

DIGITAL MULTIMETER

OPERATION MANUAL

1. INTRODUCTION

The instrument is a high performance, high accuracy, 3 3/4 digit, 42mm digit high LCD multi-meter for measuring DC and AC voltage, DC and AC current, Resistance and Capacitance, Frequency, temperature, duty circle, Transistor, Diode and Continuity test. Design parameter: unit indication, data hold (HOLD), relatively measuring (REL), AUTO/MANUAL range, auto off and buzzer sounds, etc.

The Dual-slop A/D converter 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 3/4 digit LCD with a max readings of 3999

Measuring method: Dual-slop integrating A/D converter system.

Sampling rate: Approx. 3times/second.

Max. Common Mode Voltage: 500V DC/AC RMS.

Range select method: Automatic and Manual

Polarity: Automatic negative polarity indication.

Over range indication: Only the MSD "OL" display.

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 ~ 40)°C, humidity<80%RH.

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

Power: Double, standard 1.5 volt battery. AAA 7# battery.

Dimension: 190mm (H)×93.5mm (W) ×37mm (D).

Weight: Approx.420g(including battery).

2.2 ELECTRICAL SPECIFICATIONS

Accuracy is ±(percentage of reading + number of digit) at(23±5)°C<75%RH.

DC Voltage

| Range | Accuracy | Resolution |
|-------|------------|------------|
| 400mV | ±(0.5%+4d) | 0.1mV |
| 4V | | 1mV |
| 40V | | 10mV |
| 400V | | 100mV |
| 1000V | ±(1.0%+6d) | 1V |

Input impedance: 400mV range: more than 40MΩ other range: 10MΩ

Overload protection: 1000V DC or AC peak value

DC mV:

| Range | Accuracy | Resolution |
|-------|------------|------------|
| 400mV | ±(0.5%+4d) | 0.1mV |

AC Voltage

| Range | Accuracy | Resolution |
|-------|-------------|------------|
| 4V | ±(0.8%+10d) | 1mV |
| 40V | | 10mV |
| 400V | ±(1.0%+10d) | 100mV |
| 750V | | 1V |

Input impedance: 400mV range: more than 40MΩ; other range: 10MΩ

Frequency response: 750V range : 40-100Hz other range: 40-400Hz

Overload protection: 1000DC/750VAC RMS

Indication : mean value response (rms of sine wave)

Resistance

| Range | Accuracy | Resolution |
|--------|-------------|------------|
| 400 Ω | ±(0.8%+5d) | 0.1 Ω |
| 4k Ω | | 1 Ω |
| 40k Ω | ±(0.8%+4d) | 10 Ω |
| 400k Ω | | 100 Ω |
| 4M Ω | ±(1.2%+10d) | 1k Ω |
| 40M Ω | | 10k Ω |

Overload protection: 250V DC/AC peak value

Open circuit voltage: 400mV

Note: at 400 Ω range, should short the test leads and measure the resistance of the wire, then, minus from measuring.

DC Current

| Range | Accuracy | Resolution |
|--------|-------------|------------|
| 400uA | ±(1.0%+10d) | 0.1uA |
| 4000uA | | 1uA |
| 40mA | ±(1.2%+8d) | 10uA |
| 400mA | | 100uA |
| 10A | ±(1.2%+10d) | 10mA |

Overload protection: 0.5A/250V fuse, 10A/250V fuse.

Max measuring voltage: Full scale mA range: 1.2V; A range : 100 mV.

Max input current: 10A (max. up to 15 seconds).

AC mV

| Range | Accuracy | Resolution |
|-------|------------|------------|
| 400mV | ±(1.6%+8d) | 0.1mV |

AC Current

| Range | Accuracy | Resolution |
|--------|-------------|------------|
| 400uA | ±(1.5%+10d) | 0.1uA |
| 4000uA | | 1uA |
| 40mA | ±(1.2%+8d) | 10uA |
| 400mA | | 100uA |
| 10A | ±(2.0+15d) | 10mA |

Overload protection: 0.5A/250V fuse, 10A/250V fuse

Max measuring voltage: Full scale mA range: 1.2V A range: 100mV

Max input current: 10A (up to 15 seconds).

Frequency response: 10A range: 40-100Hz; other range: 40-400Hz

Capacitance

| Range | Accuracy | Resolution |
|-------|-------------|------------|
| 4nF | ±(2.5%+20d) | 1pF |
| 40nF | | 10pF |
| 400nF | ±(3.5%+8d) | 100pF |
| 4uF | | 1nF |
| 40uF | ±(5.0%+10d) | 10nF |
| 200uF | | 100nF |

Overload protection : 250V DC/AC peak value

Frequency

| Range | Accuracy | Resolution |
|--------|-------------|------------|
| 100Hz | ±(0.5%+10d) | 0.01Hz |
| 1000Hz | | 0.1Hz |
| 10kHz | ±(0.5%+10d) | 1Hz |
| 100kHz | | 10Hz |
| 1MHz | ±(0.5%+10d) | 100Hz |
| 30MHz | | 1kHz |

Input sensitivity: 1.0V

Overload protection: 250V DC/AC peak value

Diode and continuity Test

| Range | Description | Test Condition |
|---|---|---|
|  | Display read approx. forward voltage of diode | Forward DC Current approx.0.5mA. Reversed voltage approx. 1.5V. |
|  | Buzzer sounds if resistance Between terminals V/Ω and COM is less than about70±30 Ω . | Open circuit voltage: 0.5V |

Overload Protection : 250V DC/AC peak value

Warning: do not input voltage at the range for safety.

