

equipment reports

Keithley Model 169 DMM



CIRCLE 101 ON FREE INFORMATION CARD

THE CHOICE OF A NEW DIGITAL MULTIMETER IS influenced by many factors. Since most units within a certain price range will have almost identical accuracies, other features such as ease of operation, special ranges, and cabinet sizes may be more important. In the past it was common to select a portable unit to take advantage of its use in the field as well as on the bench. In most cases however it has been discovered that a hand-held unit is not the most convenient one for bench use.

Keithley Instruments, Inc. (28775 Aurora Road, Cleveland, OH 44139) has introduced its *model 169*, a digital multimeter designed for bench use. Since the *model 169* uses six C-size batteries for power, it can also be taken into the field if the need arises.

The *model 169* features a large (0.6-inch) 3½-digit LCD display. The easy-to-understand front panel has color-coded pushbuttons. Units are displayed on the LCD to confirm the range and use selected. Since the front panel is larger than that of a hand-held unit, the push-buttons are easier to operate and the cabinet (again due to the larger size) remains stable. One hand can be used to change ranges. A large bail-type carrying handle attached to the sides of the cabinet also serves as an adjustable stand to allow the user to position the meter at an angle. The cabinet has four feet attached to the underside. Those feet have provisions for test-lead storage. Test leads can be connected to the front panel with standard banana jacks. That means you will still be able to use your favorite special-function leads. The *model 169* is supplied with standard test leads, including probes.

Input protection is provided for all functions

on the *model 169*. Those who forget to change the ranges and functions will be happy to know that the *model 169* will withstand 1400 volts (peak) on the voltage ranges and 300 volts on the resistance ranges. A two-ampere fuse protects the current ranges and the fuse is accessible without removing the cabinet.

These specifications will provide the reader with a brief idea of the *model 169's* versatility. Both AC and DC voltage is measured on five ranges from 200 mV up to 1,000 volts full-scale. Accuracy on the DC ranges is 0.25% of reading + 1 digit. Accuracy on AC is 0.75% of reading + 5 digits at frequencies under 1 kHz. Input impedance is 10 megohms shunted by less than 100 pF. Current can be measured on five scales from 200 µA to 2,000 mA full-scale on both AC and DC, although the DC readings are more accurate than AC. Resistance is measured on six ranges from 200 ohms to 20 megohms full-scale. Voltage resolution will vary from 100 µV to 1V, depending upon the range, in either the AC or DC functions. Likewise current resolution is from .0001 to 1 mA and the resistance ranges offer resolutions of from 0.1 to 10K ohms.

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BK PRECISION

Microcomputer-Controlled Autoranging DMM Model 2845



- Computer stabilized accuracy to 0.1%
- Auto-perfection
Selects range for maximum resolution
- Audible continuity indicator
Built-in audible tone generator
- G-MOV overload protection
Provides AC and DC voltage range protection to 1000 VDC or AC peak
- Shielded in RF fields
Accuracy maintained in RF fields

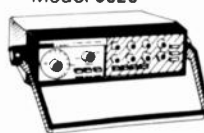
- Long life, high reliability
Four hermetically sealed reed relays perform range switching with virtually no contact wear.
- Microcomputer intelligence
Designed around 4-bit microcomputer. Analyzes stored data and range that provides greatest display resolution. Program memory capacity 1024 x 8 bits of ROM supported by 48 x 4 bits of data memory RAM

... in stock and available for immediate delivery.

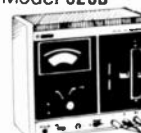
Dual Trace 5"
30 MHz Triggered Scope
Model 1479A



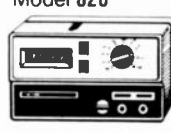
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EQUIPMENT REPORTS

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Overrange is indicated when the three least significant digits are blanked on the display. There is automatic polarity reversal, and a display indicator will signify the polarity of the test voltage or test current. The display will also indicate when there is less than five percent of battery life remaining. The estimated battery life is 1,000 hours when carbon-zinc batteries are used, and 2,000 hours with alkaline batteries.

The instruction manual also serves as a repair manual for those who like to maintain and calibrate their own equipment. It contains exploded views of the unit, complete parts lists, and an extra large two-page schematic diagram. In addition, there is an excellent discus-

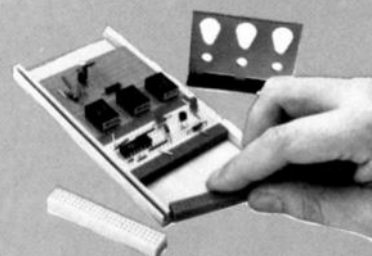
sion of the instrument's theory of operation and how the instrument is used.

