The details that can be distinguished on the television screen. Vertical resolution refers to the number of horizontal black and white lines that can be resolved in the picture height. Horizontal resolution refers to the black and white lines resolved in a dimension equal to the vertical height and may be limited by the video amplifier bandwidth.

**limit of error**—An accuracy index that indicates the expected maximum deviation of the measured value from the true value if all of the factors causing deviations act simultaneously and in the same direction.

**limit ratio**—The ratio of peak value to limited value.

**limits**—The minimum and maximum values specified for a quantity.

**limit switch**—1. A mechanically operated contact-making or contact-breaking device mounted in the path of a moving object and actuated by its passage. 2. An electromechanical device that uses changes in mechanical motion to control electrical circuits. It functions as the interlocking link between a mechanical motion and an electrical circuit. 3. A switch that is actuated by some part or motion of a machine or equipment to alter the electrical circuit associated with it.

**line**—1. In television, a single trace of the electron beam from left to right across the screen. The present United States standard is based on 525 lines to a complete picture. 2. A conductor of electrical energy. 3. The path of the moving spot in a cathode-ray tube. 4. A term used interchangeably for maxwell. 5. A row of actual or potential holes at right angles to the direction in which a punched tape advances. Line width is measured in terms of the maximum number of holes permissible, excluding the sprocket hole. 6. The interconnection between two electrical devices. Usually used with reference to a long run of interconnecting cable, as from a microphone to its tape-recorder input. 7. In communications, describes cables, telephone lines, etc., over which data is transmitted to and received from the terminal.

**line advance**—Also called line feed. The distance between the centers of the scanning lines.

**line amplifier**—1. An amplifier that supplies a program transmission line or system with a signal at a specified level. 2. Also called line stretcher. An amplifier, usually remotely powered, used in a trunk line in a distribution system to increase the strength of the signal in order to drive an additional length of cable. 3. Also called program amplifier. An amplifier for audio or video signals that feeds a transmission line. 4. An audio amplifier that is used to provide preamplification of an audio alarm signal before transmission of the signal over an alarm line. Use of an amplifier extends the range of signal transmission. 5. An amplifier that supplies an audio system or an audio long cable with a signal at a specified level, usually between -10 and +4 dBv (245 millivolts to 1.23 volts rms). 6. An amplifier inserted in any part of the transmission line following the downconverter to compensate signal losses caused by long lengths of coaxial cable or the insertion of passive devices such as splitters. Line amplifiers are also used when the signal must drive a number of television receivers.

**line and trunk group**—A group consisting of four-wire line circuits, incoming trunks from private automatic branch exchanges, and intertoll trunk groups.

**linear**—1. Having an output that varies in direct proportion to the input. 2. A ratio in which change in one of two related quantities is accompanied by a directly proportional change in the other.

**linear acceleration**—The rate of change in linear velocity.

**linear accelerator**—A device for speeding up charged particles such as protons. It differs from other accelerators in that the particles move in a straight line instead of in circles or spirals.

**linear accelerometer**—A transducer used to detect, measure, and record the rate of change in linear velocity of accelerative forces.

**linear actuator**—An actuator that produces mechanical motion from electrical energy.

**linear amplification**—Amplification in which the output is directly proportional to the input.

**linear amplifier**—1. An amplifier that operates on the linear portion of its forward transfer characteristic so that its output signal is always an amplified replica of the input signal. 2. Amplifier whose gain is constant for a wide variation in amplitude of input signal—i.e., output signal is proportional to input signal. 3. Amplifier that has linear control characteristics and negligible response time in the active bandwidth, provides a wide speed range, and usually requires minimal external circuitry to prevent instability caused by phase-shifted feedback from reactive loads. Linear amplifiers also generate little electrical noise.

**linear array**—1. An antenna array in which the elements are equally spaced and in a straight line. 2. A

multielement antenna in which individual dipole elements are arranged end to end.

**linear circuit**—1. A circuit in which the output voltage is approximately directly proportional to the input voltage; this relationship generally exists only over a limited range of signal voltages and often over a limited range of frequencies. 2. A circuit whose output is a continuous amplified version of its input. That is, the output is a predetermined variation of its input. 3. A circuit in which a proportional, or linear, relationship exists between the input and output. In manufacturers' circuit classifications the term often includes all analog circuits, both linear and nonlinear.

**linear control**—A rheostat or potentiometer having uniform distribution of graduated resistance along the entire length of its resistance element.

**linear detection**—Detection in which the output voltage is substantially proportionate to the input voltage over the useful range of the detector.

**linear detector**—A detector that produces an output signal directly proportionate in amplitude to the variations in amplitude (for AM transmission) or frequency (for FM transmission) of the rf input.

**linear device**—An amplifying-type analog device with a linear input/output relation, as opposed to a nonlinear digital device, which is either completely on or completely off over large ranges of input signals.

**linear differential transformer**—A type of electromechanical transducer that converts physical motion into an output voltage, the phase and amplitude of which are proportional to position. See also linear motion transducer.

**linear distortion**—Amplitude distortion in which the output and input signal envelopes are not proportionate, but no alien frequencies are involved.

**linear electrical parameters of a uniform line**—Frequently called the linear electrical constants. The series resistance and inductance, and the shunt conductance and capacitance, per length of a line.

