

METEX[®] 3600 SERIES

DIGITAL MULTIMETER OPERATING MANUAL

SECTION	PAGE
1. INTRODUCTION	1
2. INFORMATION FOR SAFETY	1
3. FEATURES	3
3-1 General Features	
3-2 LCD Display Features on Function	
4. SPECIFICATIONS	8
5. OPERATION TUTORIAL	17
5-1 Preliminary Note	5-7 Diode Measurement
5-2 DC Voltage Measurements	5-8 Audible Continuity Test
5-3 AC Voltage Measurements	5-9 Transistor hFE Test (except 3620)
5-4 DC Current Measurements	5-10 Capacitance Measurements (for 3630 and 3650)
5-5 AC Current Measurements	5-11 Frequency Measurements (for 3650)
5-6 Resistance Measurements	
6. MAINTENANCE	29
6-1 Battery Replacement	
6-2 Fuse Replacement	

1. INTRODUCTION

This manual provides operating and service information for M3600 Series (including 3610, 3620, 3630, 3650) which are all 3 1/2 digit LCD display Digital Multimeter for use in the field, laboratory, workshop, hobby and home applications. this instrument is compact, rigid against collision, handheld, battery operated, various functions 30 ranges measured. They use Dual-slope A/D converter of CMOS technology for auto-zeroing, polarity section and overrange indication of "1" figure. And it measures DC & AC Voltage, DC & AC Current, Resistance, Diode, Capacitance (M3630 & M3650), Transistor hFE (except 3620), Continuity Test where beeper sound capability is internally contained and Frequency Measurement (M3650).

2. INFORMATION FOR SAFETY

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.

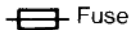
SAFETY SYMBOLS



Indicates the operator must refer to an explanation in this manual.



indicates terminals at which dangerous voltage may exist.



Fuse



Battery



Diode Test

1

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 (for 3610 & 3620) 200mA DC/AC (for 3630 & 3650) 20A DC/AC

The 20 A RANGE is NOT fuse-protected.

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.

TO AVOID DAMAGE OR INJURY

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

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

This restriction ensures protection against burns in the event at which Voltage is 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.

3. FEATURES

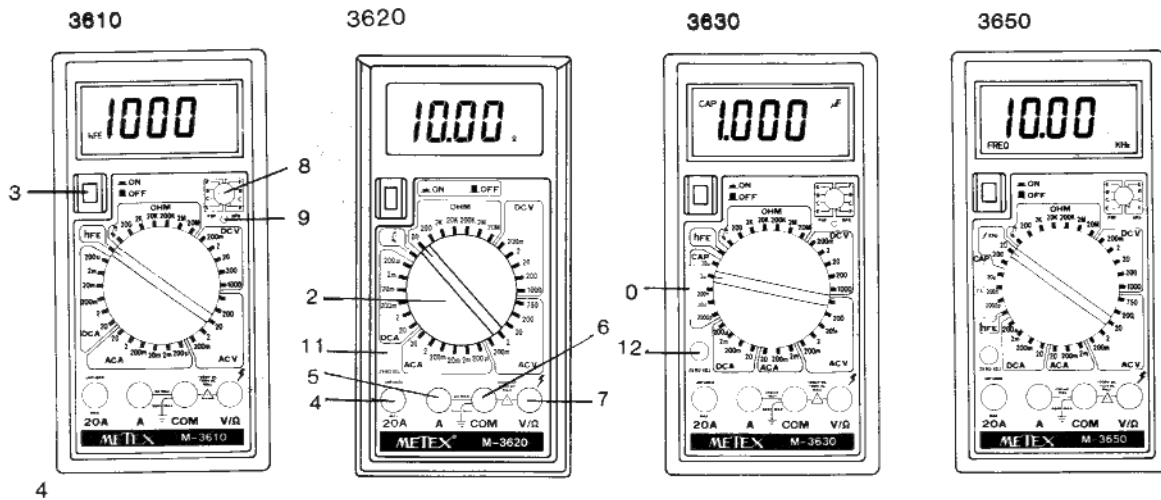
3-1. General Features

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.
- 17 mm high contrast LCD
- very rigid case fully protected from an external collision
- Automatic overrange indication by the "1" display on the left of LCD
- High surge Voltage protection 1.5KV-3KV
- Capacitance measurement (for 3630, 3650)
- Diode and Audible Continuity test (Continuity Beep sound)
- Transistor hFE test (except 3620)
- Frequency measurement (3650)
- Function Annunciators on LCD display
- Low Battery Annunciator

