

3 1/2 DIGITAL MULTIMETER

OPERATION MANUAL

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-slop 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 in production line, lab, R & D, maintenance and repair works.

2. SPECIFICATIONS

2.1 GENERAL SPECIFICATIONS

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

Polarity : Automatic polarity indication.

Zero adjustment : Automatic.

Measuring method : Dual-slop A/D converter

Sampling rate : 3 times/second

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

Low battery : The "  " displays.

Safety standards :  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) × 88.5mm(W) × 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 \pm 5°C, < 75%RH.

DC Voltage

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

Impedance: 10M Ω

Overload protection: 2-1000V range: 1000VDC/AC RMS

AC Voltage

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

Impedance: 2V range: 1M Ω

20-700V range: 10M Ω

Overload protection: 1000VDC/AC RMS

Frequency response: 2V-200V range: 40-400Hz

700V range: 40-200Hz

Indication: Average (rms of sine wave)

Resistance

Range	Accuracy	Resolution
200 Ω	$\pm (0.8\%+5d)$	0.1 Ω
20K Ω	$\pm (0.8\%+3d)$	10 Ω
200K Ω		100 Ω
20M Ω	$\pm (1.0\%+15d)$	10K Ω

Open circuit voltage : Less than 3V

Overload protection: 250V DC/AC RMS

DC Current

Range	Accuracy	Resolution
200mA	$\pm (1.2\%+4d)$	100 μ A
20A	$\pm (2.5\%+5d)$	10 mA

Max. measuring voltage: 200mV

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

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

AC Current

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

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)

Overload protection: 36V DC/AC RMS

Temperature

Range	Accuracy	Resolution
-40°C ~ 1000°C	$\pm (0.75\%+3d) < 400^\circ\text{C}$	1°C
	$\pm (1.5\%+15d) \geq 400^\circ\text{C}$	

Using F type thermocouple probes

Diode and Continuity Test

Range	Accuracy	Resolution
	Read & display approx. forward voltage of diode	Forward DC Current approx. 1mA. Reversed DC voltage approx. 3V
	Buzzer sounds if resistance Between terminals V/ Ω and COM is less than about 70 Ω	Open circuit voltage is approx. 3V

Overload protection: 250VDC/AC RMS

Transistor hFE Test

Range	Accuracy	Resolution
hFE	Read & display approx. forward Voltage (0-1000) of transistor under test (ALL TYPE)	Base Current approx. 10 μ A, Vce approx. 3V

Dwell Test

Range	Standard input	Input open Display	Measure ment Value Range	Accuracy
3CYL	10V/50Hz Sine wave	119.4-120.6	66.5-69.5	$\pm (1.5\%+1)$
4CYL		89.4-90.6	49.5-52.5	
5CYL		71.5-72.5	39.5-42.5	
6CYL		59.6-60.4	32.5-35.5	
8CYL		44.7-45.3	24.0-27.0	

Tach (X10) Test, Duty Test

Range	Standard input	Input open Display	Measure ment Value Range	Accuracy
3CYL	100Hz/7V Square wave	Open Display is zero	398-402	$\pm (2.0\%+1)$
4CYL			296-304	
5CYL			237-243	
6CYL			198-202	
8CYL			148-152	
DUTY	10Hz/7V Square wave	Open Display is zero	49%-51%	$\pm (2.0\%+1)$

3. FRONT PANEL DESCRIPTION

- LCD

1/2

- POWER Switch
- HOLD Key
- hFE Socket
- Temperature (TEMP) Socket
- FUNCTION and RANGE Rotary Switch
- V/ Ω /Hz/C Input jack terminal
- COM Input jack terminal
- Less than 200mA Input jack terminal
- 20A Input jack terminal

4. OPERATION

- Check 9-volt battery by setting the POWER switch to NO. 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 no be replaced.
 - 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.
 - The function switch should be set to the range that you want to test before operation.
- #### 4.1 DC and AC Voltage measurement
- Connect the BLACK test lead to COM jack and RED test lead the V/ Ω /Hz jack.
 - Set the FUNCTION switch to desired DCV or ACV position.
 - Connect the probes across the source or load under measurement.

Note:

- If the voltage ranges is unknown beforehand set the FUNCTION switch to a higher range and work down, until obtain the most accurate reading.
 - 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.
 -  Do not apply more than DC 1000V/AC 700Vrms to the input. Indications possible at higher voltages but there is danger of damaging the internal circuitry. To covert function and range switch, test leads must leave test dot.
 - Be careful when measuring high voltage.
- #### 4.2 DC and AC Current measurement
- Connect the BLACK test lead to COM jack and RED test lead the mA jack (Max. 200mA.)
 - Set the FUNCTION switch to desired current range position.
 - 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 display over range is being indicated and the FUNCTION switch must be set to a higher range.
- 3) Δ The max. input current is 200mA, or 20A depending upon the jack set.(Test time is less than 10 seconds). To covert function and range switch, test leads must leave test point. Excessive current will blow the fuse , it is must be replaced. The 20A range is not protected with a fuse.

4.3 Resistance measurement

1. Connect the BLACK test lead to COM jack and RED test lead the V/ Ω /Hz 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 Ω 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 display 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.

4.4 Capacitance measurement

1. Setting function switch to F position.
2. Before connecting the test capacitor, note the display which may have readings other than zero each time the range is changed. This offset reading will not affect the accuracy for it can be overridden by true value.
3. Connect the test capacitor to the input (Cx) sockets , noting the polarity connections 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) Δ : 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=10³nF 1nF=10³pF

4.5 Frequency measurement

1. Connect test leads or shield cable to COM jack and V/ Ω /Hz 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 250V DC/AC RMS to the input. Indication is possible at voltage higher than 10VAC RMS, but reading 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 of F range position.
2. Insert the cold end (BLACK plug) of thermocouple into "mA" jack, RED test lead into "V/ Ω /Hz" jack. And put work end into measurement place. Display reading is the temperature of measurement place in $^{\circ}$ C or $^{\circ}$ 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. 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 to V/ Ω /Hz jack.
2. (Note: The polarity of the red test probe is +)
3. Set the FUNCTION switch to "  " position.
4. Connect the test leads across the diode under measurement, display shows the approx. forward voltage of this diode.
5. Connect the test probes to two points of circuit, if the resistance is lower that 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 one million-amp current flows through the diode under test.
- 3) The meter display the forward voltage drop in milli-volts and overload when the diode is reverse.

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 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/25VCA 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 from the highest and work downward.
- 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 good condition with no damage to the insulation.
- 4 Take are 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

6.1 Care for your multi-meter

Your Digital Multi-meter is an example of superior design and craftsmanship. The following suggestions will help you to 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) Use 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 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: 5 \times 20mm,200mA/250V, fast-blow fuse or as the replacements.