**linear electron accelerator**—An evacuated metal tube in which electrons are accelerated through a series of small gaps (usually cavity resonators in the high-frequency range). The gaps are so spaced that, at a specific excitation frequency, the electrons gain additional energy from the electric field as they pass through successive gaps.

**linear feedback-control system**—A feedback-control system in which the relationship between the pertinent measure of the system signals is linear.

**linear integrated circuit**—Abbreviated LIC. 1. A circuit whose output is an amplified, linear version of its input or whose output is a predetermined variation of its input. A class of integrated circuits that process analog information expressed as voltages or currents. 2. An integrated circuit whose output remains proportional to the input level. Generally the term is taken to mean an analog IC, such as a voltage regulator, comparator, sense amplifier, driver, etc., as well as a linear amplifier. The operation of the circuit can be made nonlinear by connecting the basic linear amplifier to external circuit elements that have thresholds or other nonlinear characteristics.

**linearity**—1. The relationship existing between two quantities when a change in a second quantity is directly proportionate to a change in the first quantity. 2. Deviation from a straight-line response to an input signal. 3. The ability of a meter to provide equal angular deflections proportional to the applied current. Usually expressed as a percent of the full-scale deflection. 4. The relationship between the actual electrical energy input and the deflection of a meter pointer, as referenced to a

theoretical straight line. Linearity is often confused with tracking. 5. In a modulator, the ability to generate a modulation envelope that reproduces the modulating signal without distortion. 6. The state of an output that incrementally changes directly or proportionately as the input changes. 7. The closeness of a calibration curve to a specified straight line; the degree to which the output of a linear device is proportional to the input.

**linearity control** — A control that adjusts the variation of scanning speed through the trace interval.

**linearity error** — The deviation of a calibration curve from a specified straight line.

**linear logarithmic intermediate-frequency amplifier** — An amplifier used to avoid overload or saturation as a protection against jamming in a radar receiver.

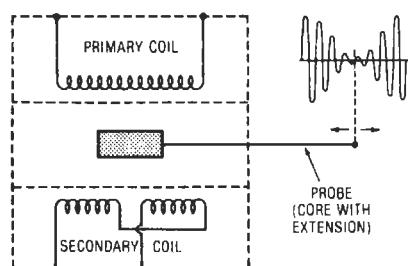
**linear magnetostriiction** — Under stated conditions, the relative change of length of a ferromagnetic object in the direction of magnetization when the magnetization of the object is increased from zero to a specified value (usually saturation).

**linear mobility** — The synchronized incremental mobility of functionally transitional electrons in a semiconductor.

**linear modulation** — Modulation in which the amplitude of the modulation envelope (or the deviation from the testing frequency) is directly proportional to the amplitude of the modulating wave at all audio frequencies.

**linear modulator** — A modulator in which the modulated characteristic of the output wave is substantially linear with respect to the modulating wave for a given magnitude.

**linear motion transducer** — An instrumentation component that translates straightline (linear) mechanical motion into an ac analog that is usable as a feedback signal for control or display. A transformer-type device in which a movable magnetic core is displaced axially by the moving component being monitored. When the core is moved in one direction from the center of its stroke, the output voltage is in phase with the excitation voltage, and when the core is moved in the opposite direction from the center, the output voltage is 180° out of phase. At the center, the output voltage is (virtually) zero. In either direction from center, the voltage increases as a precise linear function of probe displacement. Thus, the output signal has two basic analog components: phase relationship with the excitation voltage, indicating the direction of travel; and voltage amplitude, indicating the length of travel.



Linear motion transducer.

**linear polarization** — The polarization of a wave radiated by an electric vector that does not rotate but that alternates so as to describe a line. Normally the vector is oriented either horizontally or vertically.

**linear polarized wave** — At a point in a homogeneous isotropic medium, a transverse electromagnetic wave whose electric field vector lies along a fixed line.

**linear power amplifier** — A power amplifier in which the output voltage is directly proportionate to the input voltage.

**linear predictive coding** — 1. A method of analyzing and storing human speech by determining from speech patterns a description of a time-varying digital filter modeling the vocal tract. This filter is then excited by the proper type of input, depending on the sound to be synthesized. The output of the filter is passed through a digital-to-analog converter whose output is the desired synthetic speech. 2. Speech synthesis technique based in the frequency domain. The quality of the synthesis improves as the number of coefficients is increased. With ten coefficients, an approximate number of bits per second required for speech is 1200. 3. A parameter-encoding technique that models the human vocal tract with a digital filter whose controlling parameters change with time. Changes are based on previous speech samples.

**linear programming** — In computers, a mathematical method of sharing a group of limited resources among a number of competing demands. All decisions are interlocking because they must be made under a common set of fixed limitations.

**linear pulse amplifier** — A pulse amplifier that maintains the peak amplitudes of the input and output pulses in proportion.

**linear rectification** — The production, in the rectified current or voltage, of variations that are proportionate to variations in the input wave amplitude.

**linear rectifier** — A rectifier with the same output current or voltage waveshape as that of the impressed signal.

**linear regression** — A statistical function used when handling experimental data. It is especially used when performing an experiment to find a mathematical relationship between two variables. Linear regression is the name of the procedure that is used to find the line that best fits the set of data points that have been found experimentally. The procedure usually finds the equation of the straight line and also a parameter called the correlation coefficient, which indicates how well the data fits the line.

