Course Title

Computer Fundamentals and Troubleshooting

UNIT-I

Introduction to computer hardware and software

- # Introduction to hardware peripherals:

1. RAM :-

RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased. Access time in RAM is independent of the address, that is, each storage location inside the memory is as easy to reach as other locations and takes the same amount of time.

RAM is of two types –

• Static RAM (SRAM)

• Dynamic RAM (DRAM)

Static RAM(SRAM)

Characteristic of Static RAM

• Long life

• No need to refresh

• Faster

• Used as cache memory

• Large size

• Expensive

• High power consumption

Dynamic RAM (DRAM)

Characteristics of Dynamic RAM

• Short data lifetime

• Needs to be refreshed continuously

• Slower as compared to SRAM

• Used as RAM

• Smaller in size

• Less expensive

• Less power consumption

2. ROM :-

ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is nonvolatile. The information is stored permanently in such

memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.

Let us now discuss the various types of ROMs and their characteristics.

MROM (Masked ROM)

The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kind of ROMs are known as masked ROMs, which are inexpensive.

PROM (Programmable Read Only Memory)

PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip, there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

EPROM (Erasable and Programmable Read Only Memory)

EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Usually, an EPROM eraser achieves this function. During programming, an electrical charge is trapped in an insulated gate region.

EEPROM (Electrically Erasable and Programmable Read Only Memory)

EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (millisecond). In EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of reprogramming is flexible but slow.

Advantages of ROM

The advantages of ROM are as follows −

• Non-volatile in nature

• Cannot be accidentally changed

• Cheaper than RAMs

• Easy to test

• More reliable than RAMs

• Static and do not require refreshing

• Contents are always known and can be verified Differences between RAM and ROM

Different	RAM	ROM
Working type	Data stored in RAM can be retrieved and altered.	Data stored in ROM can only be read.
Use	Used to store the data that has to be currently processed by CPU temporarily.	It stores the instructions required during bootstrap of the computer.
Speed	It is a high-speed memory.	It is much slower than the RAM.

CPU Interaction	The CPU can access the data stored on it.	The CPU can not access the data stored on it unless the data is stored in RAM.
Size and Capacity	Large size with higher capacity.	Small size with less capacity.
Used as/in	CPU Cache, Primary memory.	Firmware, Micro-controllers
Accessibility	The data stored is easily accessible.	The data stored is not as easily accessible as in RAM.
Cost	Costlier	cheaper than RAM.

3. Keyboard :-

Keyboard is the most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions. Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet. The keys on the keyboard are as follows –

S.No	Keys & Description
1	**Typing Keys** These keys include the letter keys (A-Z) and digit keys (09) which generally give the same layout as that of typewriters.
2	**Numeric Keypad** It is used to enter the numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators.
3	**Function Keys** The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has a unique meaning and is used for some specific purpose.
4	**Control keys** These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).
5	**Special Purpose Keys** Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

• Introduction to Software :-

Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.

There are two types of software −

- System Software
- Application Software

A. System Software

The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software is generally prepared by the computer manufacturers. These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users. Some examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc.

B. Application Software

Application software products are designed to satisfy a particular need of a particular environment. All software applications prepared in the computer lab can come under the category of Application software. Application software may consist of a single program, such as Microsoft's notepad for writing and editing a simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheet package.

a) MS Office :-

Microsoft Office, or simply Office, is a family of client software, server software, and services developed by Microsoft. The first version of Office contained Microsoft Word, Microsoft Excel, and Microsoft PowerPoint. It contains a word processor (Word), a spreadsheet program (Excel) and a presentation program (PowerPoint), an email client (Outlook), a database management system (Access), and a desktop publishing app (Publisher).

b) VLC media player :-

VLC media player (previously the VideoLAN Client and commonly known as simply VLC) is a free and open-source, portable, cross-platform media player software and streaming media server developed by the VideoLAN project. VLC is available for desktop operating systems and mobile platforms, such as Android, iOS and iPadOS. VLC is also available on digital distribution platforms such as Apple's App Store, Google Play, and Microsoft Store. VLC supports many audio- and video-compression-methods and file-formats, including DVD-Video, Video CD, and streaming-protocols. It is able to stream media over computer networks and can transcode multimedia files.

c) Win rar :-

WinRAR is a trialware file archiver utility for Windows, developed by Eugene Roshal of win.rar GmbH. It can create and view archives in RAR or ZIP file formats and unpack numerous archive file formats. To enable the user to test the integrity of archives, WinRAR embeds CRC32 or BLAKE2 checksums for each file in each archive. WinRAR supports creating encrypted, multi-part and self-extracting archives.

• Working of SMPS :-

SMPS (Switch Mode Power Supply) is an electrical device that provides power to electronic devices and circuits. Most electronic devices used in the home or office require low power DC voltage. This led to the development of Switched Mode Power Supply (SMPS). This device converts **High voltage AC to low**

voltage DC. SMPS supplies Power to various system components of the computer, such as the motherboard and device drivers. The main parts of SMPS are Power Connectors, and Power Supply Power connectors provide DC voltage to all system components, and Power Supply Fan is used to keep SMPS fresh.

Switched Mode Power Supply is an electrical device that supplies power to all devices in a computer such as registers or capacitors by efficiently converting power from AC to DC.

First, I go from the cable to the current computer, then first pass through the small device inside the **SMPS**, then first it goes to the AC filter, then they're in the process of filtering the AC of Neutral and Phase. In between NTC, Fuse, line Filter, PF Capacitor is used, its output is given to Rectifier and Filter, which converts it from AC to DC, which was Rectifier, and the filter was with the help of two capacitors. Smooth converts to DC.

The output of this process is Pure DC, and it was given to the switching transistor. Here we use two NPN transistors, which provide one AC output with the help of the switching cycle; we give it another process. For whose name was SM transformer then this was the matter of **PRIMARY CIRCUIT of SMPS.**

This is then given to the Rectifier and Filter once again which converts it to this AC Supply and once again to Smooth DC (one thing to remember is that the current that comes from the transformer in the house is AC And the current in the battery is DC) The output after this action is in three forms, a **12VOLT, 5 VOLT, 3 VOLT**. This is the primary and secondary circuit of SMPS. But the rectifier and filter of the primary circuit would connect with an output starter transformer, and it would connect with the starter, which is connected with another amplifier IC. It has three output wire, the amplifier IC is an area of **SMPS** where there is complete management work. Three significant cables are coming out of the amplifier IC; one is green, which is Power on the wire, the other comes in violet color, which gives stand by the current of +5 volt, and the third one is in gray color which has Power Bood cable Is spoken.

These three output cables are given to the motherboard. The switching transistor and amplifier IC remain connected to a driver and are controlled via the amplifier IC. From the second switching circuit comes a sensing wire, which tells the Amplifier IC that the load is increasing, then at the same time the DRIVER, which increases the SWITCHING Transmitter on-off process, and which keeps getting voltage at a constant speed. Which are + 12volt, + 5volt, and + 3volt, and this process is called switching Mode Power Supply? When the Power of green cable is on, the motherboard gets 12v, 5v, and 3v **SMPS**. Something like this SMPS works.

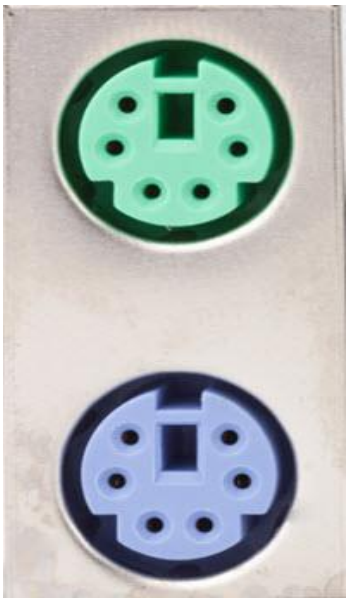
- # Study of Various Port :-

A Computer Port is an interface or a point of connection between the computer and its peripheral devices. Some of the common peripherals are mouse, keyboard, monitor or display unit, printer, speaker, flash drive etc.The main function of a computer port is to act as a point of attachment, where the cable from the peripheral can be plugged in and allows data to flow from and to the device.

Outline

PS/2

PS/2 connector is developed by IBM for connecting mouse and keyboard. It was introduced with IBM's Personal Systems/2 series of computers and hence the name PS/2 connector. PS/2 connectors are color coded as purple for keyboard and green for mouse.



PS/2 is a 6-pin DIN connector. The pin out diagram of a PS/2 female connector is shown below.

