METEX®

DIGITAL MULTIMETER

M3600(B) SERIES

OPERATING MANUAL

CONTENTS

1. INTRODUCTION

This manual provides operating and service information for M3600 (B) Series, which are 3 1/2 digit LCD display Digital Multimeter for use in the field, laboratory, workshop, hobby and home applications. This instrument is compact, handheld, battery operated and uses the Dual-slope A/D converter of CMOS technology for Auto-zeroing, polarity section and overrange indication and for measuring DC & AC Voltage, DC & AC Current, Resistance, Diode, Capacitance (M3630 (B) & M3650 (B)), Transistor hFE (except M3620 (B)) & Continuity Test where beeper sound capability is internally contained and Frequency (M3650 (B)).

In bar model, 41-points bar displays in proportion to digital value.

2. SAFETY INFORMATION

This meter has been designed and tested according to IEC Publication 348 and DIN 57 411 Pt. 1/VDE 0411 Pt. 1, Safety Requirements as Safety Class II Apparatus for Electronic Measuring Apparatus. This manual contains information and which must be kept to ensure safe operation and retain the meter in safe condition.

SAFETY SYMBOLS

⚠ indicates the operator must refer to an explanation in this manual.

⚡ indicates terminals at which dangerous voltages may exist.

Fuse

Battery

Audio

Diode Test

Double Insulation

WARNING

TO AVOID ELECTRICAL SHOCK OR DAMAGE TO METER don't apply more than 1000 V DC or 750 V AC between any terminal and earth GROUND.

TO AVOID DAMAGE TO METER
don't exceed the input limit shown below.

FUNCTION	TERMINALS	INPUT LIMITS
V DC V AC	V/Ω & COM	1000 V DC 750 V AC
Ω	V/Ω & COM	500 V DC 250 V AC
A DC A AC	A & COM 20 A & COM	2A DC/AC 20 A DC/AC
FREQ. ⊣⊢♫	V/Ω & COM	250V DC/AC

The 20A RANGE is NOT fuse-protected.

TO AVOID DAMAGE OR INJURY

Use Meter only in circuits limited by fuse or circuit breaker to 20A or 4000VA. This meter is not intended for high energy industrial use.

The test leads must be inserted before external connections are made to measuring circuits

This precautionary procedure protects the operator should a voltage be accidentally applied between the 20A and COM terminals. To avoid accidentally applying voltage to the 20A terminal, verify that the red test lead is connected to the V input terminal before measuring a Voltage.

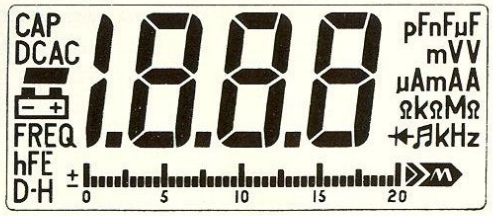
BE CAUTIOUS WHEN WORKING ABOVE 60V DC OR 25V AC RMS. SUCH VOLTAGE POSE A SHOCK HAZARD. ENSURE TEST LEADS ARE IN GOOD CONDITION.
DISCONNECT TEST LEADS FROM TEST POINTS BEFORE CHANGING FUNCTIONS. CLEAN CASE WITH DAMP CLOTH AND MILD DETERGENT NOT ABRASIVES OR SOLVENTS.

3. FEATURES

3-1. General Features

The dual-slope A/D converter uses C-MOS technology for auto-zeroing, polarity section and over range indication.

- Push button ON/OFF power switch
- 30-Positions Rotary switch easy to use for Function and Range selection.
- 17mm high contrast LCD
- Very rigid case fully protected from physical shock
- Automatic overrange indication with the "1" display and all the bar flashing in bar model.
- High surge voltage protection 1.5KV-3KV
- Capacitance measurement for 3630 (B) & 3650 (B)
- Diode and Audible Continuity test
  (Continuity Beep sound)
- Transistor hFE test (except M3620 (B))
- Frequency measurement for 3650 (B)
- Function Annunicators on LCD display
- Low Battery Annunciator



