#### **1.INTRODUCTION**

This instrument is a high performance, battery operated, 3 1/2 digital multi-meter for measuring DC and AC voltage, DC and AC current, Resistance and Capacitance, Frequency and Temperature, Transistor, Diode and Continuity test. The Dual-integral A/D converter uses CMOS technology for auto-zero, polarity selection and over-range indication. Full overload protection is provided. Because of its outstanding features, it is most suitable for use on production lines or for lab, R & D, maintenance and repair work.

#### 2.SPECIFICATIONS

#### 2.1 GENERAL SPECIFICATIONS

 

 Display
 : 3 1/2 digit, 26mm high character, large LCD with max. 1999 counts

 Polarity
 : Automatic polarity indication.

 Zero adjustment
 : Automatic.

 Measuring method
 : Dual-integral A/D converter

 Sampling rate
 : 3 times/second

 Over range indication : Only the MSD 1" or "-1" displays.

 Low battery
 : The [-+] displays.

 Safety standards
 : **( E** EMC/LVD. The meter is up to the standards of IEC1010

 Pollution Degree 2, Over voltage category II or double insulation II .

Operating environment : Temperature (0°C to 40°C), humidity<80%RH.

Storage environment : Temperature (-10°C to 50°C), humidity<80%RH.

Power : Single, standard 9 volt battery. NEDA 1604IEC6F22

Dimension : 190mm(H)x 88.5mm(W)x 27.5mm(D)

Weight : Approx. 320g(including 9V battery)

Accessories : Operation manual, Conform card, Test leads(Red & Black 1 pair), Shock-proof cover, Gift box, etc.

#### 2.2 ELECTRICAL SPECIFICATIONS

Accuracy is  $\pm$  (percentage of reading + number of digit) at 23±5°C,<75%RH. DC Voltage

Range	Accuracy	Resolution
200mV	±(0.5%+3d)	100uV
2V		lmV
20V		10mV
200V		100mV
1000V	$\pm$ (1.0%+5d)	1V

Input impedance:  $10M \Omega$ 

Overload protection: 200mV range:250VDC/AC RMS

#### 2-1000V range: 1000VDC/AC RMS

#### AC Voltage

Range	Accuracy	Resolution
2V	±(0.8%+3d)	1mV
20V		10mV
200V		100mV
700V	$\pm$ (1.2%+5d)	1V

Input impedance :2V range:  $1 M \Omega$ 20-700V range:  $10 M \Omega$ Overload protection: 1000VDC/AC RMSFrequency response: 2-200V range: 40-400Hz 700V range: 40-200Hz

#### Indication: Average (rms of sine wave) Resistance

Range	Accuracy	Resolution
200Ω	±(0.8%+5d)	0.1Ω
2 <b>k</b> Ω		1 Ω
20k Ω		10Ω
200kΩ	$\pm(0.8\%+3d)$	100Ω
2 <b>M</b> Ω		1kΩ
20MΩ	±(1.0%+15d)	10k <b>Ω</b>
200ΜΩ	±[5%(Reading-10d)+20d]	100k <b>Ω</b>

Open circuit voltage: Less than 3V

Overload protection: 250V DC/AC RMS

#### **DC Current**

Range	Accuracy	Resolution
20mA	±(0.8%+3d)	10uA
200mA	土(1.2%+4d)	100uA
20A	$\pm (2.0\% + 5d)$	10mA

Max. measuring voltage: 200mV

Max. input current: 20A(max. up to 10 seconds)

Overolad protection: Fast 0.2A/250V fuse, has not fuse at 20A range.

#### AC Current

Range	Accuracy	Resolution
20mA	$\pm(1.0\%+5d)$	10uA
200mA	$\pm (2.0\%+5d)$	100uA
20A	$\pm (3.0\% + 10d)$	10mA

Max. measuring voltage: 200mV

Max. input current: 20A (max. up to 10 seconds)

Overload protection: Fast 0.2A/250V fuse, has not fuse at 20A range.

Frequency response: 40-200Hz

Indication: Average (rms of sine wave)

#### Capacitance

Range	Accuracy	Resolution
2nF		lpF
20nF		10pF
200nF	±(2.5%+20d)	100pF
2uF		lnF
20uF		10n <b>F</b>

Measuring frequency: 150Hz

Overload protection: 36V DC/AC RMS

#### Temperature

Range	Accuracy	Resolution
-40°C~1000°C	±(0.75%+3d)<400°C	້ຳດ
	±(1.5%+15d)≥400°C	. 10
0°F~1832°F	±(0.75%+5d)<750°F	1° E
	±(1.5%+15d)≥750°F	1 F