Even though the pinout of both mouse and keyboard PS/2 ports are same, computers do not recognize the devise when connected to wrong port.

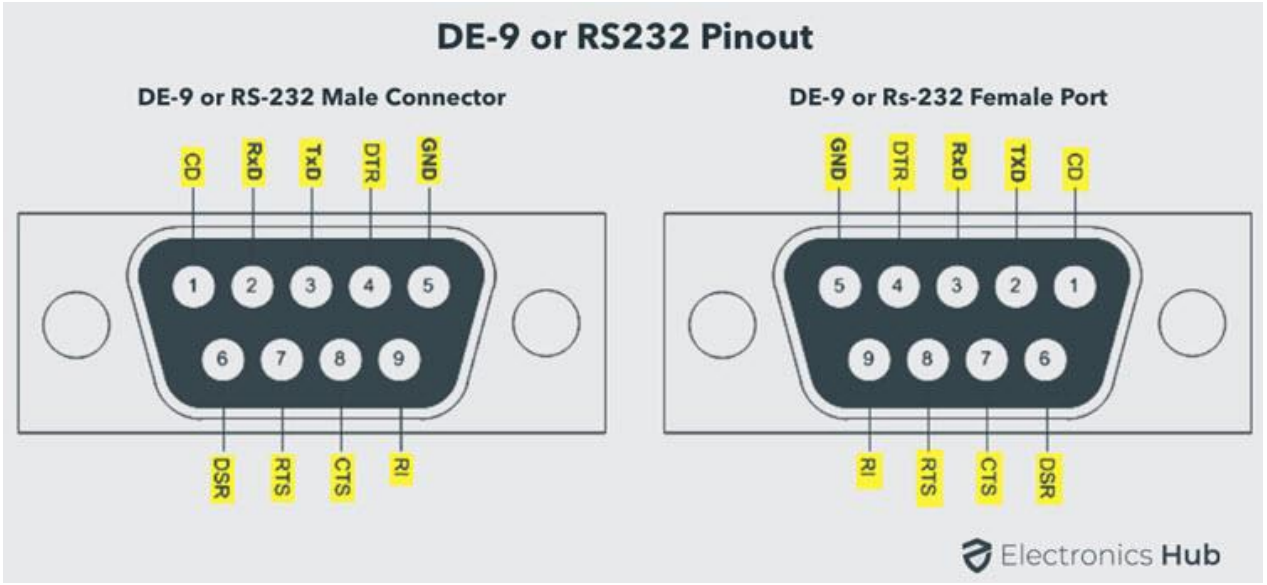
PS/2 port is now considered a legacy port as USB port has superseded it and very few of the modern motherboards include it as a legacy port.

DE-9 or RS-232 or COM Port

DE-9 is the main port for RS-232 serial communication. It is a D-sub connector with E shell and is often miscalled as DB-9. A DE-9 port is also called as a COM port and allows full duplex serial communication between the computer and it's peripheral.

Some of the applications of DE-9 port are serial interface with mouse, keyboard, modem, uninterruptible power supplies (UPS) and other external RS-232 compatible devices.

The pinout diagram of DE-9 port is shown below.



The use of DB-25 and DE-9 ports for communication is in decline and are replaced by USBs or other ports.

Audio Ports

Audio ports are used to connect speakers or other audio output devices with the computer. The audio signals can be either analogue or digital and depending on that the port and its corresponding connector differ.

Surround Sound Connectors or 3.5 mm TRS Connector

It is the most commonly found audio port that can be used to connect stereo headphones or surround sound channels. A 6 connector system is included on majority of computers for audio out as well as a microphone connection.

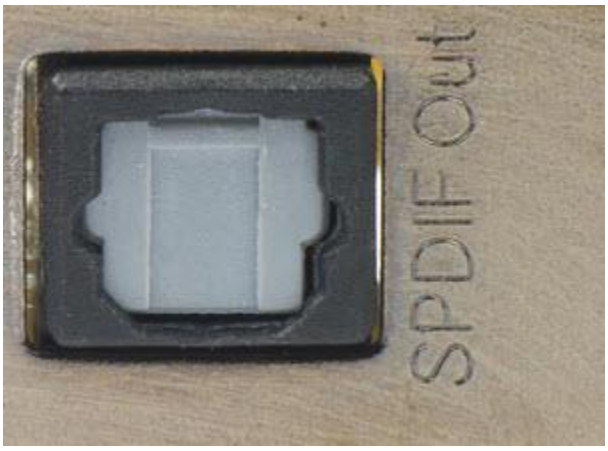
The 6 connectors are color coded as Blue, Lime, Pink, Orange, Black and Grey. These 6 connectors can be used for a surround sound configuration of up to 8 channels.

Port	*2-Channel*	*4-Channel*	*6-Channel*	*8-Channel*
Blue	Line In	Line In	Line In	Line In
Lime	Line Out	Front Speakers	Front Speakers	Front Speakers
Pink	Mic In	Mic In	Mic In	Mic In
Orange			Center/Subwoofer	Center/Subwoofer
Black		Rear Speakers	Rear Speakers	Rear Speakers
Grey				Side Speakers

S/PDIF / TOSLINK

The Sony/Phillips Digital Interface Format (S/PDIF) is an audio interconnect used in home media. It supports digital audio and can be transmitted using a coaxial RCA Audio cable or an optical fiber TOSLINK connector.

Most computers home entertainment systems are equipped with S/PDIF over TOSLINK. TOSLINK (Toshiba Link) is most frequently used digital audio port that can support 7.1 channel surround sound with just one cable. In the following image, the port on the right is an S/PDIF port.



Video Ports

VGA Port

VGA port is found in many computers, projectors, video cards and High Definition TVs. It is a D-sub connector consisting of 15 pins in 3 rows. The connector is called as DE-15.

VGA port is the main interface between computers and older CRT monitors. Even the modern LCD and LED monitors support VGA ports but the picture quality is reduced. VGA carries analogue video signals up to a resolution of 648X480.

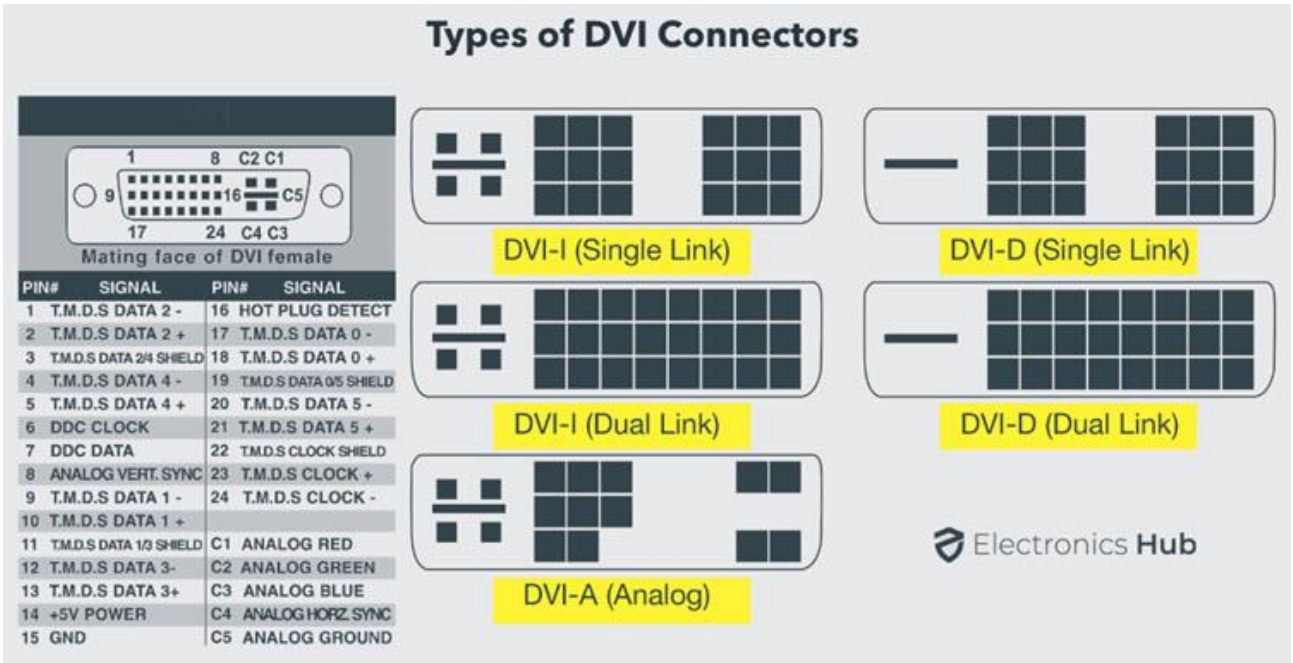
With the increase in use of digital video, VGA ports are gradually being replaced by HDMI and Display Ports. Some laptops are equipped with on-board VGA ports in order to connect to external monitors or projectors. The pinout of a VGA port is shown below.