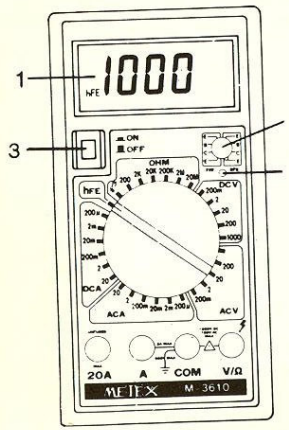
M3600 (B) Series LCD

M3600 (B) Series Familiarization

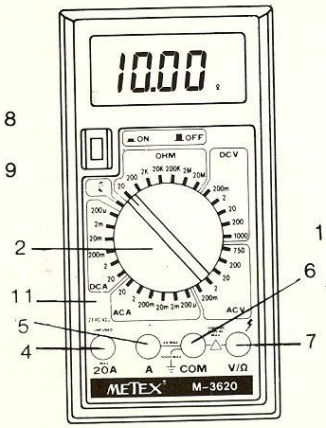
1. Digital Display (3 1/2 digits Max. 1999) with 41-points bar garph in Bar model
2. Function/Range Switch
3. Power ON/OFF Switch
4. 20A Input Jack Terminal
5. A Input Jack Terminal
6. COM Input Jack Terminal
7. V/Ω Input Jack Terminal
8. TR socket: Transistor hFE measurement only
9. LED Lamp: Continuity Test only
10. Capacitor Input Socket
11. 20Ω Range Zero ADJ Knob
12. Capacitance Zero ADJ Knob
13. Tilt Stand. (Not Shown, on rear) Converts to hanger strap if moved to upper holes at rear of case.

MULTIMETER FAMILIRIZATION M3600 Series

M3610



M3620



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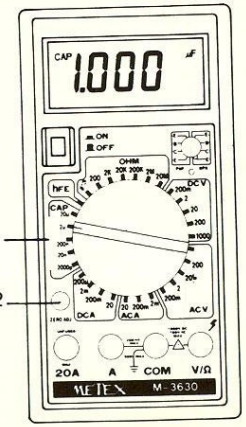
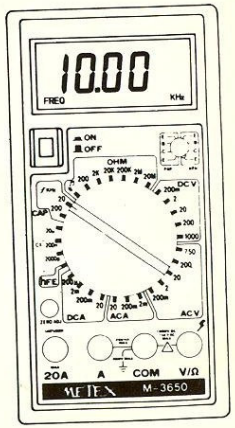
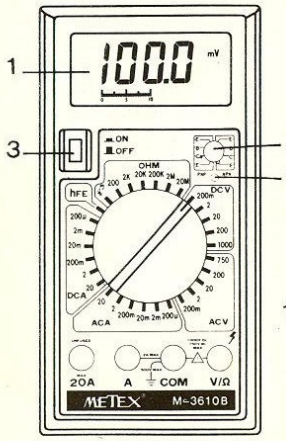


M3650

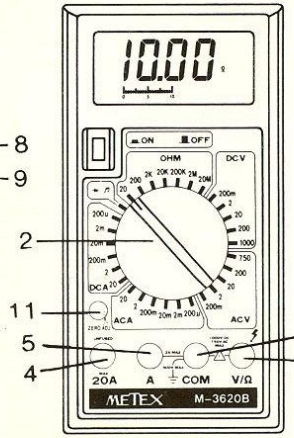


M3600B Series

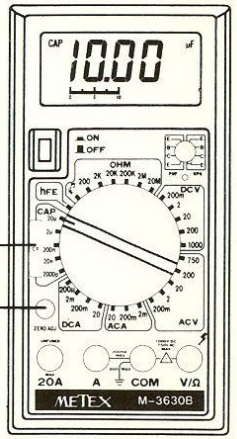
M 3610B



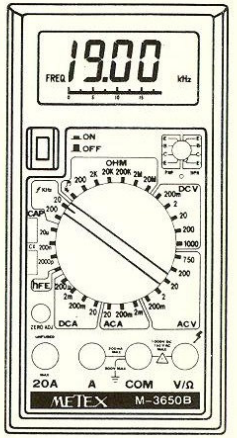
M 3620B



M 3630B



M 3650B



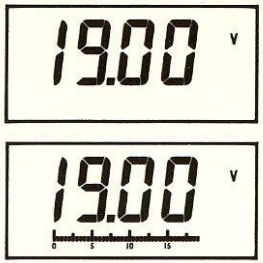
3-2. LCD Display Features on Function

Normal Reading under Measurement

The digital display of 3 1/2 (Max. 1999) appears on LCD with mode, range & decimal point and polarity of "−" if polarity omitted it means "+" polarity.