#### Using K type thermocouple probes

## Frequency

Range	Accuracy	Resolution
200 <b>k</b> Hz	±(3%+15d)	100Hz

Input sensitivity: 2V RMS

## Overload protection: 250V DC/AC RMS (max. up to 15 seconds) Diode and ContinuityTest

Range	Description	Test Condition
- <b>&gt;</b> + ·)])	Read & display approx. forward voltage of diode	Forward DC Cur rent approx. 1mA. Reversed DC voltage approx. 3V.
<b>-&gt;</b> + ·)}}	Buzzer sounds if resistance Between terminals V/Ω and COM is less than about 70Ω.	Open circuit voltage is approx. 3V

Overload protection: 250V DC/AC RMS

# **Transistor hFE Test**

Range	Description	Test Condition
	Read & dislay approx. forward	Base Current approx.
bFE	Voltage (0-1000) of transistor under test	10uA, Vce approx.
	(ALL TYPE)	3V

## 3. FRONT PANEL DESCRIPTION

### 1.LCD

- 2.POWER Switch
- 3.HOLD Key
- 4.hFE Socket
- 5.Temperature (TEMP) Socket
- 6. FUNCTION and RANGE Rotary Switch
- 7. V/Ω/Hz/C Input jack terminal
- 8. COM Input jack terminal
- 9. Less than 200mA Input jack terminal
- 10.20A Input jack terminal

# 4.OPERATION

- 1. Check 9-volt battery by setting the ON-OFF switch to ON. If the battery is weak, a + sign will appear on the display. If this does not appear on the display, proceed as below. See MAINTENANCE if the battery has to be replaced.
- 2. The mark, or sign next to the lead jacks, is for warning that the input voltage or current should not exceed the indicated values. This is to prevent from damaging the internal circuits.
- 3. The function switch should be set to the range which you want to test before operation.

## 4.1 DC and AC Voltage measurement

- 1.Connect the BLACK test lead to COM jack and RED test lead the V/ $\Omega/Hz$  /C jack.
- 2. Set the FUNCTION switch to desired DCV or ACV position.
- 3.Connect the probes across the source or load under measurement. Note:
- 1) If the voltage ranges is unknown beforehand set the FUNCTION witch to a higher range and work down, until obtain the most accurate reading.
- 2) When only the figure "1" or "-1" is displayed, over range is being indicated and the FUNCTION switch must be set to a higher range.
- 3) ⚠ : Do not apply more than DC1000V/AC700Vrms to the input. Indicati on is possible at higher voltages but there is danger of damaging the inter -nal circuitry. To covert function and range switch, test leads must leave test dot.
- 4)Be careful when measuring high voltage.

## 4.2 DC and AC Current measurement

- 1. Connect the BLACK test lead to COM jack and RED test lead the mA jack (max. 200mA.)
- 2.Set the FUNCTION switch to desired current range position.
- 3. Connect the probes in series with the current source to be measured.
- 4.For current measurement from 200mA to 20A follow generally the above procedure but connect the RED test lead to "20A" jack.

# Note:

- 1)If the current range is unknown beforehand, set the FUNCTION switch to a
- higher range and work down. Until obtain the most accurate value.
- 2)When only the figure "1" or "-1" is displayed over range is being indicated

and the FUNCTION switch must be set to a higher range.

- 3) A: The max input current is 200mA, or 20A depending upon the jack used (Test times less than 10 seconds). To covert function and range switch, test leads must leave test point. Excessive current will blow the
  - fuse so that must be replaced. The 20A range is not protected by a fuse.

# 4.3 Resistance measurement

- 1.Connect the BLACK test lead to COM jack and RED test lead the  $V/\Omega/Hz/C$  jack.
- 2.Set the FUNCTION Switch to desired resistance range position.
- 3.Connect the probes across circuit to be tested.
- 4. Caution: Ensure that the circuit to be tested is "dead".

Note:

- 1) If the resistance value being measured exceeds the max value of the range selected, and over range indication will be displayed ("1" or "-1"). Select a higher range, for resistance of approx.  $1M\Omega$  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" or "-1" will be displayed for the over range condition.
- 3)When checking in-circuit resistance, be sure the circuit under test has all power removed and that all capacitor are fully discharged.
- 4) Don't input voltage. This is to prevent from damaging the internal circuit.
- 5) When test leads short,  $200M \Omega$  range display reading is 10 digits, this is normal, when measure  $10M \Omega$  resistance (on  $200M \Omega$  range) display reading is 11.0, measure 1000hm resistance (on  $200M \Omega$  range) digits reading is 101.0. The 10 digits is a constant and should be subtracted from the reading.

### 4.4 Capacitance measurement

- 1.Setting function switch to F position.
- 2.Connect the BLACK test lead to COM jack and RED test lead to V/ $\Omega$  /Hz/C jack.
- 3. Connect the probes across capacitance to be tested, and noting polarity when required.

### Note:

1)If the capacitance value being measured exceeds the max value of the range selected, and over range indication will be displayed ("1" or "-1"). Select a higher range.

2)  $\triangle$ : Do not connect an external voltage or current to the measuring terminals. Turn off power and capacitors should be full discharged before measuring.