**linear scan** — A radar beam that traverses only one arc or circle.

**linear scanning** — Scanning in which a radar beam generates only one arc or circle.

**linear sweep** — In a television receiver, the movement of the spot across the screen at a uniform velocity during active scanning intervals.

**Linearsyn** — A linear displacement pickoff of the differential-transformer type consisting of a coil assembly and a movable magnetic core. Linear velocity units of high-coercive-force permanent magnetic cores that induce sizeable dc voltages while moving concentrically within shielded coils; the voltage varies linearly with the core velocity (Sanborn Co.).

**line art** — A computer-drawn graphic (without halftones) that can be clearly printed.

**linear taper** — A potentiometer that changes the resistance linearly as it is rotated through its range.

**linear time base** — In a cathode-ray tube, the time base in which the spot moves at a constant speed along the time scale. This type of time base is produced by application of a sawtooth waveform to the horizontal-deflection plates of a cathode-ray tube.

**linear transducer** — 1. A transducer for which the pertinent measures of all the waves concerned are related by a linear function (e.g., a linear algebraic differential

or integral equation). 2. A transducer having its output at any given frequency proportional to the received input.

**linear variable-differential transformer**—See differential transformer.

**linear varying parameter network**—A linear network in which one or more parameters vary with time.

**linear velocity transducer**—A transducer that produces an output signal proportionate to the velocity of single-axis translational motion between two objects.

**line-a-time printing**—A type of computer output in which an entire horizontal row of characters is printed at the same time. *See also* line printer.

**line balance**—1. The degree to which the conductors of a transmission line are alike in their electrical characteristics with respect to each other, other conductors, and ground. 2. Impedance equal to that of the line at all frequencies (e.g., in terminating a two-wire line).

**line-balance converter**—A device used at the end of a coaxial line to isolate the outer conductor from ground.

**line characteristic distortion**—Distortion experienced in teletypewriter transmission when the presence of changing current transitions in the wire circuit affects the lengths of the received signal impulses.

**line circuit**—In a telephone system, the relay equipment associated with each station connected to a dial or manual switchboard. The term is also applied to a circuit for interconnecting an individual telephone and a channel terminal.

**line coordinate**—In a matrix, a symbol (normally at the side) identifying a specific row of cells and, in conjunction with a column coordinate, a specific cell.

**line cord**—Also called a power cord. A two-wire cord terminating in a two-prong plug at the end that goes to the supply, and connected permanently into a radio receiver or other appliance at the other end.

**line-cord resistor**—An asbestos-enclosed, wire-wound resistance element incorporated into a line cord along with the two regular wires. It lowers the line voltage to the correct value for the series-connected tube filaments and pilot lamps of a universal ac/dc receiver.

**line diffuser**—A circuit used to produce small vertical oscillations of the spot on the screen of a television monitor or receiver to make the line structure of the image less noticeable to an observer close to the screen.

**line driver**—1. An integrated circuit designed for transmitting logic information through long lines (normally at least several feet in length). 2. A buffer circuit with special characteristics (i.e., high current and/or low impedance) suitable for driving logic lines longer than normal interconnection length (greater than a few feet). It may have complementary (push-pull) outputs to work with the differential inputs of a line receiver. *See* line receiver. 3. A signal converter that conditions a digital signal to ensure reliable transmission over an extended distance.

## linear variable-differential transformer — line fonts

**line drop**—A voltage loss occurring between any two points in a power or transmission line. Such a loss, or drop, is due to the resistance, reactance, or leakage of the line. An example is the voltage drop between a power source and load when the line supplying the power has excessive resistance for the amount of current.

**line-drop signal**—A signal associated with a subscriber line on a manual switchboard.

**line-drop voltmeter compensator**—A device using a voltmeter to enable it to indicate the voltage at some distant point in the circuit.

**line equalizer**—An inductance and/or capacitance inserted into a transmission line to correct its frequency-response characteristics.

**line-equipment balancing network**—A hybrid network designed to balance filters, composite sets, and other line equipment.

**line-fault protection**—A means of eliminating or reducing the effects of faults that occur on a transmission line such as a telephone circuit. Such faults include momentary losses of transmission due to signal outages and high noise levels.

**line feed**—*See* line advance.

**line fill**—The ratio of the number of main telephone stations connected to a line to the nominal main-station capacity of the same line.

**line filter**—1. A device containing one or more inductors and capacitors. It is inserted between a transmitter, receiver, or appliance and the power line to block noise signals. In a radio receiver, it prevents power-line noise signals from entering the receiver. In other appliances it prevents their own electrical noises from entering the power line. 2. A filter associated with a transmission line. In some applications, line filter may imply a filter used to separate the speech frequencies. In other applications, it may imply directional separation, etc.

**line-filter balance**—A network designed to maintain phantom-group balance when one side of the group is equipped with a carrier system. Since the network must balance the phantom group for voice frequencies only, its configuration is much simpler than the filter it balances.

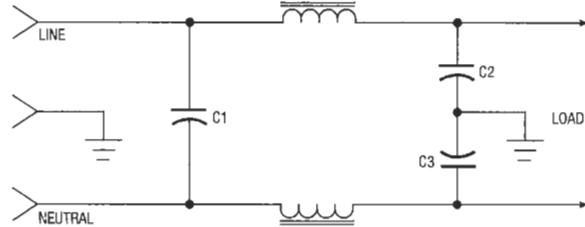
**linewriter**—1. A switching mechanism that locates a calling telephone line among a group and connects it to a trunk, selector, or connector. 2. An electromechanical device that automatically line-feeds the platen of a printer to a predetermined line on a printed form.