Transistor hFE Test

| Range | Displaying value | Test condition |
|----------------|------------------|---|
| hFE NPN or PNP | 0~1000 | Base Current approx. 15uA, Vce approx. 1.5V |

Temperature

| Range | Displaying value | Test condition |
|--------------|---------------------------------------|----------------|
| (-20-1000)°C | <400°C±(1.0%+5d) ≥400°C±(1.5%+15d) | 1°C |

Thermocouple: K type

Warning: do not input voltage at the range for safety.

3. FRONT PANEL DESCRIPTION

1.LCD

2.Function key

2-1.HOLD Key

2-2.REL KEY

2-3.Hz/DUTY Key

2-4 "select" key

2-5.RANGE Key

3.Rotary Switch

4.Voltage, Resistance, Frequency socket.

5.COM input jack terminal

6.Less than 400mA input jack terminal

7.10A input jack terminal

4. OPERATION

1. Check the 1.5-volt battery by setting the ROTARY Switch removes to OFF position.

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 that you want to test before operation.

4.1 DC Voltage measurement

1) Insert the BLACK test lead to "COM" jack and RED test lead to the "V/Ω/Hz" jack.

2) Set the FUNCTION switch to "V" range.

3) The default range is Auto range, and "AUTO" is displayed. Pressing RANGE key switch to manual range, 400mV/4V/40V/400V/1000V can be selected.

4) Connect the test leads to the tested point, the voltage and polarity which connected with the red lead will appear on LCD.

Note:

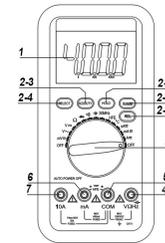
1) Manual range, if LCD display "OL", over range is being indicated and the FUNCTION switch must be set to a higher range.

2) Do not measure over 1000V, or, the meter will be damaged.

3)Caution to avoid contact with high voltage circuits when measuring high voltage.

4.2. AC voltage measurement

1) Insert the black test lead to "COM" jack and the red one to "V/Ω/Hz" jack.



- 2) Set the function switch to " $\sqrt{\sim}$ " range.
- 3) The default range is Auto range, and "AUTO" is displayed. Pressing RANGE key switch to manual range, 400mV/4V/40V/400V/700V can be selected.
- 4) Connect the test leads to the test point, the voltage of the two points which connected with the leads will appear on LCD.

4.3 DC Current measurement

- 1) Insert the BLACK test lead to "COM" jack and RED test lead to the "mA"(max. 400mA) or "10A" jack (max. 10A).
- 2) Set the FUNCTION switch to current range. Pressing " $\sim / \text{---}$ " key to select DC measure method, connect the leads across to the tested circuit, the current value and polarity the red lead connect with will appear on LCD.

Note:

- 1) If the current range is unknown beforehand, set the FUNCTION switch to a high range and work down.
- 2) When only the figure "OL" is displayed over range is being indicated and the FUNCTION switch must be set to a higher range.
- 3) The max input current is 400mA, or 10A depending upon the jack used. Excessive current will blow the fuse.

4.4 AC current measurement

- 1) Insert the BLACK test lead to "COM" jack and RED test lead to the mA"(max. 400mA) or "10A" jack (max. 10A).
- 2) Set the FUNCTION switch to current range. Pressing " $\sim / \text{---}$ " key to select AC measure method, connect the leads across to the tested circuit, the current value will appear on LCD.

Note:

- 1) If the current range is unknown beforehand, set the FUNCTION switch to a high range and work down.
- 2) When only the figure "OL" is displayed over range is being indicated and the FUNCTION switch must be set to a higher range.
- 3) The max input current is 400mA, or 10A depending upon the jack used. Excessive current will blow the fuse.

4.5 Resistance measurement

- 1) Connect the BLACK test lead to "COM" jack and RED test lead to the " $\sqrt{\Omega/\text{Hz}}$ " jack.
- 2) Set the FUNCTION Switch to " Ω " range.
- 3) Press "RANGE" to select Auto/Manual range
- 4) If measuring small resistance, should short test leads first, press "REL" once, ensure measure value accuracy.

Note:

- 1) To use manual method, if the resistance range is unknown beforehand, set the FUNCTION switch to a higher range and work down.
- 2) If "OL" displays on LCD, it means over-range. When measuring resistance more than $1\text{M}\Omega$, the meter may take a few seconds to stabilize. This is normal for high resistance readings.
- 3) When the input is not connected, i.e. at open circuit, the figure "OL" will be displayed for the over range condition.
- 4) When checking in-circuit resistance, be sure the power has been switched off all capacitors are fully discharged.
- 5) Do not input any voltage at this range.