3

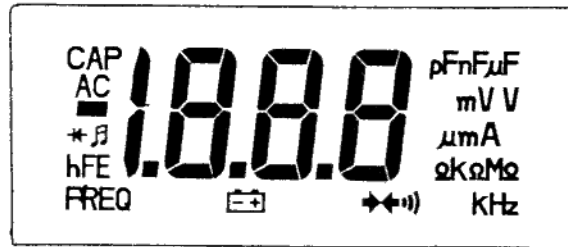
M3600 Seris Front PANEL



4

1. Digital Display (3 1/2 digits Max. 1999)
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. 20 Ω Range Zero ADJ Knob
12. Capacitance Zero ADJ Knob

FULL DISPLAY OF LCD

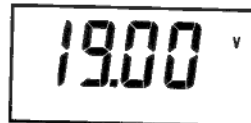


M3600 Series

5

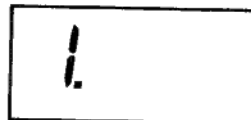
3.2. LCD Display Features on Function

Normal Reading under Measurement



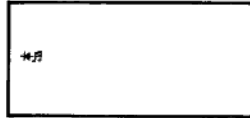
According to the position of Rotary switch the Maximum value that can be displayed on LCD is determined. When the reading value is over the upper limit, "1" figure appears on the left of LCD as an overrange indicator.

Overrange Indication



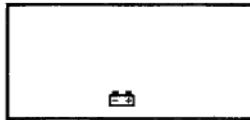
The digital display of 3 1/2 (Max. 1999) appears on LCD with mode, range & decimal point and polarity of "-" if omitted it means the polarity of "+".

Audible Continuity Indication*



The indicator of Buzzer appears in state that conductance is less than about 30 ohm at the same time with LED lamp lighting up (except 3620) and Beeper sounding.

Low-Battery Indication




As soon as above symbol appears on LCD the Battery has to be replaced for a proper operation as soon as possible.

On condition that this meter continues being used since the above symbol appears on LCD, pay attention to reading value which may be abnormal.

7

4. SPECIFICATION

Maximum Display	1999 Count (3 1/2 digit) with automatic polarity indication
Indication Method	LCD Display
Measuring Method	Dual-slope integration A/D (converter)
Overrange	"1" figure display on LCD
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°C to +50°C (14°F to 122°F)
Power Supply	One 9-Volt Battery NEDA 1604, 6F22 type or equivalent
Low Battery Indication	Display  on LCD
Size	90mmW X 176mmL X 36mmH
Weight	370g ± 10g (including 9 volt battery)
Accessories	Operating Manual, 9V Battery (Zinc-Carbon type), Test Leads (Red & Black 1 pair), spare Fuse.

8

Accuracies are \pm (% reading + No. of digits) Guaranteed for 1 year $23 \pm 5^\circ\text{C}$, less than 75% RH.
Warm up time is 1 minute.

DC Voltage

Range	Accuracy	Resolution
200 mV	$\pm 0.3\%$, 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.

9

AC Voltage

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

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

DC Current

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

* except 3630 and 3650

Overload Protection : 200mA/250V fuse of fast blow type (for 3630 and 3650)
 2A/250V fuse of fast blow type (for 3610 and 3620)
 20A range unfused

Maximum Input Current 20A (Maximum of 15 Minutes)

Measuring Voltage Drop : 200 mV

11

AC Current

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

* except 3630 and 3650

Overload Protection : 200mA/250V fuse of fast blow type (for 3630 and 3650)
 2A/250V fuse of fast blow type (for 3610 & 3620)
 20A range unfused

Maxim Input Current : 20A (Maximum of 15 Minutes)