**linewriter shelf**—A group (usually 20) of linewriters with the equipment required for routing the dial pulses from any of its associated calling telephones to a selector or connector.

**linewriter switch**—In a telephone system, an automatic switch for seizing the selector apparatus that provides the dial tone transmitted to the calling party.

**line-focus tube**—An X-ray tube in which the focal spot is roughly a line.

**line fonts**—Repetitive pattern used to give meaning to a line, e.g., solid, dashed, dotted, etc.



Line filter.

**line frequency**—Also called horizontal line frequency or horizontal frequency. 1. In television, the number of times per second the scanning spot crosses a fixed vertical line in the picture in one direction, including vertical-return intervals. 2. The nominal operating frequency of the power-line voltage used to supply operating power to instruments or equipment.

**line-frequency regulation**—The change in output (current voltage or power) of a regulated power supply for a specified change in line frequency.

**line group**—The frequency spectrum occupied by a group of carrier channels as they are applied to a transmission facility.

**line hit**—An electrical interference causing the introduction of spurious signals on a circuit.

**line hydrophone**—A directional hydrophone consisting of a single straight-line element, an array of adjacent electroacoustic transducing elements in a straight line, or the acoustic equivalent of such an array.

**line impedance**—The impedance measured across the terminals of a transmission line.

**line input**—Input channel of an amplifier designed to accept signal at a given level from a line at a specific impedance, usually 600 ohms.

**line interlace**—See interlaced scanning.

**line leakage**—Resistance existing through the insulation between the two wires of a telephone-line loop.

**line lengthener**—A device for altering the electrical length of a waveguide or transmission line, but not its physical length or other electrical characteristics.

**line level**—1. The level of a signal at a certain point on a transmission line. Usually expressed in decibels. 2. Based roughly on the "standardized" signal intensity sent over a telephone line, this term refers to any audio signal having a maximum intensity of between  $\frac{1}{2}$  and  $1\frac{1}{2}$  volts. Typically, this is the signal level put out by audio components that do not require preamplification (tuners, for instance).

**line load**—Usually a percentage of maximum circuit capability to reflect actual use during a period of time (e.g., peak-hour line load).

**line loop**—An operation performed over a communication line from an input unit at one terminal to output units at a remote terminal.

**line loop resistance**—Also called loop resistance. The metallic resistance of the pair of line wires that extend from a subscriber's telephone to the central office (does not include the resistance of the telephone).

**line loss**—The total of the various energy losses in a transmission line.

**line microphone**—A directional microphone consisting of a single straight-line element, an array of adjacent electroacoustic transducing elements in a straight line, or the acoustical equivalent of such an array.

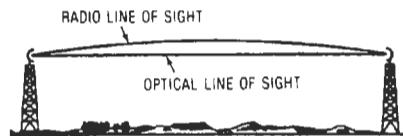
**line noise**—Noise originating in a transmission line.

**line of force**—1. Used in the description of an electric or magnetic field to represent the force starting from a positive charge and ending on a negative charge. 2. In an electric or magnetic field, an imaginary line in the same direction as the field intensity at each point. Sometimes called a maxwell when used as a unit of magnetic flux.

**line of propagation**—The path over which a radio wave travels through space.

**line of sight**—1. The distance to the horizon from an elevated point, including the effects of atmospheric refraction. The line-of-sight distance for an antenna at zero height is zero. 2. A straight line between an observer or radar antenna and a target. 3. An unobstructed, or optical, path between two points. 4. The radio-propagation

characteristic of a microwave. 5. The optical axis of a telescope or other observation system. The straight line connecting the object and the objective lens of the viewing device.



*Line of sight, 3.*

**line-of-sight coverage**—The maximum distance for transmission above the highest usable frequency. Radio waves at those frequencies do not follow the curvature of the earth and are not reflected from the ionosphere, but go off into space and are lost.

**line-of-sight stabilization**—In shipboard or airborne radar, compensating for the roll and pitch by automatically changing the elevation of the antenna in order to keep the beam pointed at the horizon.

**line of travel**—The path followed by an electromagnetic wave from one point to another.

**line oscillator**—An oscillator in which the resonant circuit is a section of transmission line an integral number of quarter wavelengths in electrical length.

**line output**—Output channel of an amplifier designed to deliver signal at a given level to a line at a specific impedance, usually 600 ohms.

**line pad**—In radio broadcasting, a pad inserted between the final program amplifier and the transmitter to ensure a constant load on the amplifier.

**line printer**—1. In computers, a high-speed printer that produces an entire line at one time. All characters of the alphabet are contained around the rim of a continuously rotated disc, and there are as many discs as there are characters in the line. The computer momentarily stops the discs at the right characters for each line, and stamps out an impression in a fraction of a second. 2. A high-speed printer capable of printing simultaneously a complete line (80 to 120 characters) at once. It is capable of printing as many as 3000 lines a minute.

**line protocol**—1. A set of rules used to organize and control the flow of information between two or more stations connected by a common transmission facility. 2. A control program used to perform data-communication functions over network lines. Consists of both handshaking and line-control functions that move the data between transmit and receive locations.