All circuitry is contained on a $4\frac{1}{2} \times 7\frac{1}{2}$ inch printed-circuit board and, due to the relatively large size, troubleshooting is greatly simplified. The front panel is attached to the board with connectors that makes removal easy. The LCD display is fastened to the panel by two studs and it is connected to the main board by ribbon cable. The model 169 measures $3\frac{1}{2} \times 9\frac{1}{4} \times 10\frac{1}{4}$ inches and has a net weight of three pounds.

The unit has been tested and it performed well. All ranges equalled or exceeded the published specifications. If you are in the market for a large DMM that can also be used in the field, it may be worth your time to check out this versatile unit. The model 169 from Keithley sells for \$169.

R-E

A P Products Hobby-Blox Solderless Breadboarding System



CIRCLE 102 ON FREE INFORMATION CARD

IT SEEMS THAT EVERY TIME WE TURN AROUND, someone has taken another step toward making prototyping less complicated, more instantaneous, and, admittedly, a little more fun. A P Products' *Hobby Blox*, are a very versatile series of breadboarding products that, working together, perform as a complete system for circuit building.

The generous use of color and the low prices of the several elements of the *Hobby-Blox* system can easily lead to the impression that it is a system intended strictly for beginners. That is not the case. *Hobby-Blox* perform on a par with any professional breadboard, in most applications. Its many unique elements permit the easy incorporation of circuit elements that would be difficult to accommodate with many breadboarding products.

Part of the secret of the flexibility of *Hobby-Blox* lies in its unique carrier tray. In addition to its primary purpose of providing structural rigidity for the breadboard strips, the tray also has a number of molded-in features that contribute to the modularity and expandability of the system. The side rails, for example, feature a tongue on one edge and a mating groove on the opposite. There are also slots spaced along one edge to accommodate the blank panel, control panel, or speaker panel elements of the system.

The trays can be readily stacked side-to-side or, with tray extender clips, end-to-end. Also available is a right-angle, vertical tray pack that includes a smaller tray and adapter strip. Either large or small trays, however, may be vertically mounted using the adapter strip.

The standard tray is 6.3×3.12 inches and the shorter tray is 3.7×3.12 inches. The inside width, between the side rails, is 2.75 inches. That is the same as each of the solderless strip elements of the system except one—a between-the-trays, 6.3-inch long, bus strip with two continuous rows of 60 connected, solderless tie points each.

There are five different types of solderless breadboarding elements designed to fit in the *Hobby-Blox* tray. Yellow terminal strips provide a row of 26 three-tie-point terminals. Red distribution strips each provide two rows of 26 connected tie points. Gray 3×16 -inch terminal strips repeat arrays of 16 three-tie-point terminals (arranged as twin columns of eight each on either side of a 0.3-inch DIP-standard center spacing) three times across its width—perfect for placing three 7-segment DIP displays in a row. Gold LED strips accept six discrete LED's, provide a solderless tie-point connection to each solderless LED socket lead,

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ADVANCE IS PROUD TO INTRODUCE the KEITHLEY Line of High Quality Digital Multimeters Featuring The New 130 Hand-Held DMM

Take a look at Keithley's new Model 130 measurement problem-solver.

Easy to use

- Two rotary switches instead of eight pushbuttons
- Large, easy to read 1.8cm (.6") LCD digits—larger and sharper than competitors'

Rugged

- High-impact ABS plastic case
- Shock-mounted LCD
- Tough polycarbonate plastic window and front panel

Performance Plus

- Convenient size and weight—only 10 oz. ($7.0'' \times 3.1'' \times 1.5''$)
- 200 hour battery life
- Low battery annunciator
- Easy to maintain—all components on one board
- One-year guarantee on specifications
- Only one calibration adjustment, only once
- 25 Ranges and five functions: DC volts, AC volts, DC amps, ohms
- $100\mu\text{V}$, $1\mu\text{A}$, 0.1Ω sensitivity
- 1000V DC, 750V AC, 10A and $20\text{M}\Omega$ upper range limits



\$115

Case \$10.00
Shipping \$3.00

SPECIFICATIONS

	RANGE	ACCURACY
DC VOLTAGE	200mv, 2V, 20V, 200V, 1000V	.5%
AC VOLTAGE	200mV, 2V, 20V, 200V, 750V	1%
DC CURRENT	2mA, 20mA, 200mA, 2000mA, 10A	2%
AC CURRENT	2mA, 20mA, 200mA, 2000mA, 10A	3%
RESISTANCE	200Ω , $2\text{k}\Omega$, $20\text{k}\Omega$, $200\text{k}\Omega$, $20\text{M}\Omega$.5%



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