Frequency Range : 40 Hz to 400 Hz

Indication : Average (rms of sine wave)

Measuring Voltage Drop : 200mV

12

Resistance

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

* only for 3620

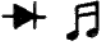
Overload Protection : 500V DC/AC rms on all ranges, except 20 ohm and 200 ohm range (250V DC/AC)

Open Circuit Voltage : less than 900mV

Relative Humidity : 0 to 75%, 0°C to 35°C on 2 Mohm, 20 Mohm
 0 to 90%, 0°C to 35°C on all other ranges
 0 to 70%, 35°C to 50°C

13

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 2.8 V
	Built-in buzzer sounds and LED lamp lights up (except 3620) if conductance is less than Approximately 30 ohm.	Open Circuit Voltage Approximately 2.8V

Overload Protection: 250V DC or 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 10uA. VCE 2.8 Volts

14

Capacitance (for 3630)

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

Open Circuit Voltage: less than 3V

Frequency Measuring: about 200Hz (for 2000pF to 2μF)
about 20Hz (for 20uF)

15

(for 3650)

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

Open Circuit Voltage: less than 3V

Frequency Measuring: about 200Hz (for 2000pF to 200nF)
about 20Hz (for 20μF)

Frequency (for 3650)



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

Overload Protection: 250V DC or AC rms

16 Input Sensitivity: 250mV (in the Worst Case) it is subject to change according to frequency measuring

5. OPERATION TUTORIAL

5-1. PRELIMINARY NOTE

1. Above all, check the 9V Battery by setting Power ON/OFF switch to ON. In case that the mode is in DC or AC volt function, LCD will display "1" or otherwise "0" in normal operating state. If your LCD as above proceed the measurement you want with following the procedure of next page. If the Battery is weak  sign will appear on LCD. When replacing Battery refer to MAINTENANCE section.
2. Sometimes the last digit will not register "0". This, however, will have no effect on the accuracy of final reading.
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 should be set to the range which you want to test before operation. Do not turn the selector switch to other range during voltage applied to the probe on any range measured. It may harm the internal circuitry if doing so. Turn the selector switch after the probe removed.
5. 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. Turn the Rotary 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. 17

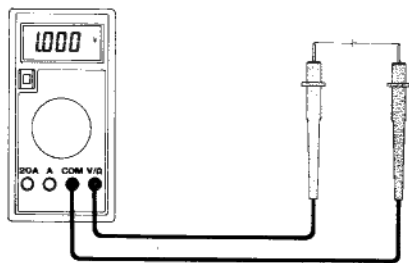



Fig. 5-2 DC Voltage Measurement

- 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 on the left of LCD, 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. Pay caution to avoid contact with high tension circuit when measuring high voltage.

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. Turn the Rotary 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.

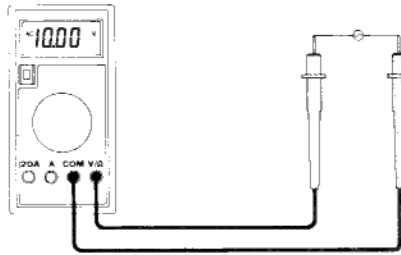
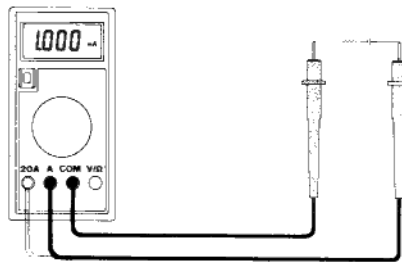


Fig. 5-3 AC Voltage Measurement

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 2 A (for 3610/3620) or 200mA (for 3630, 3650). For a maximum of 20A, move the red test lead to the 20A jack.
2. Turn the Rotary 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.

- 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. Use extrem caution to avoid contact with high tension circuits when high voltage is measured. 19



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" on the left is displayed, overrange is being indicated and the function switch must be set to a higher range.
 3. The Maximum Input Current is 2A (for 3610/3620), 200mA (for 3630, 3650), or 20A depending on the jack used. Excessive current will blow the fuse which must be replaced. The 20A range is not protected by a fuse. The fuse rating should not be over 2A (for 3610/3620), 200mA (for 3630 & 3650) to prevent damage to the internal circuitry.
 4. The maximum terminal voltage drop is 200mV.