(for Bar model)

Normal Reading under Measurement

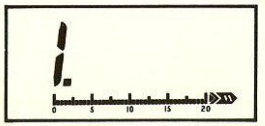


Overrange Indication

According to the position of rotary switch, the maximum value that can be displayed on LCD is determined. When reading value is over the limit, "1" figure appears on the left of LCD as an overrange indicatior, at the same time all the bars are flashing in bar model.

(for Bar model)

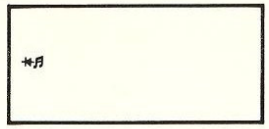
Overrange Indication



Audible Continuity Indication

If the conductance is less than 30 ohm at the same time the LED lamp lights up (except 3620 (B)) and the beeper operates.

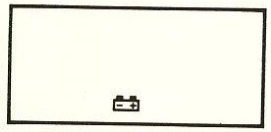
Audible Continuity Indication



Low-Battery Indication

The Battery has to be replaced for a correct operation when right sign appears on LCD.

Low-Battery Indication



4. SPECIFICATION

- Maximum Display ..... 1999 Count (3 1/2 digit) with automatic polarity indication and 41-points bargraph in bar model
- Indication Method ..... LCD Display
- Measuring Method ..... Dual-slope integration A/D converter
- Overrange ..... "1" figure display on LCD with all the bar flashing in bar model
- Maximum Common Mode Voltage .. 500V DC/AC rms
- Reading Rate Time ..... 2-3 readings per sec
- Temperature for guaranteed Accuracy +23°C±5°C
- Temperature Ranges ..... Operating 0 to 40°C (32°F to 104°F) Storage −10°to 50°C (14°F to 122°F)
- Power Supply ..... One 9-Volt Battery
- Low Battery Indication ..... Display on LCD
- Size ..... 90mmW×176mmL×36mmH
- Weight ..... 360g±10g including 9 volt battery 380±10g (in Bar model)
- Accessories ..... Operating Manual, 9V Battery (Zinc-Carbon type), Test Leads (Red & Black 1 pair), Spare Fuse.

Accuracies are±(% reading + No. of digits).
Guaranteed for 1 year in 23±5°C, less than 75% RH. Warm up time is 1 minute.

DC Voltage

Range	Accuracy	Resolution
200 mV	±0.3%, of rdg + 1 dgt	100 μV
2 V		1 mV
20 V		10 mV
200 V		100 mV
1000 V		1 V

* Input impedance: 10Mohm on all ranges.
Overload Protection: 1000V DC or peak AC on all ranges.

AC Voltage

Range	Accuracy	Resolution
200 mV	±0.8%, of rdg + 3 dgts	100 μV
2 V		1 mV
20 V		10 mV
200 V		100 mV
750 V	±1.2%, of rdg + 3 dgts	1 V

Input impedance: <10Mohm in parallel with >50PF (AC coupled).
Frequency Range: 40Hz to 400Hz
Overload Protection: 750V rms or 1000V peak continuous on AC ranges except 200mV AC range (15 seconds maximum above 300V rms).
Indication: Average

DC Current

Range	Accuracy	Resolution
200 μA	±0.5%, of rdg+1 dgt	0.1 μA
2 mA		1 μA
* 20 mA		10 μA
200 mA	±1.2%, of rdg + 1 dgt	100 μA
* 2A		1 mA
20 A	±2.0%, of rdg + 5 dgts	10 mA

* except 3630 (B) and 3650 (B)
Overload Protection: 2A/250 V fuse of fast blow type
20A range unfused
Maximum Input Current: 20A (Maximum of 15 Minutes)
Maximum Voltage Drop (under full scale)
200 μA-200 mA : 300mV
2A : 700mV
20A : 900mV

AC Current

Range	Accuracy	Resolution
*200 μA	±1.0%, of rdg + 3 dgts	0.1 μA
2 mA		1 μA
* 20 mA		10 μA
200 mA	±1.8%, of rdg + 5 dgts	100 μA
* 2 A		1 mA
20 A	±3.0%, of rdg + 7 dgts	10 mA

* except 3630 (B) and 3650 (B)
Overload Protection: 2A/250V fuse of fast blow type
20A range unfused
Maximum Input Current :20A (Maximum of 15 Minutes)
Frequency Range: 40 Hz to 400 Hz
Indication: Average
Maximum Voltage Drop (under full scale)
200 μA-200mA : 300 mV
2 A : 700 mV
20 A : 900 mV