Digital Video Interface (DVI)

DVI is a high speed digital interface between a display controller like a computer and a display device like a monitor. It was developed with an aim of transmitting lossless digital video signals and replace the analogue VGA technology.

There are three types of DVI connectors based on the signals it can carry: DVI-I, DVI-D and DVI-A. DVI-I is a DVI port with integrated analogue and digital signals. DVI-D supports only digital signals and DVI-A supports only analogue signals.

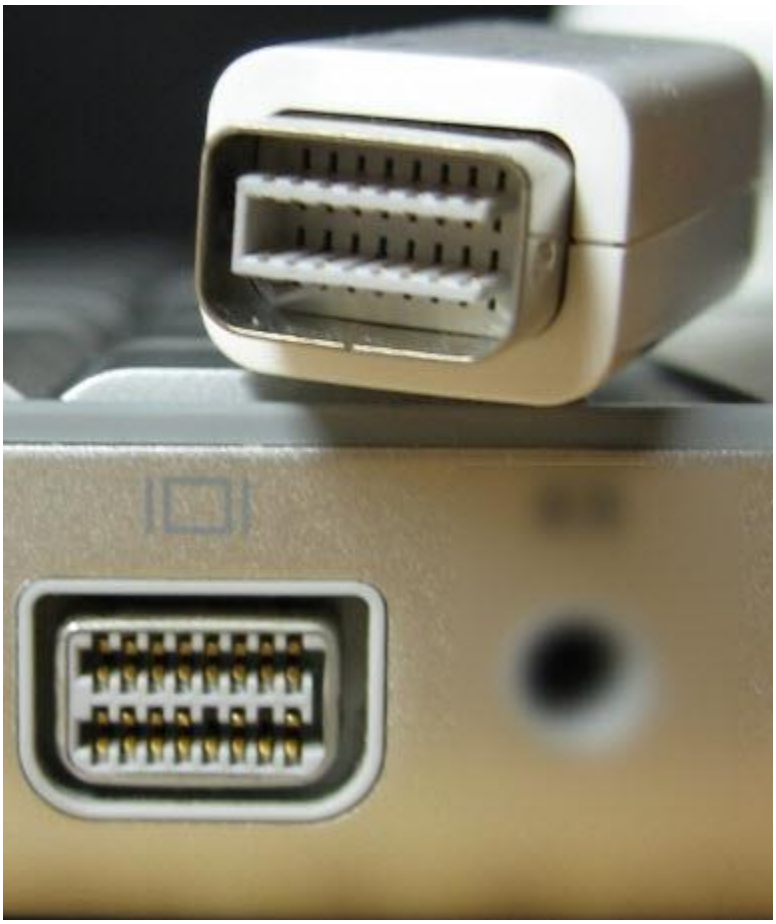
The digital signals can be either single link or dual link where a single link supports a digital signal up to 1920X1080 resolution and a dual link supports a digital signal up to 2560X1600 resolution. The following image compares the structures of DVI-I, DVI-D and DVI-A types along with the pinouts.



Mini-DVI

Mini-DVI port is developed by Apple as an alternative to Mini-VGA port and is physically similar to one. It is smaller than a regular DVI port.

It is a 32 pin port and is capable of transmitting DVI, composite, S-Video and VGA signals with respective adapters. The following image shows a Mini-DVI port and its compatible cable.



Micro-DVI

Micro-DVI port, as the name suggests is physically smaller than Mini-DVI and is capable of transmitting only digital signals.

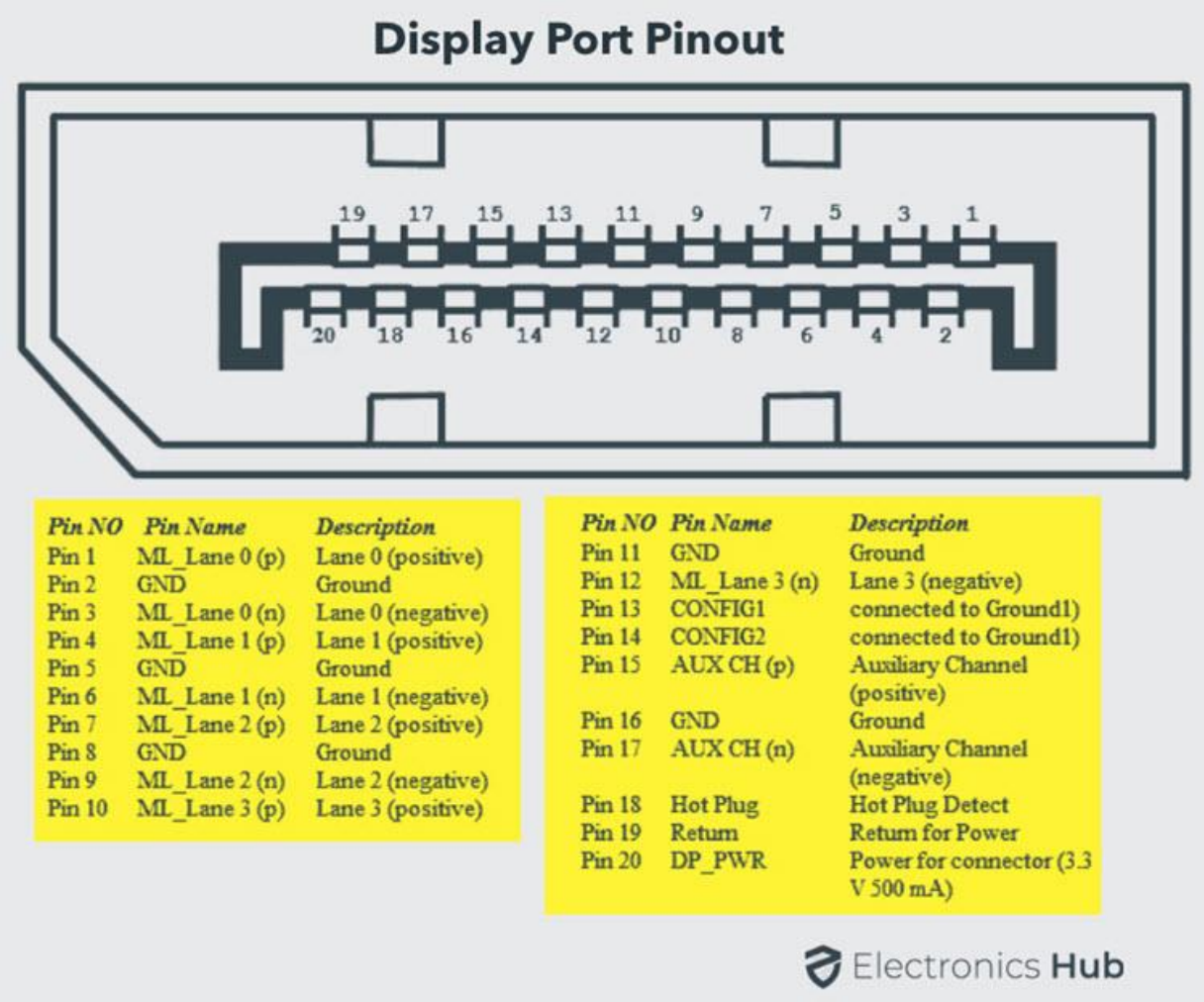
This port can be connected to external devices with DVI and VGA interfaces and respective adapters are required. In the following image, a Micro-DVI port can be seen adjacent to headphone and USB ports.

Display Port

Display Port is a digital display interface with optional multiple channel audio and other forms of data. Display Port is developed with an aim of replacing VGA and DVI ports as the main interface between a computer and monitor.

The latest version DisplayPort 1.3 can handle a resolution up to 7680 X 4320.

The Display Port has a 20 pin connector, which is a very less number when compared to DVI port and offers better resolution. The pin out diagram of a Display Port is shown below.



Update: DisplayPort 1.4a is the latest (in production) version of DisplayPort Specification with support for 4K (3840 x 2160) at 120 Hz or 8K (7680 x 4320) at 60 Hz. An improved DisplayPort version 2.0 specification is released in June of 2019 with an increased bandwidth of 77.37 Gbps (approximately).