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 3610 & 3620), 200mA (for 3630 and 3650). For 20A move the Red test lead to the 20A-jack.

- Turn the Rotary switch to the AC A range to be used and connect the test lead in series with the load under measurement. See Figure 5-5.

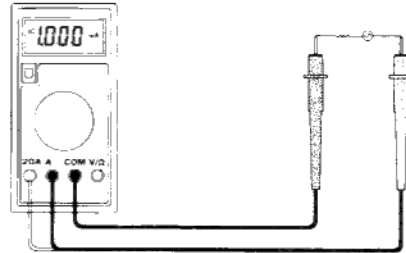


Fig. 5-5 AC Current Measurement

- Note
- If the current range is not known beforehand, set the Function switch to the highest range and work down.
 - When only the figure "1" is displayed on the left of LCD, overrange is being indicated and the function switch must be set to a higher range.
 - The Maximum Input Current is 2A (for 3610 & 3620), 200mA (for 3630, 3650) or 20A depending on the jack used. Excessive current will blow the fuse which must be replaced. The 20A range is not protected by a fuse. The fuse rating should not be over 2A (for 3610 & 3620), 200mA (for 3630 & 3650) to prevent damage to the internal circuitry.
 - The maximum terminal voltage drop is 200mV.

21

5-6. Resistance Measurement

- Connect the Black test lead to the COM jack and the Red test lead to the V/ Ω jack. (The polarity of the Red test lead is "+")
- Turn the Rotary switch to the ohm range to be used and connect the test leads across the resistance under measurement. See Figure 5-6.

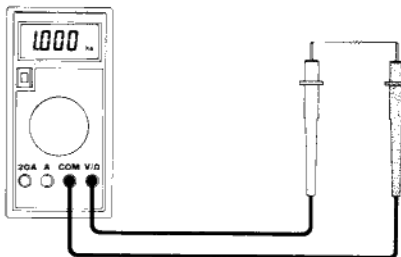



Fig. 5-6 Resistance measurement

- Note
- If the resistance value being measured exceeds the maximum value of the range selected, an overrange indication will be displayed as "1". Select a higher range. For resistance of approximately 1 M ohm and above, the Meter may take a few seconds to stabilize. This is normal for high resistance readings.
 - When the input is not connected, i.e. at open circuit, only the figure "1" in the left on LCD is displayed, overrange is being indicated and the function switch must be set to a higher range

22

3. When checking in circuit resistance, be sure the circuit under test has all power removed and that all capacitors are fully discharged.
4. The resistance ranges of this instrument are protected by a resistor above 500V and a resistor network below 500V, except 20 ohm and 200 ohm range (250V).
5. Zero ADJ knob at 3620 is used for zero reading of 20 ohm range.

5-7. Diode Measurement

1. Connect the Black test lead to the COM jack and the Red test lead to the V/ Ω jack.
2. Turn the Rotary switch to the  range and connect the test leads, Red test lead to "+" polarity and Black test lead to "-" polarity, across the diode under measurement. See Figure 5-7.

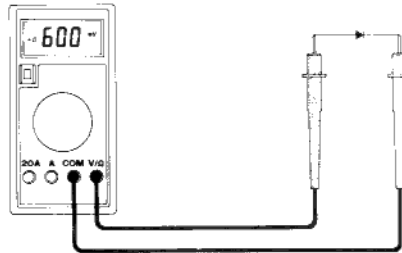



Fig. 5-7 Diode Measurement

- Note
1. When the input is not connected, i.e. at open circuit, only the figure "1" in the left on LCD is displayed, overrange is being indicated.
 2. There is 1 mA Current flow through the device under test.
 3. The meter displays the forward voltage drop in millivolts, and overload when the diode is reversed. 23

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 (except 3620) lights up if the resistance between two probes is less than about approximately 30 ohms.