Resistance

Range	Accuracy	Resolution
* 20 ohm	±1.0%, of rdg + 5 dgts	0.01 ohm
200 ohm	±0.5%, of rdg + 3 dgts	0.1 ohm
2 Kohm	±0.5%, of rdg + 1 dgt	1 ohm
20 Kohm		10 ohm
200 Kohm		100 ohm
2 Mohm		1 Kohm
20 Mohm	±1.0%, of rdg + 2 dgts	10 Kohm

* Only for 3620 (B)
Overload Protection: 500V DC/250 V AC rms on all ranges
except 20 ohm and 200 ohm range (250V DC/AC)
Open Circuit Voltage: Less than 900 mV
Relative Humidity: 0 to 75% 0°C to 35°C on 2Mohm, 20Mohm
0 to 90% 0°C to 35°C on all other ranges
0 to 70% 35°C to 50°C

Diode and Audible Continuity Test

Range	Description	Test Condition
	Display reads approximate forward voltage drop of diode	Forward DC current Approximately 1 mA Reversed DC Voltage Approximately 2.8V
	Built-in buzzer sounds and LED lamp lights up (except 3620 (B)) if conductance is less than approximately 30 ohm.	Open Circuit Voltage Approximately 2.8V

Overload Protection: 250 V DC/AC rms

Transistor hFE Test

Range	Description	Test Condition
hFE	Display reads Approximate hFE value (0-1000) of transistor under test (All type)	Base Current Approximately 10μA. VCE 2.8 Volts

Capacitance for 3630 (B)

Range	Accuracy	Resolution
2000 pF	±2.0%, of rdg + 3 dgts	1 pF
20 nF		10 pF
200 nF		100 pF
2 μF	±3.0%, of rdg + 5 dgts	1 nF
20 μF		10 nF

Open Circuit Voltage; less than 3V
Test Frequency: about 200 Hz for 2000 pF to 2μF
about 20 Hz for 20 μF
Overload NOT protected.

Capacitance for 3650 (B)

Range	Accuracy	Resolution
2000 pF	±2.0%, of rdg + 3 dgts	1 pF
200 nF		100 pF
20 μF	±3.0%, of rdg + 5 dgts	10 nF

Open Circuit Voltage: less than 3V
Test Frequency: about 200 Hz for 2000 pF to 200 nF
about 20 Hz for 20 μF
Overload NOT protected.

Frequency for 3650 (B)

Range	Accuracy	Resolution
20 KHz	± 2.0%, of rdg + 3 dgts	10 Hz
200 KHz		100 Hz

Overload Protection: 250V DC/AC rms
Input Sensitivity: 250mV

5. INSTRUMENT OPERATION

5-1. PRELIMINARY NOTE

1. Above all, check the 9V Battery by pushing the Power ON/OFF to ON. If the Battery is weak, sign will appear on LCD. If this does not appear on the display, proceed as below. When replacing Battery, refer to MAINTENANCE section.
2. Sometimes the last digit will not register "0". This, however, will have no effect on the measurement.
3. ⚠ is the sign for warning that the input voltage or current should not exceed the indicated values. This is to prevent damage to the internal circuitry.
4. The function switch must be set to the range before operation.
5. In case that Bar does not appear in bar model after power switch ON, reset the power switch to ON again by pressing power button for a second.
6. Do not get wet.

5-2. DC Voltage Measurement

1. Connect the Black test lead to the COM Jack and the Red test lead to the V/Ω Jack.
2. Set the function switch to the DC V range to be used and connect the test leads across the source or load under measurement. See Figure 5-2.
   The polarity of the Red lead connection will be indicated at the same time as the voltage.

Note:
1. If the voltage range is not known beforehand, set the function switch to the highest range and work down.
2. When only the figure "1" is displayed or all the bar are flashing in bar model, overrange is being indicated and the function switch must be set to a higher range.
3. ⚠ Don't apply more than 1000V to the input. Indication is possible at higher Voltage but there is a danger of damaging the internal circuitry.
4. Take care to avoid contact with high tension circuit when measuring high voltage.