4.6 Capacitance measurement

- 1) Set the FUNCTION switch to " $\text{---}|\text{---}$ " position.
- 2) Press "REL" once to adjust to zero.
- 3) Connect the tested capacitor to "COM", " $\sqrt{\Omega/\text{Hz}}$ " input sockets in accordance to the leads (the polarity of the red lead is "+"), the value will be displayed on LCD.
- 4) When measuring more than 4uF, it takes 15 seconds to stabilize.

Note:

- 1) Capacitance range have only auto mode.
- 2) Before measuring each time, must press "REL" to ensure measure accuracy.
- 3) Units: $1\mu\text{F}=1000\text{nF}$ $1\text{nF}=1000\text{pF}$
- 4) Capacitors should be fully discharged to avoid damaging the meter.

4.7 Frequency measurement

- 1) Connect test leads or shield cable to "COM" and " $\sqrt{\Omega/\text{Hz}}$ " jack.
- 2) Set the FUNCTION switch to the "Hz" range, and connect test leads or cable across the source load under test.
- 3) Press "Hz/Duty" to switch frequency/duty cycle, and display the reading of frequency or duty cycle.

Note:

- 1) Frequency rang have only auto range mode.
- 2) Do not apply more than 250V DC/AC peak value to the input. Indication is possible at voltage higher than 10V AC rms, but readings may be out of specification.
- 3) In noisy environment, it is preferable to use shield cable for measuring small signal.
- 4) Be caution to avoid contact with high tension circuits when measurement high voltage.

4.8 hFE measurement

- 1) Set the function switch to hFE range.
- 2) Define the transistor is NPN or PNP type, insert the emitter, base and collector separately to the correct hole, the approx. value will be displayed on LCD.

4.9 Diode and continuity Test

- 1) Connect the BLACK test lead to "COM" jack and RED test lead to the " $\sqrt{\Omega/\text{Hz}}$ " jack..
- 2) Set the FUNCTION switch to " $\text{---}|\text{---}$ " position. Press " DC/AC " key which select diode measure method.
- 3) Forward measure: Connect RED test lead to the positive of the test diode, BLACK test lead to the negative, then, reading of approx. forward voltage of this diode displays.
- 4) Reverse measure: Connect BLACK test lead to the positive of the test diode, RED test lead to the negative, the mark "OL" will be displayed.
- 5) Proper diode testing should include both steps.
- 6) Press " $\sim / \text{---}$ " to select continuity mode.
- 7) Connect the test probes to two points of circuit, if the resistance is lower than approx. $50\pm 20\Omega$. Buzzer sounds.

Note: Do not input voltage at this range.

4.10 Temperature measurement

1. Set the function key to " $\text{---}|\text{---}$ " range.
2. Insert the cold-point of the thermocouple to " K TEMP" hole, and the work-point to the place wanted to take temperature, the value will be displayed on LCD.

NOTE:

1. When the input terminal is in open circuit, will display the " normal temp."
2. Do not change the thermocouple, or, the accuracy can not be secured.
3. Do not input voltage at this range.

4.11 Data hold

Press "Hold" key, the current data will display on LCD; Press the key again, will cancel the hold function.

4.12 Auto power off

- 1) Stop working for 15mins, the instrument is auto off and into the sleep mode. The buzzer will sound before power off. Press any key to turn on the power.
- 2) Pressing " $\sim / \text{---}$ " key before turning on can cancel the function.

5. WARNING

- 1) When measuring 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) Take extreme care 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.
- 5) Before making resistance measurements or diode test, ensure that the circuit under test is de-energized.

- 6) 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.
- 7) Extreme care should be taken when using the instrument to conjunction with a current transformer connected to the terminals if an open circuit occurs.
- 8) Ensure that the test leads and probes are good condition with no damage to the insulation.
- 9) Take care not to exceed the over-load limits as given in the specification.
- 10) FUSE FOR REPLACEMENT MUST BE OF THE CORRECT TYPE AND RATING.
- 11) Before opening the case of the instrument to replace battery or fuse, disconnect the test leads from any external circuit, set the selector switch to "OFF" position.

6. MAINTENANCE

Do not try to modify the inner circuit.

- 1) Keep the multimeter dry. Keep the multi-meter away from dust and dirt
- 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 can cause the multi-meter to work improperly although the holster can provide enough protection.
- 4) 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.
- 5) Take out off the battery if do not use for a long time. When LCD displays " $\text{---}|\text{---}$ ", the battery should be replaced.
 - 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.
- 6) Replace the fuse with same type and rating as the replacements.

NOTE:

- 1) Do not input a voltage over 1000V DC/AC peak value.
- 2) Do not measure voltage at current range, resistance range, diode and buzzer range.
- 3) Do not use the meter if the battery is not replaced well or the battery case is not fixed.
- 4) Before replacing battery or fuse, release the test leads from the test point and turn power off.