**line pulsing**—A method of pulsing a transmitter by charging an artificial line over a relatively long period, and then discharging it through the transmitter tubes at a shorter interval determined by the line characteristics.

**line radiator**—A speaker enclosure that has several speakers arranged in a straight line to achieve a specific directional pattern.

**line receiver**—1. A circuit to receive signals from a line, usually driven by a line driver and having features such as differential input, Schmitt trigger, and the like. 2. Used in conjunction with a line driver to detect signals at the receiving end of a long line. *See also* line driver.

**line regulation**—1. The change in output (current, voltage, or power) of a regulated power supply for a specified change in line voltage. It may be stated as a percentage of the specified output and/or as an absolute value. 2. Percent change in output voltage at constant

junction temperature for a specified change in input voltage. This determines output accuracy of a regulator for changes in input voltage. 3. The maximum deviation of the output voltage of power supply in percent as the input voltage is varied from nominal to high line and nominal to low line. Output load and ambient temperature are held constant.

**line relay**—A relay activated by the signals on a line.

**line sensor**—A sensor with a detection zone that approximates a line or series of lines, such as a photoelectric sensor that senses a direct or reflected light beam.

**line-sequential color-television system**—A color-television system in which the individual lines of green, red, and blue are scanned in sequence rather than simultaneously.

**line side**—1. The contacts or terminals of an electrical device, designed to be connected to a conductor carrying line voltage from the source; the input side. 2. The side of equipment that "looks" toward the transmission path.

**lines of force**—In electric and magnetic fields, the electric and magnetic forces of repulsion or attraction, which are taken to follow certain imaginary lines radiating from the electric charge or the magnetic pole. (It is assumed that any unit electric charge or unit magnetic pole placed in the appropriate field will be acted upon so as to move in the direction of these imaginary lines.)

**line spectra**—Spectra that originate from atoms; they are composed of lines having irregular spacing and intensity.

**line spectrum**—The spectrum of a periodic, discrete signal consisting of one or more frequencies. For example, a square wave is characterized by a fundamental and odd-order harmonics.

**line speed**—1. The maximum rate at which signals may be sent over a given channel, usually expressed in bauds or in bits per second. 2. The rate at which text is transmitted over a line, expressed in bits per second.

**line splitter**—An active or passive device that divides a signal into two or more signals that contain all of the original information. A passive splitter feeds an attenuated version of the input signal to the output ports. An active splitter amplifies the input signal to overcome the splitter loss.

**line-stabilized oscillator**—An oscillator in which the frequency is controlled by using one section of a line as a sharply selective circuit.

**line stretcher**—1. A section of rigid coaxial line with telescoping inner and outer conductors that permit the section to be conveniently lengthened or shortened. 2. See line amplifier, 2.

**line supervision**—A means of determining that a transmission line is functional. Electronic protection of an alarm line accomplished by sending a continuous or coded signal through the circuit. A change in the circuit characteristics, such as a change in impedance due to the circuit's having been tampered with, will be detected by a monitor. The monitor initiates an alarm if the change exceeds a predetermined amount.

**line switcher**—Direct-current power supply that directly converts the ac line voltage to a lower dc value using switching techniques. Line switchers are highly efficient, but require care to contain electrical noise.

**line switching**—Also called circuit switching. A communications switching system that completes a circuit from sender to receiver at the time of transmission, as opposed to message switching.

**line transformer**—A transformer inserted into a system for such purposes as isolation, impedance matching, or additional circuit derivation.

**line triggering**—Triggering from the power-line frequency.

**line unit**—An electric device used in sending, receiving, and controlling the impulses of a teletypewriter.

**line voltage**—1. The voltage existing in a cable or circuit, such as at a wall outlet or other terminals of a power line system. The line voltage is usually between 115 and 120 volts, with 117 as an average, but may vary at times as much as 5 volts above or below the 115- and 120-volt limits. It is also the voltage existing in a cable or circuit. 2. The voltage supplied by an electrical power line or source, measured at the point of supply or sometimes at the point of utilization.

**line-voltage regulator**—A device that counteracts variations in the power-line voltage and delivers a constant voltage to the connected load.

**line voltage transient protection**—A device, or circuit, generally located on the line side of the control, that will divert or dissipate the energy contained in an abnormal line voltage spike. The purpose of this is to prevent possible control damage, especially to solid-state components, as a result of excessive voltage surges.

**linguistic**—Pertaining to language or its study, including its origin, structure, phonetics, etc.

**linguistic variable**—Common-language terms used to describe a fuzzy set, such as "hot," "slow," "very cold," or "medium."

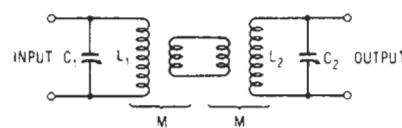
**link**—1. A transmitter-receiver system connecting two locations. 2. In a digital computer, the part of a subprogram that connects it with the main program. 3. An interconnection. 4. In automatic switching, a path between two units of switching apparatus within a central office. See channel. 5. A communication channel between two adjacent signaling points that provides a path for messages to travel. 6. To connect two elements in a data structure by using index variables or pointer variables.