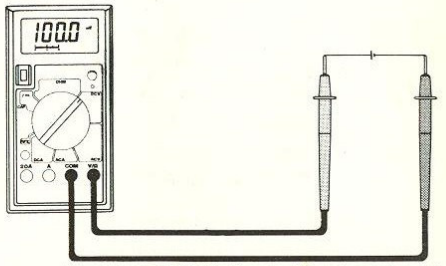


Fig. 5-2 DC Voltage Measurement

5-3. AC Voltage Measurement

1. Connect the Black test lead to the COM jack and the Red test lead to the V/Ω jack.
2. Set the function switch to the AC V range to be used and connect the test leads across the source or load under measurement. See Figure 5-3.

Note
1. See DC voltage measurement Note 1.2.
2. ⚠ Do not apply more than 750V rms to the input. Indication is possible at higher voltage but there is a danger of damaging the internal circuitry.
3. Take special care to avoid contact with high tension circuits when high voltage is measured.

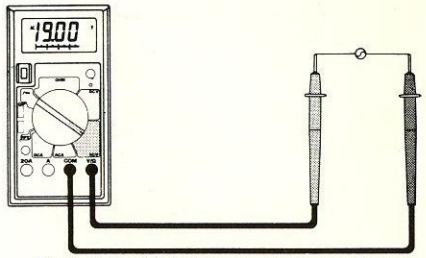


Fig. 5-3 AC Voltage Measurement

5-4 DC Current Measurement

1. Connect the Black test lead to the COM jack and the Red to the A jack for a maximum of 2A. For a maximum of 20A, move red test lead to the 20A jack.
2. Set the function switch to the DC A range to be used and connect the test leads in series with the load under measurement. See Figure 5-4.
3. The polarity at the Red test lead connection will be indicated at the same time as the current.

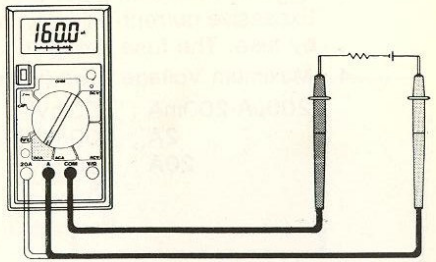


Fig. 5-4. DC Current Measurement

Note 1. If the current range is not known beforehand, set the Function switch to the highest range and work down.
2. When only the figure "1" is displayed or all the bar are flashing in bar model, overrange is being indicated and the function switch must be set to a higher range.
3. ⚠ The Maximum Input Current is 2A or 20A depending on the jack used.
Excessive current will blow the fuse which must be replaced. The 20A range is not protected by fuse. The fuse rating should not be over 2A to prevent damage to the internal circuitry.
4. Maximum Voltage Drop (under full scale)

200μA-200mA : 300mV
2A : 700 mV
20A : 900 mV

5-5 AC Current Measurement

1. Connect the Black test lead to the COM jack and the Red test lead to the A jack for a maximum of 2A. For a maximum of 20A, move the Red test lead to the 20A jack.
2. Set the function switch to the AC A range to be used and connect the test leads in series with the load under measurement. See Figure 5-5.

Note 1. If the current range is not known beforehand, set the Function switch to the highest range and work down.
2. When only the figure "1" is displayed or all the bar are flashing in bar model, overrange is being indicated and the function switch must be set to a higher range.
3. ⚠ The Maximum Input Current is 2A or 20A depending on the jack used.
Excessive current will blow the fuse which must be replaced. The 20A range is not protected by fuse. The fuse rating should not be over 2A to prevent damage to the internal circuitry.
4. Maximum Voltage Drop (under full scale)

200μA-200mA : 300mV
2A : 700mV
20A : 900mV

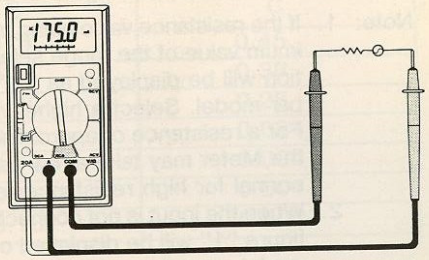


Fig. 5-5 AC Current Measurement

5-6 Resistance Measurement

1. Connect the Black test lead to the COM jack and the Red test lead to the V/Ω jack.
2. Set the function switch to the ohm range to be used and connect the test leads across the resistance under measurement. See Figure 5-6.