Mini Display Port

Apple introduced a miniature version of Display Port and called it Mini Display Port (mDP or Mini DP). Even though Mini Display Port has 20 pins, the physical size of the connector is smaller than a regular Display Port and the pin out is also different.

Most laptops provide Mini Display Port as an additional video out option in addition to HDMI.

RCA Connector

RCA Connector can carry composite video and stereo audio signals over three cables. Composite video transmits analogue video signals and the connector is as yellow colored RCA connector.

The video signals are transmitted over a single channel along with the line and frame synchronization pulses at a maximum resolution of 576i (standard resolution).

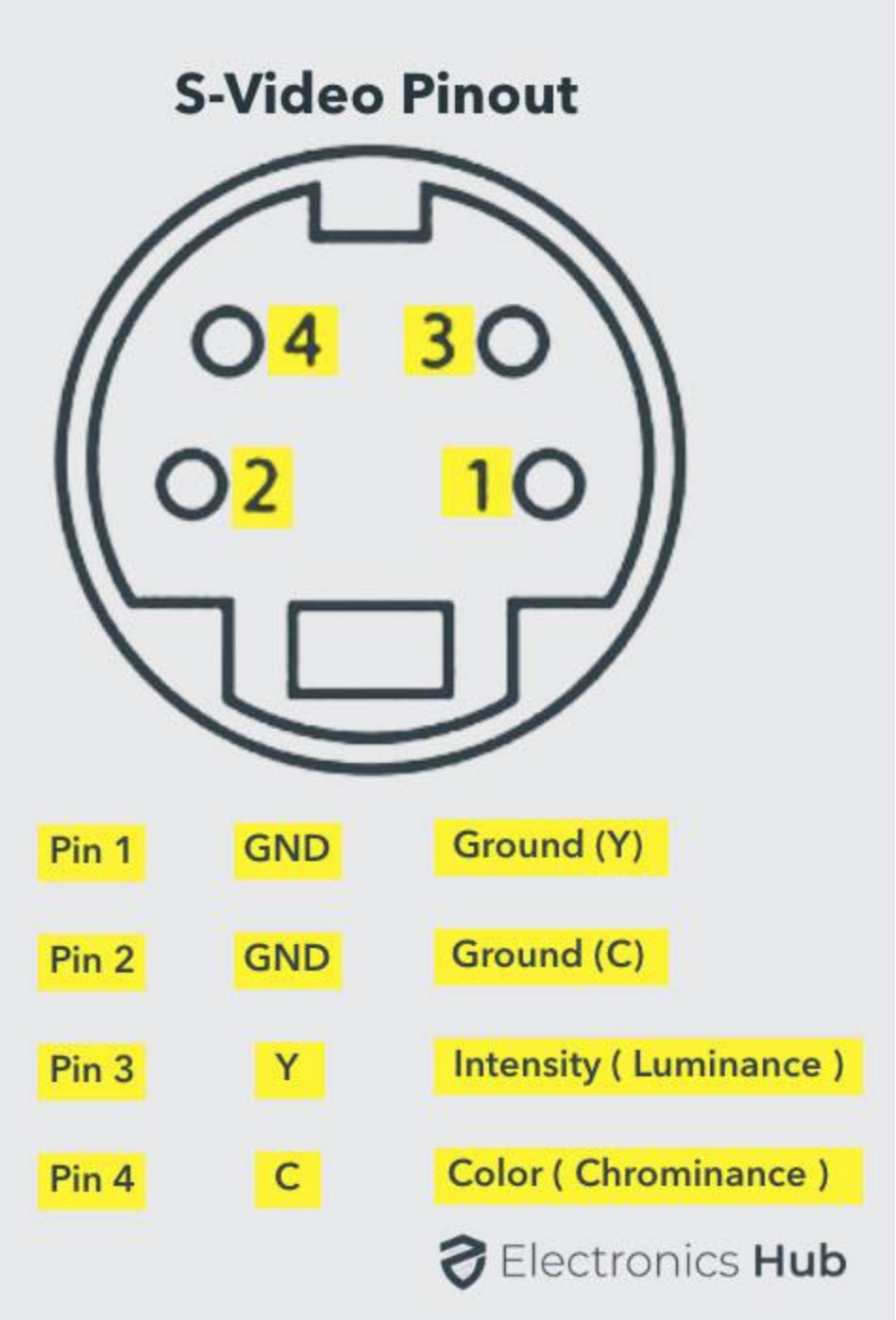
The red and white connectors are used for stereo audio signals (red for right channel and white for left channel).

S-Video

S-Video or Separate Video connector is used for transmitting only video signals. The picture quality is better than that of Composite video but has a lesser resolution than Component video.

The S-Video port is generally black in color and is present on all TVs and most computers. S-Video port looks like a PS/2 port but consists of only 4 pins.

Out of the 4 pins, one pin is used to carry the intensity signals (black and white) and other pin is used to carry color signals. Both these pins have their respective ground pins. The pinout diagram of an S-Video port is shown below.



HDMI

HDMI is an abbreviation of High Definition Media Interface. HDMI is a digital interface to connect High Definition and Ultra High Definition devices like Computer monitors, HDTVs, Blu-Ray players, gaming consoles, High Definition Cameras etc.

HDMI can be used to carry uncompressed video and compressed or uncompressed audio signals. The HDMI port of type A is shown below.

The HDMI connector consists of 19 pins and the latest version of HDMI i.e. HDMI 2.0 can carry digital video signal up to a resolution of 4096×2160 and 32 audio channels. The pinout diagram of an HDMI port is as follows.

USB

Universal Serial Bus (USB) replaced serial ports, parallel ports, PS/2 connectors, game ports and power chargers for portable devices.

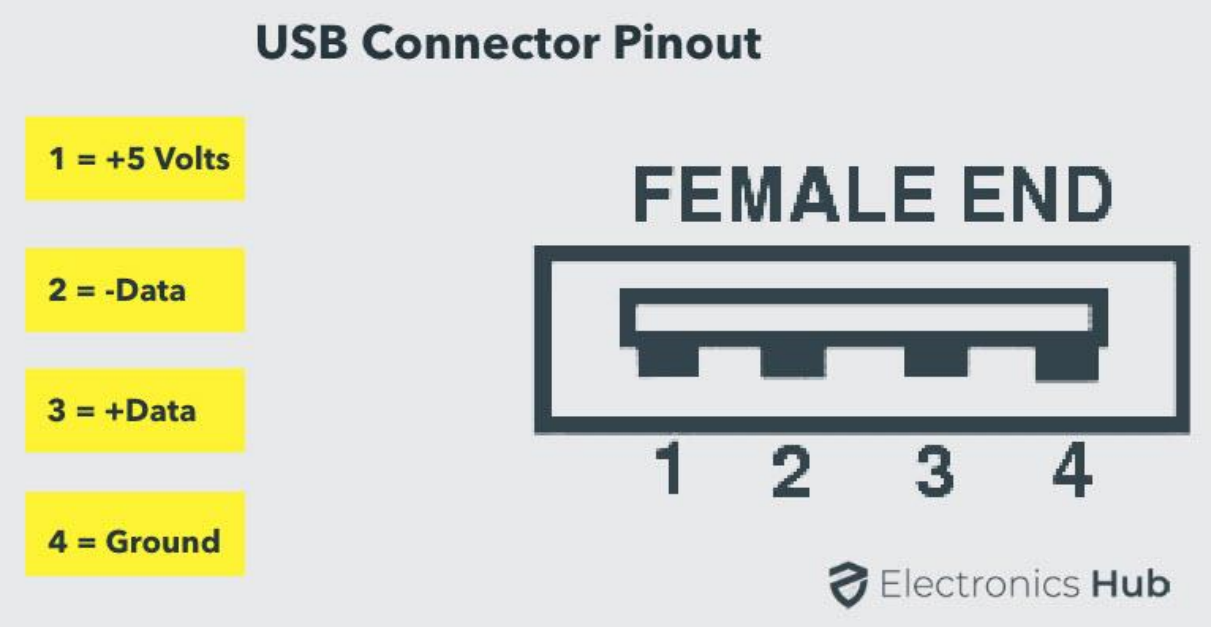
USB port can be used to transfer data, act as an interface for peripherals and even act as power supply for devices connected to it. There are three kinds of USB ports: Type A, Type B or mini USB and Micro USB.

USB Type A

USB Type-A port is a 4 pin connector. There are different versions of Type – A USB ports: USB 1.1, USB 2.0 and USB 3.0. USB 3.0 is the common standard and supports a data rate of 400MBps.