**linkage**—1. A measure of the voltage that will be induced in a circuit by magnetic flux. It is equal to the flux times the number of turns linked by the flux. 2. A mechanical arrangement for transferring motion in a desired manner. It consists of solid pieces with movable joints. 3. In a computer, a technique used to provide interconnections for entry and exit of a closed subroutine to or from the main routine. 4. The instructions that connect one program to another, providing continuity of execution between the programs.

**link blowing**—An IC trimming technique that involves passing current pulses through points on the chip to open interconnection links between parallel resistors.

**link circuit**—A closed loop used for coupling purposes. It generally consists of two coils, each having a few turns of wire, connected by a twisted pair of wires or by other means, with each coil placed over, near, or in one of the two coils to be coupled.

**link coupling**—Inductive coupling between circuits. A coil in one circuit acts as the primary, and a coil in the second circuit as the secondary.



Link coupling.

**linked list**—A list formed by tying together (with pointers) several items on a disk.

**linker**—1. A program that connects small sections of a program together so they can run as a whole. 2. A utility program that ties different software modules into one entity.

**link fuse**—An unprotected fuse consisting of a short, bare wire between two fastenings.

**linking loader**—1. A computer program that takes program segments and places them one after the other in memory, adjusting jump and call instruction locations to match the new placement in the memory. 2. A routine that combines program segments and reassigns addresses to reflect the new memory locations. 3. A relocatable loader that links various object modules into a single load module, resolving external references in the process. This lets users load their programs into any memory area.

**link neutralization**—Neutralization of a tuned radio-frequency amplifier by means of an inductive coupling loop from the output to the input.

**link transmitter**—In broadcasting, a booster for a remote pickup or from a studio to main transmitter.

**lin-log receiver**—A radar receiver in which the amplitude response is linear for small-amplitude signals and logarithmic for large ones.

**LiON**—Abbreviation for lithium-ion.

**lip microphone**—A sensitive microphone that is placed in contact with the lip.

**liquid-borne noise**—Undesired sound characterized by fluctuations of pressure of a liquid about the static pressure as a mean.

**liquid cooling**—The use of a circulating liquid to cool components or equipment that heat up during operation.

**liquid-core fiber**—An optical fiber consisting of optical glass, quartz, or silica tubing filled with a higher-refractive-index liquid, such as tetrachloroethylene.

**liquid-core optical fibers**—Multimode straight fibers capable of transporting linearly polarized light with any incident polarization angle, and in which no form of internal stress can develop that could lead to birefringence.

**liquid-crystal display**—*See LCD.*

**liquid crystals**—Liquids that are doubly refracting and that display interference patterns in polarized light.

**liquid-filled capacitor**—A capacitor in which a liquid impregnant occupies substantially all of the case volume not required by the capacitor element and its connections. Space may be allowed for the expansion of the liquid under temperature variations.

**liquid fuse unit**—A fuse unit in which the fuse link is immersed in a liquid or the arc is drawn into the liquid when the fuse link melts.

**liquid-impregnated capacitor**—A capacitor in which a liquid impregnant is dominantly contained with the foil and paper winding, but does not occupy substantially all of the case volume not required by the capacitor element and its connections.

**liquid laser**—1. A laser in which the active material is in the liquid state. Present types employ a chelated rare-earth ion dissolved in an organic liquid. 2. A laser whose active medium is in liquid form, such as organic dye and inorganic solutions. Dye lasers are commercially available; they are often called organic dye or tunable dye lasers.

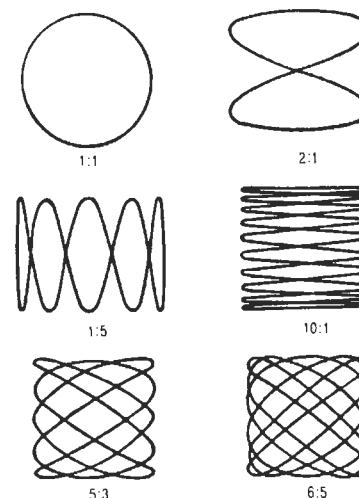
**liquid rheostat**—A rheostat consisting of metal plates immersed in a conductive liquid. The resistance is changed by raising or lowering the plates or the liquid level to vary the area of the plates contacting the liquid.

**liquidus**—The lowest temperature at which a metal or alloy is completely liquid.

**liser**—A microwave oscillator of very high spectrum purity. Its emission consists of right circularly polarized waves of two different cavity resonant frequencies.

**LISP**—Acronym for list processing. A high-level programming language used primarily for list processing, symbol manipulation, and recursive operations; it can handle many different data types, treat programs as data, and provide for the self-modification of the program as it is executing; generally considered a difficult language to learn.

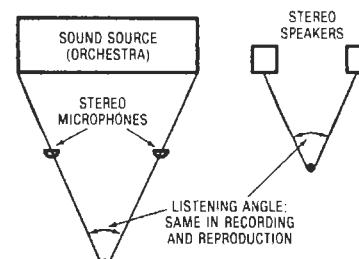
**Lissajous figures**—Patterns produced on the screen of a cathode-ray tube when sine-wave signal voltages of various amplitude and phase relationships are applied to the horizontal- and vertical-deflection circuits simultaneously.



*Lissajous figures.*

**list**—Also called a chained or threaded list. A data structure in which each item of information has attached to it one or more links or pointers that refer to other items.

**listening angle**—The enclosed angle between the listener and the two speakers of a stereo reproducing system.



*Listening angle.*

**listening post**—The receiving terminus in a bugging or tapping operation. It may consist of recording equipment or a human operator or a combination of both.