Note: 1. If the resistance value being measured exceeds the maximum value of the range selected, an overrange indication will be displayed as "1" and all the bar flashing in bar model. Select a higher range.
For a resistance of approximately 1 M ohm and above, the Meter may take a few seconds to stabilize. This is normal for high resistance readings.
2. When the input is not connected, i.e. at open circuit, the figure "1" will be displayed or all the bar flashing in bar model as overrange indication.
3. When checking in-circuit resistance, be sure the circuit under test has all power removed and all capacitors are fully discharged.

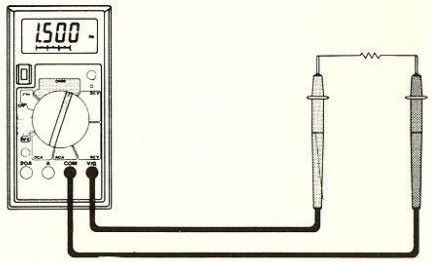


Fig. 5-6 Resistance Measurement

4. The resistance ranges of this instrument are protected by a posistor above 500V and a resistor network below 500V, except 20 ohm and 200 ohm range (250V).
5. Zero ADJ knob in 3620 (B) is used for zero reading of 20 ohm range.
6. Some devices may be damaged by the current applied during resistance measurements. The following table list shows the voltage and current available on each range.

Range	A	B	C
20 ohm	0.676	0.08	0.45
200 ohm	0.67	0.8	0.38
2 Kohm	0.67	0.28	0.28
20 Kohm	0.33	0.16	0.024
200 Kohm	0.33	0.16	0.004
2 Mohm	0.33	0.16	0.001
20 Mohm	0.33	0.16	0.0001

* Only for 3620 (B)
A is open circuit voltage at the jack.
B. is voltage across a resistance equal to full scale value.
C. is current in milliamperes through a short circuit at the input jacks.
All values are typical.

5-7 Diode Measurement

1. Connect the Black test lead to the COM jack and the Red test lead to the V/Ω jack. (Note: The plarity of the RED test lead is "+".)
2. Set the function switch to the ⊣◀ ♫ range and connect the test leads across the diode under measurement. See Figure 5-7.

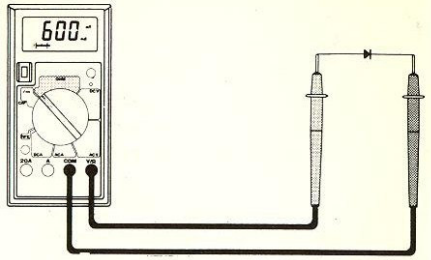


Fig. 5-7 Diode measurement

Note: 1. When the input is not connected, i.e. at open circuit , only the figure "1" on the left of LCD is displayed or all the bar flashing in bar model as overrange indication.
2. There is 1mA Current flow through the device under test.
3. The meter displays the forward voltage drop in millivolts, and overload when the diode is reversed.

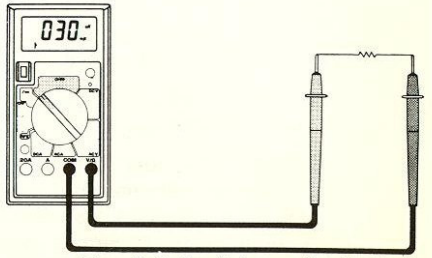


Fig. 5-8 Audible continuity test

5-8 Audible Continuity Test

1. Connect the Black test lead to the COM jack and the Red test lead to the V/Ω jack.
2. Set the function switch to the ⊣◀ ♫ range (same range as diode) and connect test leads across the resistance under measurement. See Figure 5-8.
3. Buzzer sounds and LED lamp lights up except 3620 (B) if the resistance between two probes is less than approximately 30 ohms.

Note: 1. When the input is not connected, i.e. at open circuit, only the figure "1" on the left of LCD is displayed or all the bar flashing as overrange indication.
2. The circuit to be tested must be in power off status during the continuity test.