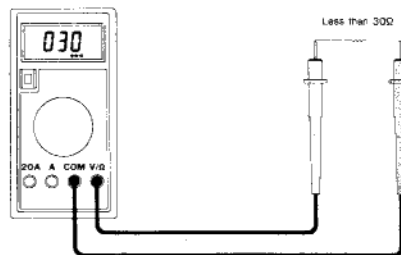


Fig. 5-8 Audible Continuity Test

- Note
1. When the input is not connected, i.e. at open circuit, only the figure "1" in the left on LCD is displayed, overranged is being indicated.
 2. Even though Data-hold function is being performed Audible continuity is measured independently of LCD display data hold.
 3. The circuit to be tested must be in power off status during the continuity test.

5-9. Transistor hFE Test (except 3620)

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 proper 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 10uA VCE 2.8V.

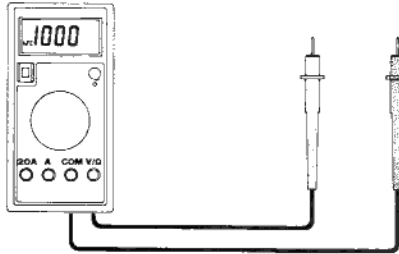
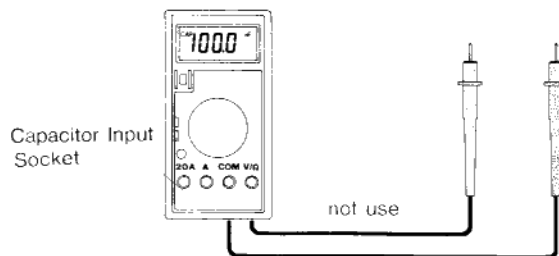


Fig. 5-9 Transistor hFE Test

5-10. Capatance Measurement (for 3630 and 3650)

1. There is no internal protection circuitry for this measurement. Take care on measuring for safety.
2. 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.
3. Connect the test capacitor to the input sockets (not test leads) with noting the polarity connections when required. See Figure 5-10.



- Note
1. The capacitance measuring voltage is less than about 3.0V peak. Measurement 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 measurements, to achieve higher accuracy at each range, it is necessary to have the display 000 by adjusting the ZERO ADJ knob without capacitor connections.
 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: $1\text{pF}=10^{-12}\text{F}$, $1\text{nF}=10^{-9}\text{F}$, $1\mu\text{F}=10^{-6}\text{F}$, $1\text{mF}=10^{-3}\text{F}$
 7. Frequency Measuring: 200Hz for 2000pF to $2\mu\text{F}$
20Hz for $20\mu\text{F}$
 8. \triangle Do not connect an external voltage or a charged capacitor (especially large capacitors) to the measuring terminals. It can damage the internal circuitry.

27

5-11. Frequency Measurement (only 3650)

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

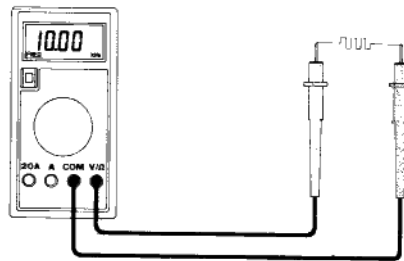


Fig. 5-11 Frequency Measurement

- Note
1. Do not connect test leads to AC outlet. If connected, it damages the internal circuitry. If, however, measurement by connecting to AC electric outlet is required, connect test leads to AC outlet through an annunciator by all means.
 2. During test leads connected to AC outlet do not turn the selector switch to other range. It is also dangerous to the internal components.

28

6. MAINTENANCE

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

The apparatus shall 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 under voltage is inevitable, it shall 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 procedure described previously.

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 needed, use only 2A (for 3610 & 3620) or 200mA (for 3630, 3650), fuses 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.

29



WARRANTY

Warrants this instrument to be free from defects in material and workmanship for a period of one year. Any instrument found defective within 6 months from the delivery date and returned to the factory with transportation charges prepaid, will be repaired, adjusted, or replaced at no charge to the original purchaser. This warranty does not cover expendable items such as batteries or fuses. If the defect has been caused by a misuse or abnormal operating conditions, the repair will be billed at a nominal cost.