**listening sonar**—*See sonar.*

**list-processing language**—A programming language that is widely used in artificial-intelligence research to manipulate categories or lists of items.

**lithium**—An alkali metal used in the construction of photocells and batteries.

**lithium chloride sensor**—Also called Dunmore cell. A hygroscopic element that has fast response, high accuracy, and good long-term stability and whose resistance is a function of relative humidity.

**lithium-ion**—Abbreviated LiON. A rechargeable battery technology that is able to produce considerably more charge than comparable size nickel-cadmium or nickel-metal hydride batteries.

**lithography**—A method of defining patterns for semiconductor device processing. Patterns are most frequently produced in thin films of materials called resists, which then resist a subsequent processing step being applied to an underlying material in accordance with that pattern. In typical semiconductor integrated-circuit fabrication, many different patterns are used to delineate features in a sequence of processing steps.

**litz wire**—Also called Litzendraht wire. A conductor composed of a number of fine, separately insulated strands that are woven together so that each strand successively takes up all possible positions in the cross section of the entire conductor. Litz wire gives reduced skin effect, hence, lower resistance to high-frequency currents.

**live**—1. A term applied to a circuit through which current is flowing. 2. Connected to a source of an electrical voltage. 3. Charged to an electrical potential different from that of the earth. 4. Reverberant, as a room in which there are reflections of sound. 5. A program that is transmitted as it happens, with no delay.

**live cable test cap**—A protective cap placed over the end of a cable to insulate the cable and seal its sheath.

**live end**—The end of a radio studio where the reflection of sound is greatest.

**live parts**—Metallic portions of equipment that are at a potential different from that of the earth.

**live room**—A room with a minimum of sound-absorptive material, such as drapes, upholstered furniture, rugs, etc. Because of the many reflecting surfaces, any sound produced in the room will have a long reverberation time.

**LLTV**—Also LLLTV and L<sup>3</sup>TV. Abbreviation for low-light television and low-light-level television. A CCTV system capable of operating with scene illumination less than 0.5 lumen/ft<sup>2</sup>.

**LNA**—See low-noise amplifier.

**LNB**—Abbreviation for low-noise block downconverter. A microwave amplifier that converts a block of frequencies to a lower frequency. LNBs for satellite TV typically convert C- and Ku-band signals to a frequency band of 950 to 1450 MHz for input to the receiver.

**LNC**—See low-noise converter.

**L-network**—A network composed of two impedance branches in series. The free ends are connected to one pair of terminals, and the junction point and one free end are connected to another pair.

**LO**—See local oscillator.

**load**—1. The power consumed by a machine or circuit in performing its function. 2. A resistor or other impedance that can replace some circuit element. 3. The power delivered by a machine. 4. A device that absorbs power and converts it into the desired form. 5. The impedance to which energy is being supplied. 6. Also called work. The material heated by a dielectric or induction heater. 7. In a computer, to fill the internal storage with information obtained from auxiliary or external storage. 8. The resistance or impedance that the input of one device offers to the output of another device to which it is connected. See input impedance; termination. 1. 9. The circuit or transducer (e.g., speaker)

## **lithium — loaded applicator impedance**

connected to the output of an amplifier. The source (e.g., pickup) is loaded by the amplifier's input impedance. 10. The electrical demand placed on a circuit or a system by the utilization equipment connected to it. Also, any piece of electrical utilization equipment of any given rating so connected. 11. To feed a program into a computer system. A common means of loading the program is via a form of magnetic media. The media is inserted into the media drive and the program read into the system's memory.

**load and go**—In a computer, an operation and compiling technique in which the pseudo language is converted directly to machine language and the program is then run without the creation of an output machine-language program.

**load balance**—See load division.

**loadbreak connector**—A connector designed to close and interrupt current on energized circuits.

**load cell**—1. Transducer that measures an applied load by a change in its properties, such as a change in resistance (strain-gage load cell), pressure (hydraulic load cell), etc. 2. A device that produces an output signal proportional to the applied weight or force.

**load circuit**—The complete circuit required to transfer power from a source to a load (e.g., an electron tube).

**load-circuit efficiency**—In a load circuit, the ratio between its input power and the power it delivers to the load.

**load-circuit power input**—The power delivered to the load circuit. It is the product of the alternating component of the voltage across the load circuit and the current passing through it (both root-mean-square values), times their power factor.

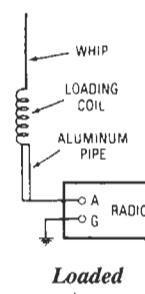
**load coil**—Also called a work coil. In induction heaters, a coil that, when energized with an alternating current, induces energy into the item being heated.

**load curve**—A curve of power versus time—i.e., the value of a specified load for each unit of the period covered.

**load divider**—A device for distributing power.

**load division**—Also called load balance. A control function that divides the load in a prescribed manner between two or more power sources supplying the same load.

**loaded antenna**—1. An antenna to which extra inductance or capacitance has been added to change its electrical (but not its physical) length. 2. An antenna employing a loading coil at its base or above its base to achieve the required electrical length using physically shorter elements.



**Loaded antenna.**

**loaded applicator impedance**—In dielectric heating, the complex impedance measured at the point of application with the load material properly positioned for heating and at the specified frequency.