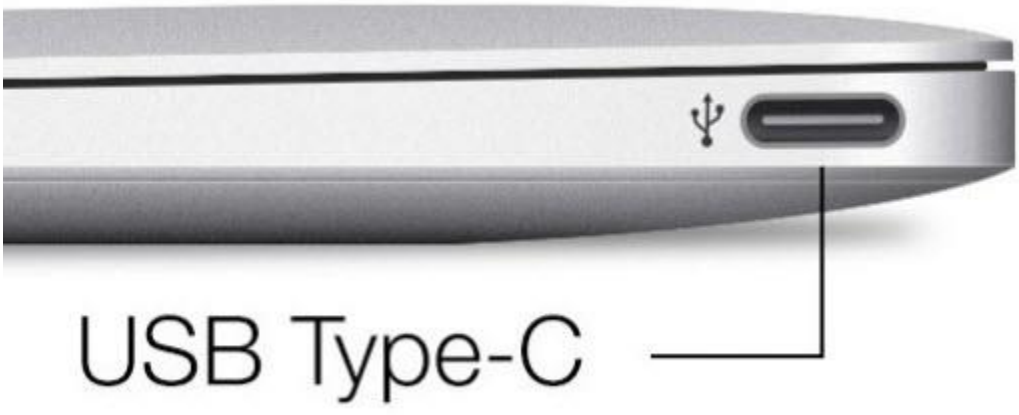
USB 3.1 is also released and supports a data rate up to 10Gbps. Usually, but not all the times, the USB 2.0 is Black color coded and USB 3.0 is Blue. The following image shows USB 2.0 and USB 3.0 ports.

The pinout diagram of USB Type – A port is shown below. The pinout is common to all standards of Type – A.

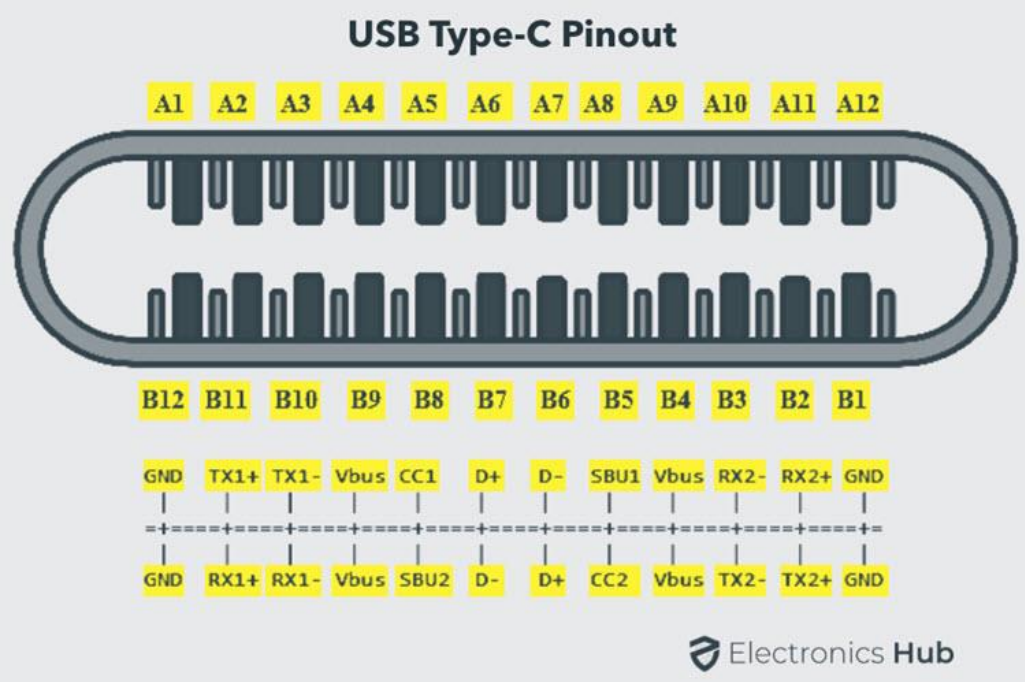


USB Type C

USB Type – C is the latest specification of the USB and is a reversible connector. USB Type – C is supposed to replace Types A and B and is considered future proof.



The port of USB Type – C consists of 24 pins. The pinout diagram of USB Type – C is shown below. The latest USB Specifications (USB4) is an USB-C only specification i.e., only USB type C devices can be used with USB4 specifications.



In the latest USB4 specification, USB Type C Devices can support speeds up to 40 Gbps.

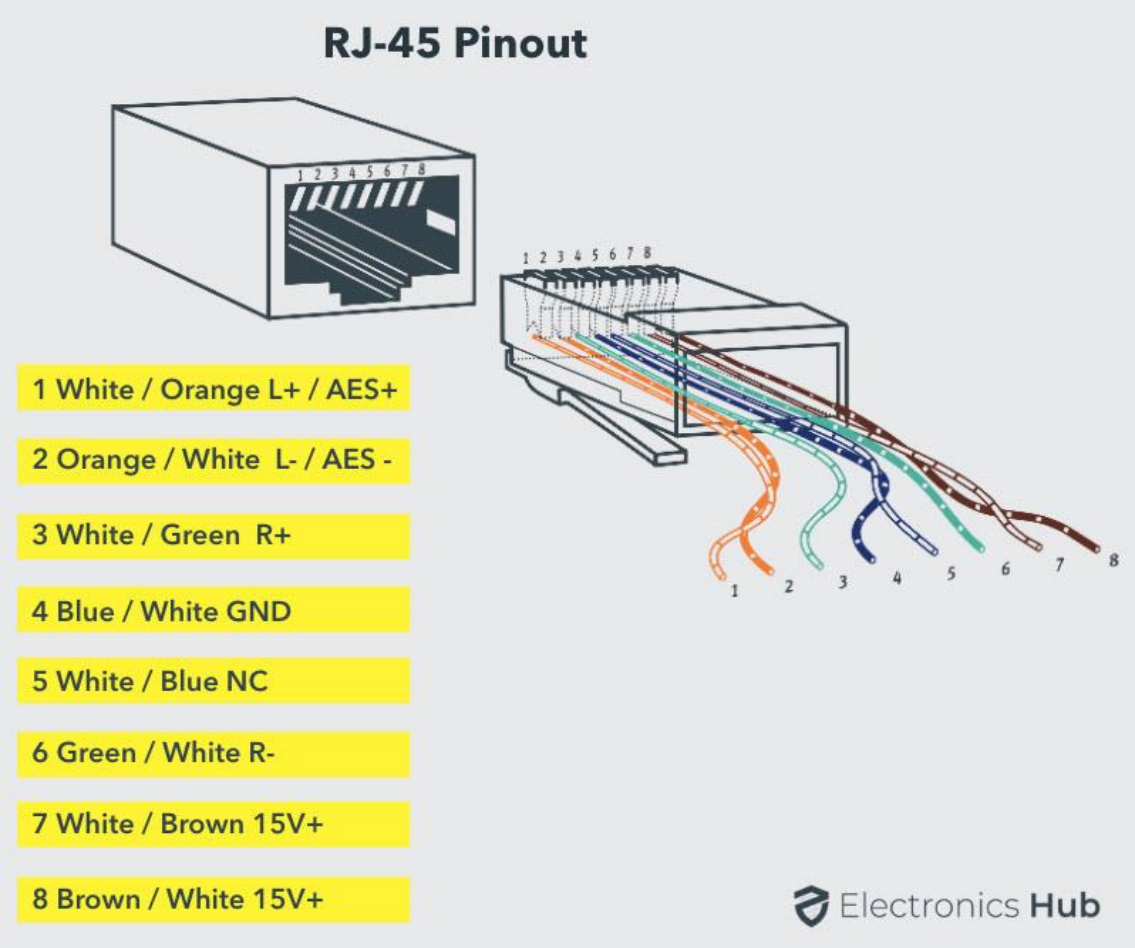
USB Power Delivery specifications allow USB devices to supply power to devices connected to the USB Port. USB Type – C can handle a current of 5A at 20V (only Power Delivery certified USB Type-C Ports).

RJ-45

Ethernet is a networking technology that is used to connect your computer to Internet and communicate with other computers or networking devices.

The interface that is used for computer networking and telecommunications is known as Registered Jack (RJ) and RJ – 45 port in particular is used for Ethernet over cable. RJ-45 connector is an 8 pin – 8 contact (8P – 8C) type modular connector.