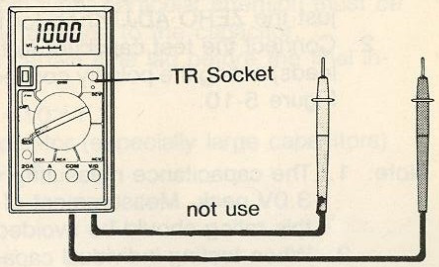


Fig. 5-9 Transistor hFE Test

5-9. Transistor hFE Test

1. Change the function switch to the hFE range.
2. Determine whether the transistor is NPN or PNP and locate the Emitter, Base and Collector Leads. Insert the leads into the correct holes in the socket on the front panel. See Figure 5-9.
3. The display will read the approximate hFE value at the test condition of base current 10μA VCE 2.8V.

5-10. Capacitance Measurement for 3630 (B) and 3650 (B)

1. Before connecting the test capacitor, note the display which should be 000, each time the range is changed. Adjust the ZERO ADJ. Knob for this condition.
2. Connect the test capacitor to the input sockets (not test leads) noting the polarity connections when required. See Figure 5-10.

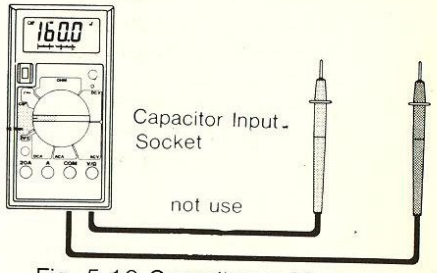


Fig. 5-10 Capacitance Measurement

Note: 1. The capacitance measuring voltage is less than about 3.0V peak. Measurement of capacitors with less than this rating should be avoided.
2. When testing individual capacitor, insert the leads into the two sockets, with the "+" (upper socket), "−" (lower socket), at the left on the panel.
(capacitor should be discharged before being inserted into the test-jack.)

3. Before each measurement, to achieve higher accuracy at each range, it is necessary to have the display 000 by adjusting the ZERO ADJ knob without the capacitor connected.
4. When testing polarized capacitors, for example, the tantalum type, particular attention must be paid to the polarity connections. This is to prevent possible damage to the capacitor.
5. When testing large capacitances, note that there will be a certain time lag before the final indication.
6. Units : 1 pF=10^{-12} F, 1 nF=10^{-9} F, 1 μF=10^{-6} F, 1 mF=10^{-3} F.
7. ⚠ Do not connect an external voltage or a charged capacitor (especially large capacitors) to the measuring terminals. It can damage the internal circuitry.

5-11. Frequency Measurement for 3650 (B)

1. Connect the Black test lead to the COM jack and the Red test Lead to the V/Ω jack.
2. Set the Function switch to the f KHz range to be used and connect the test leads across the frequency under measurement. See Figure 5-11.

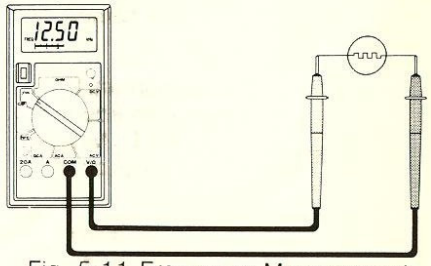


Fig. 5-11 Frequency Measurement

Note: 1. Do not connect test leads to AC outlet. If connected, indication is possible but it damages the internal circuitry. If, however, measurement by connecting to AC electric outlet is required, connect test leads to AC outlet through an attenuator.
2. When the test leads are connected to AC outlet, do not turn the selector switch to other range. It is also dangerous to the internal components.

6. MAINTENANCE

Your Digital Multimeter is a precise electronic device. Do not tamper with circuitry.

The apparatus must be disconnected from all voltage sources before any adjustment, replacement or maintenance and repair during which the apparatus shall be opened.

If afterwards any adjustment, maintenance or repair of the opened apparatus with voltage applied is necessary, it must be carried out only by a skilled person who is aware of the hazard involved.

To Avoid Damage:

A. Never connect more than 1000 Volt DC or 750 Volt rms AC.
B. Never connect a source of voltage with function switch in OHM position.
C. Never operate the DVM unless the back case is in place and fully closed.
D. Battery or Fuse replacement should only be done after the test leads have been disconnected and power is OFF.

6-1. 9 Volt Battery Replacement

Note the condition of 9 Volt battery following the procedure described previously in contents 5-1. If the battery needs to be replaced, open the back cover, remove the spent battery and replace it with a battery of the same type.

6-2. Fuse Replacement

If the fuse should be replaced, use only 2A fuse identical in physical size to the original or use the spare fuse in the storage compartment adjacent to the main fuse in the battery compartment.