**loaded impedance** — In a transducer, the impedance at the input when the output is connected to its normal load.

**loaded line** — 1. A telephone line equipped with loading coils to add inductance in order to minimize amplitude distortion. 2. A transmission line that has lumped elements (inductance or capacitance) added at uniformly spaced intervals. Loading is used to provide a given set of characteristics to a transmission line.

**loaded motional impedance** — *See* motional impedance.

**loaded Q** — Also called the working *Q*. 1. The *Q* of an electric impedance when coupled or connected under working conditions. 2. In bandpass filters, a quantity that defines the percentages of 3-dB bandwidths. Numerically, it is equal to the center frequency divided by the 3-dB bandwidth.

**loader** — 1. A program in a minicomputer that takes a program from some input or storage device and places it in memory at some address. Programs loaded by a loader are then ready to run. 2. A program that places a binary (machine language) program into successive core memory locations for execution. Some can replace relocatable addresses with absolute addresses. 3. A program that accepts input from an external device and places it in memory. The simplest loaders do no more than this. Other loaders include relocating loaders, linking loaders, and bootstrap loaders. 5. A program that controls peripheral device operation when reading programs for execution into system memory. 6. A program that transfers the object program from an external medium, such as paper tape, to the microcomputer random-access memory. Some loaders also convert a relocatable version of the object program to a loadable version. A program might originally be assembled to reside in the microcomputer memory starting at address zero. If the compiler or assembler has allowed the object program to be relocatable, the programmer can specify to the loader the program's new base address and the loader will modify all addresses accordingly in the object program. Another feature that is sometimes available is linkage editing, which establishes the linkages between different object programs that make reference to one another. Linkage editing requires both a compiler or assembler and a loader program that can communicate the appropriate information.

**load factor** — The ratio of average power demand, over a stipulated period of time, to the peak or maximum demand for that same interval.

**load impedance** — The impedance that the load presents to a transducer.

**loading** — 1. In communication practice, the insertion of reactance into a circuit to improve its transmission characteristics. 2. Placing some material at the front or rear of a speaker so as to change its acoustic impedance and thus alter its radiation pattern.

**loading coil** — An inductor inserted into a circuit to increase its inductance and thereby improve its transmission characteristics.

**loading-coil spacing** — The line distance between the successive loading coils of a line.

**loading disc** — A metal disc placed on top of a vertical antenna to increase its natural wavelength.

**loading error** — The error introduced when more than negligible current is drawn from the output of a device.

**loading factor** — A number that represents the relative capacity of a gate for driving other gates or the relative load presented by a gate to the gate that drives it.

**loading noise** — Any unwanted signal caused by fluctuating contact resistance between the slider and the wire or film in a potentiometric transducer when current is drawn from the instrument.

**loading routine** — In a computer, a routine that, when in the memory, is able to read other information into the memory from external devices, tape, etc.

**load isolator** — A waveguide or coaxial device (usually ferrite) that provides a good energy path from a signal source to a load, but provides a poor energy path for reflections from a mismatched load back to the signal source.

**load life** — The ability of a device to withstand its full power rating over an extended period of time, usually expressed in hours.

**load line** — 1. A straight line drawn across a series of plate-current plate-voltage characteristic curves on a graph to show how plate current changes with grid voltage when a specified plate-load resistance is used. 2. A line drawn on the collector characteristic curves of a transistor on which the operating point of the transistor moves as the collector current changes. Called a load line because the slope of the line depends on the value of the collector load resistance. 3. The line used to locate the operating point of the permanent magnet on the demagnetization curve. The slope of the shearing line is equal to the permeance coefficient.

**load matching** — In induction and dielectric heaters, adjustment of the load-circuit impedance so that the desired energy will be transferred from the power source to the load.

**load-matching network** — An electrical impedance network inserted between the source and the load to provide for maximum transfer of energy.

**load-matching switch** — In induction and dielectric heaters, a switch used in the load-matching network to alter its characteristics and thereby compensate for a sudden change in the load characteristics (such as in passing through the Curie point).

**load mode** — In some variable-word-length computers, data transmission in which certain delimiters are moved with the data (in contrast with move mode).

**load point** — Sometimes called BOT (beginning of tape). The point on a magnetic tape at which writing and reading begin. It is indicated by a reflective marker placed on the tape.

**load regulation** — 1. For a constant-current supply, the change in the steady-state value of the output dc current due to a change in load resistance from a short-circuit current (zero resistance) to a value that results in the maximum rated output voltage. 2. For a constant-voltage supply, the change in the steady-state value of the output dc voltage due to a change in load resistance from an open-circuit condition (infinite resistance) to a value that results in the maximum rated output current. 3. The maximum deviation of the output voltage of a power supply in percent as the load is changed from minimum to maximum rated load. Input voltage is nominal value and ambient temperature is constant.

**load resistor** — A resistor connected in parallel with a high-impedance load so that the output circuit driving the load can provide at least the minimum current required for proper operation.

**load sharing** — A scheduling technique in multiprocessor systems whereby a task is executed by the next available processor. In order to make this technique operate successfully, all processors must be identical and have identical memory addressing capabilities.

**load side** — The contacts or terminals of an electrical device designed to be connected to conductors carrying voltage away from the device to the utilization equipment, or load, or another device; the output side.

**loadstone** — *See* lodestone.