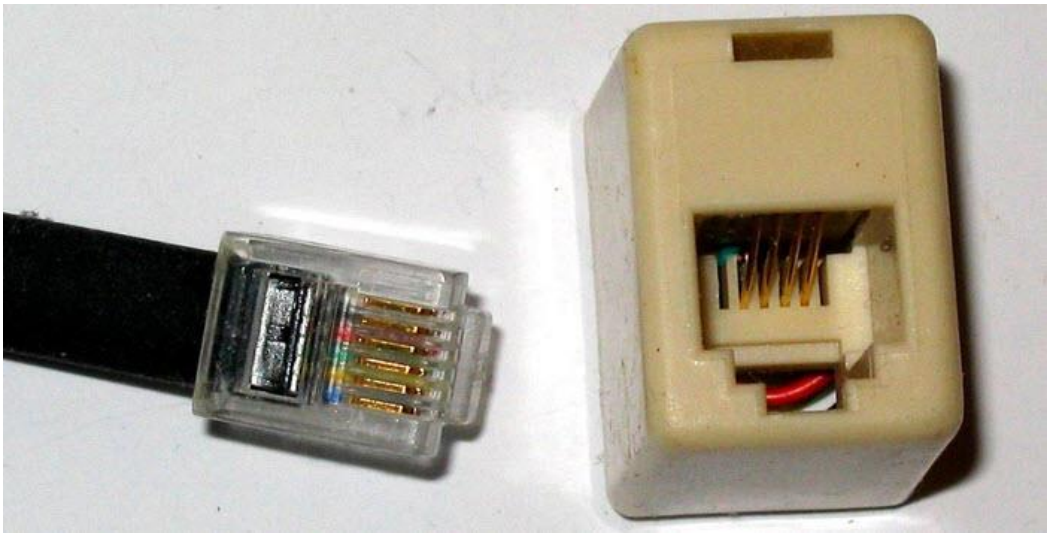
As mentioned earlier, an Ethernet RJ-45 port has 8 pins and the following picture depicts the pinout of one.



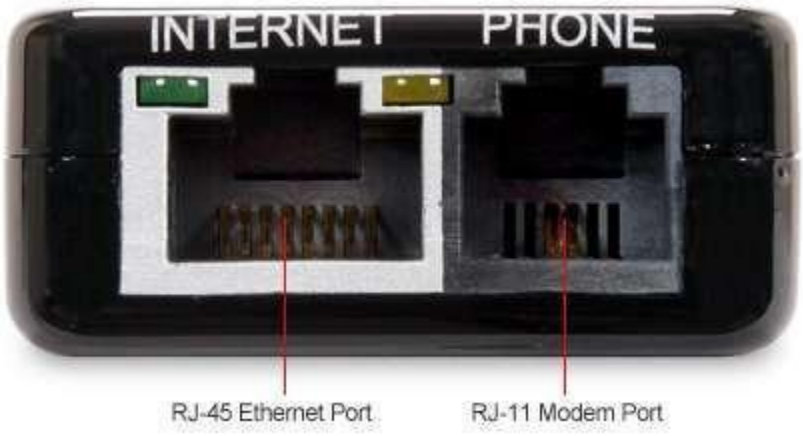
RJ-11

RJ-11 is another type of Registered Jack that is used as an interface for telephone, modem or ADSL connections. Even though computers are almost never equipped with an RJ-11 port, they are the main interface in all telecommunication networks.

RJ-45 and RJ11 ports look alike but RJ-11 is a smaller port and uses a 6 point – 4 contact (6P – 4C) connector even though a 6 point – 2 contact (6P – 2C) is sufficient. The following is a picture of an RJ-11 port and its compatible connector.



The following image can be used to compare RJ-45 and RJ-11 ports.



e-SATA

e-SATA is an external Serial AT Attachment connector that is used as an interface for connecting external mass storage devices. Modern e-SATA connector are called e-SATAp and stands for Power e-SATA ports.

They are hybrid ports capable of supporting both e-SATA and USB. Neither the SATA organization nor the USB organization has officially approved the e-SATA port and must be used at user's risk.

- # Steps to assemble computer:-

As we know, computer assembly is a systematic process. First, arrange the computer parts. The sequence for assembly and working of the computer listed below is as:

• Open the case.

• Install the power supply.

• Attach the components to the motherboard.

• Install the motherboard.

• Install internal drives.

• Connect all internal cables.

• Install motherboard power connections

• Connect external cables to the computer.

• Boot the computer for the first time.

Procedure

Step 1: Open the case

• The first step in assembling a computer is to open the computer case. There are different methods for opening cases.

• The computer comes with various types of cabinets. The method for opening the case is different based on the manufacturer.

• To open the case, first remove the screws of the left side cover and slide the side cover.

Step 2: Install the power supply

The next step is to install a power supply. There are usually four screws that attach the power supply to the case. Power supplies have fans that can vibrate and loosen screws that are not secured. When installing a power supply, make sure that all of the screws are used and that they are properly tightened.

Step 3: Attach the components to motherboard

The motherboard has to be prepared before its installation.

To prepare the motherboard, you first need to install the CPU, then the heat sink on the CPU and CPU fan.

CPU

The CPU and motherboard are sensitive to electrostatic discharge. So place them on a grounded anti-static mat and wear an anti-static wrist strap while handling the CPU. When handling a CPU, do not touch the CPU contacts at any point.

Heat sink and fan assembly

Heat sink and fan assembly is a two-part cooling device. The heat sink draws heat away from the CPU. The fan moves the heat away from the heat sink. The assembly has a 3-pin power connector. To install a CPU and heat sink and fan assembly

Installation of RAM

It is better to install the RAM first on the motherboard and then fix the motherboard in the case. To install RAM, first ensure its compatibility with the motherboard. If DDR3 is mentioned on the motherboard, then DDR3 RAM may be fixed in the memory slot. To install RAM, follow these steps.

Step 4: Install motherboard

After preparing the motherboard, you can install the computer case. Plastic and metal standoffs are used to mount the motherboard and to prevent it from touching the metal portions of the case. To install the motherboard, follow these steps:

Step 5: Install internal drives

Hard drive

The hard drive is the device which stores all the data. It is 3.5 inch wide and needs to be mounted so that access to the cable connections on the back is gained. Drives that are installed in internal bays are called internal drives. A hard disk drive (HDD) is an example of an internal drive.

Optical drive

• Position the optical drive so that it aligns with the 5.25 inch drive bay.

• Insert the optical drive into the drive bay so that the optical drive screw holes align with the screw holes in the case.

• Secure the optical drive to the case using the proper screws.

• Connect the power cable coming from the SMPS to the power socket of optical drive.

• Connect SATA data cable from optical drive socket to the motherboard socket.

Step 6: Connect all internal cables

Power cables are used to distribute electricity from the power supply to the motherboard and other components. Data cables transmit data between the motherboard and storage devices, such as hard drives.

Step 7: Install motherboard power connections

Just like other components, motherboards require power to operate. The Advanced Technology eXtended (ATX) main power connector will have either 20 or 24 pins. The power supply may also have a 4-pin or 6-pin auxiliary (AUX) power connector that connects to the motherboard. A 20-pin connector will work in a motherboard with a 24-pin socket. Follow these steps for motherboard power cable installation:

SATA power connectors

SATA power connectors use a 15-pin connector. Serial advanced technology attachment (SATA) power connectors are used to connect to hard disk drives, optical drives, or any devices that have a SATA power socket.

Step 8: Connect external cables to the computer

Setting up the computer system involves the complete process of establishing the proper connectivity of various parts of the computer system—input and output devices, connectivity of computer with the surge power supply. Reattach the side panels to the case. The process of connecting the external cables given below:

Locate the monitor cable

Locate the two power cable and one VGA cable or monitor cable. The VGA cable is used to connect to monitor and another point on to the back side of the cabinet. If you are having trouble finding these, refer to the instruction manual of or the computer.

Connecting monitor

Connecting keyboard

Connecting mouse

Connecting headphones or speakers, and microphone

Connect the computer to a power supply

Ups (uninterruptible power supply)

Plug the surge protector

Connecting printer, scanner, webcam

Step 9: Starting the computer

To start the computer, it is necessary to follow the correct sequence to start up. Now push the power button on the CPU to start the computer. Practically when we start our vehicle, we always check that the light or air conditioner (AC) is off. Otherwise it will consume more power compared to normal start up.

• Precautions to assemble computer:-

• When working on your PC or any electric-powered equipment, always disconnect it completely from the mains wall socket. Never dismantle the actual PSU in your computer.