3)Unit: 1uF=10 nF 1nF=10 pF

## 4.5 Frequency measurement

1.Connect test leads or shield cable to COM jack and  $V/\Omega/Hz/C$  jack.

2.Set the FUNCTION switch to 200kHz range position.

3.Connect the probes or shield cable across the source load under test. Note:

- 1)Do not apply more than 250VDC/ACrms to the input. Indication is possible at voltage higher than 10VACrms, but readings may be out of specification.
- 2)In noisy environment, it is preferable to use shield cable for measuring small signal.
- 3)Be careful when measurement high voltage.

## 4.6 Temperature measurement

- 1.Setting function switch to C or F range position.
- 2. Insert the cold end of thermocouple into socket (noting polarity
- BLACK plug is "-"), and put work end into measurement place. Display reading is the temperature of measurement place in "C or "F. Note:

The instrument has special thermocouple probes.

## 4.7 hFE measurement

1.Setting function switch to hFE position.

- 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.
- 3. The display will read the approximate hFE value at the test condition Base Current 10uA, Vce approx. 3V.
- 4.8 Diode and continuity Test
- 1.Connect the BLACK test lead to COM jack and RED test lead the  $V/\Omega/Hz/C$  jack. (Note: The polarity of the red test probe is +).
- 2.Set the FUNCTION switch to "-+----)) " position.
- 3. Connect the test leads across the diode under measurement, display shows the approx. forward voltage of this diode.
- 4.Connect the test probes to two points of circuit, if the resistance is lower than approx. 70 Ω. Buzzer sounds.

### Note:

- 1)When the input is not connected, i.e. at open circuit, the figure "1" or " -1" will be displayed.
- 2) There is a milliamp current flow through the diode under test.
- 3) The meter displays the forward voltage drop in milli-volts and overload when the diode is reversed.

### 4.9 HOLD KEY

This key is used to hold data during measurement. This function is operative in all measurement method, Pressing the key, reading this held and H appears in the display. Pressing the key once again in order to releases the hold function.

## 4.10 Auto off and sleep mode

- 1. Working after 15min, instrument is auto off.
- 2. Press "POWER" key, the instrument was opened again.
- 5. WARNING
- 1. When measuring more than 36VDC/25VAC voltage ensure that instrument is not connected or switched to a current or resistance range, or to the diode check. Always ensure that the correct terminals are used for the type of measurement to be made.
- 2.Pay attention when measuring voltage above 50V, especially from sources where high energy is existed.
- 3. Avoid making connections to live circuits whenever possible.
- 4. When making current measurements ensure that the circuit not live before opening it in order to connect the test leads, and don't input more than 20A.
- 5.Before making resistance measurements or diode test, ensure that the circuit under test is de-energized.
- 1. Always ensure that the correct function and range is selected. If in doubt about the correct range to use, start with the highest and work downwards.
- 2. Extreme care should be taken when using the instrument to conjunction with a current transformer connected to the terminals if an open circuit occurs.
- 3.Ensure that the test leads and probes are in good condition with no damage to the insulation.
- 4. Take care not to exceed the over-load limits as given in the specification.
- 5.FUSE FOR REPLACEMENT MUST BE OF THE CORRECT TYPE AND RATING.
- 6.Before opening the case of the instrument to replace battery or fuse, disconnect the test leads from any external circuit, set the POWER switch to OFF.

# 6. CARE AND MAINTENANCE

# 6.1Care for your multi-meter

Your Digital Multi-meter is an example of superior design and craftsmanship. The following suggestions will help you care for the multi-meter so you can enjoy it for years.

- 1.Keep the multimeter dry If it gets wet, wipe it dry immediately.
- Liquids can contain minerals that can corrode electronic circuits.
- 2. Operate and store the multi-meter only in normal temperature

environments. Temperature extremes can shorten the life of electronic devices, damage batteries, and distort or melt plastic part.

- 3.Handle the multimeter gently and carefully. Dropping it can damage the circuit boards and case and can cause the multi-meter to work improperly although the holster can provide enough protection.
- 4.Keep the multi-meter away from dust and dirt, which can cause premature wear of parts.
- 5. Wipe the multi-meter with a damp cloth occasionally to keep it looking new. Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the multi-meter.
- 6. Use only fresh battery of the required size and type. Always remove old or weak batteries.
- 7. They can Leak chemicals that destroy electronic circuits.

# 6.2 Maintenance

- 1) 9-Volt battery replacement
- a. Ensure the instrument is not connected to any external circuit. Set the selector switch to OFF position and remove the test leads from terminals.
- b. Remove the screw on the bottom case and lift the bottom case.
- c. Remove the spent battery and replace it with a battery of the same type.
- 2) Fuse replacement
- a. Ensure the instrument is not connected to any external circuit. Set the selector switch to OFF position and remove the test leads from terminals.
- b. Remove the screw on the bottom case and lift the bottom case.
- c. Replace the fuse with same type and rating: 5x20mm, 200mA/250V, fast-blow fuse or as the replacements.