• Beware of sharp edges inside computer cases and small pins on the boards. It may seem harmless but the case edges can be as sharp as a knife, and can remove large chunks of flesh if accidentally nudged with a slipping hand.

• Always remember to fully disconnect the power before connecting/disconnecting components or cables. When making cabling connections of any kind, use firm, even pressure but never excessive force. Small signal pins are very easily damaged if connected incorrectly.

• Computer devices/peripherals are generally very delicate in nature. Handle them with extra care and always employ some method to disperse static electricity.

•Except the exterior part of the computer casing, don't ever try to clean any part of your system unit with any liquid detergents or cloths.

•In case you see a build-up of dust inside your machine after some time, disconnect the unit completely, remove the case sides and use an Air Duster to blow out dust from the case.

•Keep in mind that when working with your computer you should stay calm, and always check your work over and over again. If it still doesn't work ask someone who does.

• Study of different types of Motherboards:-

a. What is a motherboard?

The motherboard is a logic board that is made up of a non-conductive plastic sheet consisting of the main circuit and placeholders. Motherboard consists of a provision for connecting any type of component to meet the application requirement. It is a single planar board to manage every function, unlike the backplane that allows connection with multiple extension boards. This board can hold more components. It consists of crucial components to ensure that the system is working properly. These consist of sockets for connecting components and providing logistics for every component to work in a coordinated way.

b. *Features of Motherboards:-*

The following are the features of different types of motherboards:

1. It is important to choose a motherboard with a CPU socket that accommodates your choice of CPI.

2. The motherboard has minimal impact on the performance of a computer.

3. Chipset on the motherboard determines the speed with which the computer can run.

4. Different types of motherboards have three types of slots. Memory slots allow you to plug RAM modules into the computer. With more slots, you can add more memory. These slots are specific to RAM type.

5. Motherboards consist of both internal and external connectors. Some types of motherboards come with support for USB 3.0, graphic connectors, external eSATA, and legacy ports for parallel and serial connectors.

6. Some types of motherboards use multiple hard drives together in a special configuration.

c. *Types of Motherboards:-*

Let us now discuss the different types of Motherboards that are available:

1. Advanced Technology eXtended (ATX)

It is a type of motherboard that was developed and patented by Intel in the year 1995. The purpose of this motherboard type was to improve de facto standards such as the AT design. It is the first changed and improved motherboard that improved standardization and interchangeability of parts. This is one of the most common motherboard designs.

2. AT Motherboards

This board is one of the oldest types of motherboards that consists of advanced technology (AT) power connectors. AT motherboards have bigger physical dimensions ranging for hundreds of millimeters. Due to the size constraint, they are not the right fit for mini desktops. Due to the size issue, new drivers cannot be installed in such motherboards. Six pin plugs and sockets are used as power connectors in this type of motherboard; since power connectors are not easily identifiable, users face difficulties in connecting and using such motherboards.

3. Balance Technology Extended (BTX)

It is a type of motherboard that was intended to replace the 2004 and 2005 ATX motherboards. This was designed with the purpose of decreasing heat and, eventually, power requirements. It employs an enhanced technology, including universal serial bus (USB) 2.0, serial advanced technology attachment (ATA) and peripheral component interconnect (PCI) express. The aim of developing this type of motherboard was to reduce the problem of ATX standards by reducing heat and power consumption. It provides an efficient design for both small and large systems.

4. Mini ITX Motherboard

It is a miniature version of a motherboard that was designed in the 2000s and is mainly used in small form factor computers. The reason behind its use is its faster cooling ability and low power consumption. It is one of the most preferred types of motherboard that is preferred in home theater due to its low level of fan noise. These primarily appeal to industrial and embedded PC markets with the majority sold as bulk components. These are produced with a longer sales life-cycle than consumer code which is a quality that is required by industrial users.

5. LPX (Low Profile eXtension)

This is a form factor motherboard that was used throughout the 1990s. It uses a riser card with different placements of parallel, serial, video, and PS/2 ports as compared to other motherboards. The motherboard uses a riser card so that expansion cards can be installed parallel to the motherboard.

- ## Motherboard Configuration:-

Step 1: Prepare your Tools

Whether you are installing the motherboard or any PC components, the first thing to do is to ensure that you have all the tools. In this case, the main tool you will need is a long, head screwdriver with a magnetic tip for easy screwing and unscrewing. A pair of needle-nose pliers will also come in handy when you have to fish out any screws dropped on the PC case. Also, wear safety accessories such as an anti-static wristband while doing the installation. Check if you have adequate lighting and do the installation on a non-conductive surface. Having the motherboard manual handy when you are doing the installation will also prove to be very useful if you have any questions about the board.

Step 2: Unpack the Board

When you open the motherboard's box, you will see a lot of cables. You will also see a driver CD and a metal blanking plate. Take out all these components and keep them on one side. You will find the motherboard enclosed in an anti-static bag resting on the top of an anti-static foam. Slide the motherboard from the bag but do not detach it from the foam just yet.

Step 3: Measure where the Motherboard goes

Check where the screws of the motherboard will be fitted on the PC case. Push aside all the internal cables to make way for the motherboard to be installed. Remove the motherboard from the foam and slide it into the case. Then, push the rear ports of the motherboard against the blanking plate. Check where the screw holes in the motherboard fit against the case and take a note of it. Remove the board and place it back on its foam.

Step 4: Screw in the Standoffs

While installing the motherboard, you have to ensure that it does not come into contact with the conductive chassis of the PC case as the board is a sensitive piece of equipment. For this purpose, you have to install

the standoffs first before installing the board. The standoffs are male screws that come with a female head so that you can screw the motherboard directly. Some cases come with pre-fitted stand offs saving you the trouble. But, the fittings may not suit your motherboard. Check the motherboard manual to find out which standoffs you have to screw and the locations you have to screw them. Then, screw them accordingly using your hand.

Step 5: Remove Unnecessary Bits

The next step that you have to do is to remove unnecessary parts from the blanking plate.If you want to remove the metal bits, you should rock them gently until the metal snaps. If you want to remove the flap covering the ports, you should bend the flap inwards to give enough clearance for the motherboard ports to pass underneath them.

Step 6: Install I/O Shield

The I/O shield is the black or silver panel that protects the rear ports of your motherboard. Some motherboards will have the I/O shield pre-installed. If that is the case, then you don't have to do anything. You can proceed to the next step. But if the shield comes separately, then you will have to install it. You should insert the I/O shield into the rear gap.

Step 7: Slide the Motherboard into Place

Slowly insert the motherboard in the case in such a way that all its screw holes align with the risers underneath. In case they are not aligned properly, ensure that you have not screwed the risers into the wrong place. Due to pressure from the backplate pressing against the motherboard, the motherboard will be slightly off from the risers. You do not have to worry about that. However, the motherboard's ports should align with the backplate.

Step 8: Screw the Motherboard

Once you have aligned the ports and screw holes, start screwing the motherboard in. First, start screwing at the corners so that the screw holes line up with the risers. Be cautious not to put too much pressure on the motherboard. The screws have to be tight enough for the motherboard to be secure but not too tight that it may cause the board to crack. After screwing at the corners, start screwing in the other holes. You do not have to screw all the holes. Screw until you feel the motherboard is secure in its place.

Step 9: Identify and Plug-in the ATX Connector

Once you have installed the motherboard, you will have to plug-in the ATX connector. The moderns have a 24-pin connector while the older motherboards have a 20-pin connector. You have to plug the appropriate ATX connector on your motherboard. The matching connector on the motherboard will be located by the IDE ports. It has a clip on it to securely hold the ATX connector in place. You have to gently press the ATX connector to get it to clip in.

Step 10: Identify and Plug-in CPU Power Connectors

The latest motherboards come with a secondary power connector. The board will either have a four-pin connector or an eight-pin connector. You will only get the eight-pin connectors in the market. So, you have to split it into two if your motherboard has a four-pin connector. Most motherboards will have the secondary power connector near to the processor socket. Slide the connector into the plug and apply gentle pressure to get it secured in its place. You will hear a 'click' sound once the connector is locked.

- ## Identifying Internal and External connectors of Motherboard :-

A. Internal Motherboard Ports

Here are some of the most common internal ports on a modern motherboard:

1. CPU socket - Where the CPU or processor plugs in.
2. CPU power connector - Power cable connection for the CPU.
3. ATX power connector - Power cable connection for the system.
4. DIMM/RAM Memory slots - Connectors for system memory or RAM.
5. PCIe slots (x16, x2, x1) - Expansion card slots, including the graphics card.
6. SATA ports - Modern internal hard drive ports.
7. Front panel connector - Connection for USB, and audio ports on the front or top of the case.
8. Front panel header - Connection for LED/RGB lighting, power switch, and reset switch.
9. USB headers (3.1, 2. etc.) - Connection for rear USB ports on the motherboard.
10. Fan headers - Connection for the case and system fans.

B. External Motherboard Ports (Rear Ports)

Here are some of the most common external ports on a modern motherboard:

1. PS/2 - Used for older PS/2 interface keyboards.
2. USB - Connection for USB peripherals including keyboards, mice, hard drives, audio equipment, and more.
3. HDMI/Display Port/VGA - They're all video or display connectors to output video or audio to a monitor.
4. Ethernet /RJ-45 - Connection for wired internet.
5. Analog/Digital Audio - Connections for speakers and digital audio equipment, including home theater systems.

- **Types of data cables:-**

A. *VGA Cable*

Video Graphics ray which is called VGA in simple terms. VGA cable is been used for sending video signals. Also, you can utilize it for establishing the connection between the CPU and monitor of a computer system. Nowadays, all of us are using high-definition televisions. In such electronic devices, a VGA cable is been used for displaying the complete information on the monitor.

B. Computer power cord

Connect one end to: AC power socket

Connect other end to: power supply unit (see image below), computer monitor.

Note: Always turn off your power supply unit (with the 1–0 switch at the back) before connecting a power cord to it.

C. SATA Cable

SATA cables are used for connecting hard drives to the system motherboard. This types of computer cables consists of **7 pins** which is easily recognized as it has the shape of an L. IDE is been replaced by SATA, the reason behind this is it deliver a high data transfer speed.

D. DVI Cable

Digital visual interface is another kind of computer cable which is used for connecting the LCD monitor and video card. The high image quality is been visible to users and hence such cables are used in CRT, LCD monitors. It is

feasible to transmit both signals analog and digital to the computer machine. The reason behind this is that this type of computer cables is compatible with both digital and analog connections.

The users can find the difference easily by looking at the pins of the cable. In case, the cable consists of a flat pin and the number is four then it is surely DVI analog. If you are able to see only a single flat pin then the cable will be DVI digital.

E. HDMI Cable

High-definition media interface which is called as HDMI cable is one of the types of computer cables**.** The users are able to transmit the high-definition audio and video information signals easily with the help of this cable. The process will not hamper the quality of images. Another advantage of using these cables is that you will be able to send crystal clear images without any trouble.

- ## Types of Processor:-

What is a Processor?

Definition: The processor is a chip or a logical circuit that responds and processes the basic instructions to drive a particular computer. The main functions of the processor are fetching, decoding, executing, and write back the operations of an instruction. The processor is also called the brain of any system which incorporates computers, laptops, smartphones, embedded systems, etc. The ALU (Arithmetic Logic Unit) and CU (Control Unit) are the two parts of the processors. The Arithmetic Logic Unit performs all

mathematical operations such as additions, multiplications, subtractions, divisions, etc and the control unit works like traffic police, it manages the command or the operation of the instructions. The processor communicates with the other components also they are input/output devices and memory/storage devices.

Types of Processors

There are different types of processors in the embedded system which include the following.

General Purpose Processor

There are five types of general-purpose processors they are, Microcontroller, Microprocessor, Embedded Processor, DSP and Media Processor.

Microprocessor

The general-purpose processors are represented by the microprocessor in embedded systems. There are different varieties of microprocessors available in the market from different companies. The microprocessor is also a general-purpose processor that consists of a control unit, ALU, a bunch of registers also called scratchpad registers, control registers and status registers.

There may be an on-chip memory and some interfaces for communicating with the external world like interrupt lines, other lines for the memory and ports for communicating with the external world. The ports often called the programmable ports that means, we can program these ports either to be acting as an input or as an output. The general-purpose processors are shown in the below table.

Microcontroller

The microcontroller is basically a computer that comes in various packages and sizes. The reading input and responding to output is the basic function of the microcontroller. Generally, it is known as General Purpose Input Output (GPIO). Some of the microcontrollers are Microchip Atmega328-AU, Microchip P1C16F877A-I/P, Microchip P1C16F1503-I/P, Microchip P1C16F671-I/SN, Microchip P1C18F45K22-I/P, etc.

Embedded Processor

An embedded processor is one type of processor which is designed to control mechanical functions and electrical functions. It consists of several blocks they are the processor, timer, an interrupt controller, program memory and data memory, power supply, reset and clock oscillator circuits, system application-specific circuits, ports and interfacing circuits.

Media Processor

The image/video processor is the media processor that is designed or created to deal with the data in real-time. The voice user interface and professional audio are the applications of the audio processor. Some of the media processors are TN2302AP IP, IN2602 AP IP, DM3730, DM3725, DM37385, DM388, TMS320DM6467, TMS320DM6431, etc.

MultiProcessor

The multiprocessor is a computer with more than one CPU, each shares main memory, a computer bus, and peripherals to simultaneously process the programs and these systems are also known as tightly coupled systems. The advantages of multiprocessors are increased throughput, increased reliability and economy of scale. These processors are used when very high speed is required to process a large volume of data.

- **Generation of processors:-**

1. 1st Generation
2. 2nd Generation
3. 3rd Generation
4. 4th Generation
5. 5th Generation
6. 6th Generation
7. 7th Generation
8. 8th Generation
9. Dual Core processors generation

1. First Generation Processors

Due to the IBM's choice as the assembler of the first PCs, the Intel's processors were selected to be the first in use, creating what is called now a 1stgeneration of processors.

First generation processors:

- 8086 and 8088
- 80186 and 80188
- 8087 (coprocessor)

2. 2nd Generation

- 80286 introduced in 1982.
- Released also 80287 coprocessor which was identical to 8087 (with some small compatibility changes that failed on synchronization).
- Protected mode of execution, improved DMA, increased speed, versions for laptop computers.

3. 3rd Generation

- All 386 had internal 32bit registers
    a) 386DX –the first introduced by Intel
    b) 386SX –cheaper version of DX with 24bit memory addressing (up to 16MB rather than 4GB)
    c) 386SL –laptop version of 386
    d) 80386 Coprocessor –without synchronization issues –worked with the same clock speed.

4. 4th Generation

- After revolutionary ideas realized in the 3rd generation, the 4th generation focused on optimizing the performance improving what was already invented.

- The great increase in performance made working with GUI a real option. Windows increased it‘s sales dramatically.

5. 5th Generation

- Intel willing to protect it’s processors names quit the number convention and instead of 586 called his new processor Pentium released in 1992.

- First Complex Instruction Set Computer (CISC) implementing superscalar technology.

6. 6th Generation

The 686 processors represent a new generation with features not found in the previous generation units. The 686 processor family began when the Pentium Pro was released in November 1995. Since then, Intel has released many other 686 chips, all using the same basic 686 core processor as the Pentium Pro –released already in 1995

New features

- Dividing the CISC instructions into RISC instructions (microinstructions).
- Executing them multiple execution units. Parallel and out of the initial order.
- Execution speculation.
- Advanced branch prediction.

7. 7th Generation – Pentium 4

- Introduced in 2000, started from 0,18 micrometers at 1.3GHz and reached 0.09 micrometers technology running 3.8GHz.

- Introduced new sets of SSE instructions: SSE2 and SSE3.

- L1 cache of 8 to 16kB, L2 cache up to 1MB.

- Hyper Threading– Simulating two processors in the system (virtual processor). Let’s two threads to really run at the same time (without time division).

- The Pentium 4 cores had the following codenames:

a) Willarnette–the first one.
b) Northwood –there could be differed Mobile and Mobile Pentium 4 M versions.
c) Gallatin –also know as Extreme Edition with 2MB of L3 cache.
d) Prescott and Prescott 2M (Extreme Edition) with 64bit instructions.

8. 8th Generation

- The first 64bit processor was released in 2001 by Intel –Itanium. One year later it improved it to Itanium 2.
- In 2003 AMD released Athlon 64 and later Opteron for servers use.
- In 2004 Intel released versions of Pentium 4 that were having 64bit instructions.

9. Dual core processors

- As the Intel's processors based on NetBurst core (the same as in Pentium 4 series) reached the barrier of 4GHz, they realized that the power consumption and the amount of heat produced is too high. Continuing in that way would effect in too expensive and too noisy system cooling and maintenance.
- The solution for now is to research towards processors which work with lower clock speed, but execute more instructions at the same time. Like multiple core processors.