



310 SERIES

3 1/2 DIGITAL MULTIMETER

OWNER'S MANUAL

- Read this owner's manual thoroughly before use






WARRANTY

This instrument is warranted to be free from defects in material and workmanship for a period of one year. Any instrument found defective within one year 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 expandable items such as batteries or fuses. If the defect has been caused by a misuse or abnormal operation conditions, the repair will be billed at a nominal cost.

SAFETY INFORMATION

The multimeter has been designed according to IEC-1010 concerning electronic measuring instruments with an overvoltage category (CAT II 600V) and Pollution degree 2.


ELECTRICAL SYMBOLS

- ~ AC (Alternating Current)
- ≡ DC (Direct Current)
-  Important safety information. Refer to the manual.
-  Dangerous voltage may be present.
-  Earth ground
-  Fuse
- CE Conforms to European Union directives
-  Double insulated

WARNING

To avoid possible electric shock or personal injury, follow these guidelines:

- a. Do not use the meter if it is damaged. Before you use the meter, inspect the case. Pay particular attention to the insulation surrounding the connectors.
- b. Inspect the test leads for damaged insulation or exposed metal. Check the test leads for continuity. Replace damaged test leads before you use the meter.
- c. Do not use the meter if it operates abnormally. Protection may be impaired. When in doubt, have the meter serviced.
- d. Do not operate the meter around explosive gas, vapor, or dust.
- e. Do not apply more than the rated voltage, as marked on the meter, between terminals or between any terminal and earth ground.
- f. Before use, verify the meter's operation by measuring a known voltage.
- g. When measuring current, turn off circuit power before connecting the meter in the circuit. Remember to place the meter in series with the circuit.
- h. When servicing the meter, use only specified replacement parts.

- i. Use with caution when working above 30V ac rms, 42V peak, or 60V dc. Such voltages pose a shock hazard.
- j. When using the probes, keep your fingers behind the finger guards on the probes.
- k. Connect the common test lead before you connect the live test lead. When you disconnect test leads, disconnect the live test lead first.
- l. Remove the test leads from the meter before you open the battery door.
- m. Do not operate the meter with the battery door or portions of the cover removed or loosened.
- n. To avoid false readings, which could lead to possible electric shock or personal injury, replace the batteries as soon as the low battery indicator ("  ") appears.

CAUTION

To avoid possible damage to the meter or to the equipment under test, follow these guidelines:

- a. Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.
- b. Use the proper terminals, function, and range for your measurements.

- c. Before measuring current, check the meter's fuses and turn power OFF to the circuit before connecting the meter to the circuit.
- d. Before rotating Function / Range switch to change functions, disconnect test leads from the circuit under test.
- e. Before attempting to insert transistors for testing, always be sure that the test leads have been disconnected from any measurement circuits.
- f. Remove test leads from the meter before opening the meter case.




MAINTENANCE

- a. Before opening the case, always disconnect the test leads from all live circuits.
- b. To continue protection against fire, replace fuse only with the specified voltage and current ratings:
F 250mA / 250V (Fast Blown) \varnothing 5 x 20
- c. Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents.

GENERAL DESCRIPTION

This series instruments are compact 3 1/2 digit digital multimeters for measuring DC and AC Voltage, DC Current, Resistance and testing Diode, Transistor & Audible Continuity. Some of them also provide Temperature measurement or Battery test

function, or can be used as a signal generator (see the following table). Full range overload protection and low battery indication are provided. They are ideal instruments for use in fields, laboratory, workshop, DIY and home applications.

| | DCV | ACV | DCA | OHM |  |  | hFE |  | TEMP |
|-----|-----|-----|-----|-----|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------|------|
| 310 | * | * | * | * | * | * | * | | |
| 311 | * | * | * | * | * | * | * | * | |
| 312 | * | * | * | * | * | * | * | | * |

FRONT PANEL DESCRIPTION

1. DISPLAYS

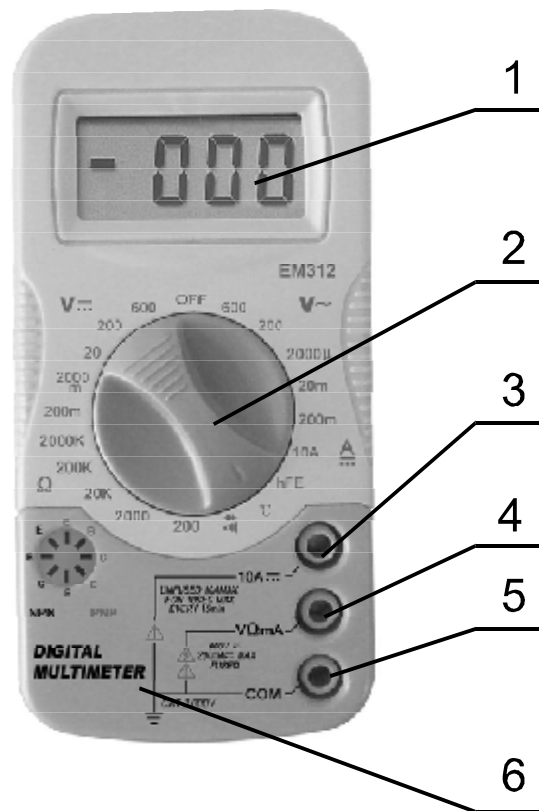
3 1/2 digit LCD, Max. reading 1999.

2. FUNCTION / RANGE SWITCH

This switch is used to select the function and desired range as well as to turn ON/OFF the instrument. To extend the life of the battery, the switch should be set to the "OFF" position when the instrument is not in use.

3. "10A" JACK

Plug in connector for the red (positive) test lead for current (between 200mA and 10A) measurements.



4. "VΩmA" JACK

Plug in connector for the red (Positive) test lead for all voltage, resistance and current (up to 200mA) measurements.

5. "COM" JACK

Plug in connector for the black (Negative) test lead.

6. BATTERY COMPARTMENT COVER

Remove battery
compartment cover.



SPECIFICATIONS

Accuracy is specified for a period of 1 year after calibration and at 18° C ~ 28° C (64° F ~ 82° F) with relative humidity up to 75%

Accuracy specifications take the form of:

$\pm [(\% \text{ of Reading}) + (\text{Number of Least Significant Digits})]$

DC VOLTAGE

| RANGE | RESOLUTION | ACCURACY |
|--------|------------|-------------------|
| 200mV | 100μV | $\pm (0.5\% + 2)$ |
| 2000mV | 1mV | $\pm (0.8\% + 2)$ |
| 20V | 10mV | |
| 200V | 100mV | |
| 600V | 1V | $\pm (1.0\% + 2)$ |

AC VOLTAGE

| RANGE | RESOLUTION | ACCURACY |
|-------|------------|--------------------|
| 200V | 100mV | $\pm (1.2\% + 10)$ |
| 600V | 1V | |

Response: Average responding, calibrated in rms of a sine wave.

Frequency Range: 45Hz~450Hz

DC CURRENT

| RANGE | RESOLUTION | ACCURACY |
|--------------|-------------|-------------------|
| 200 μ A | 100nA | $\pm (1.0\% + 2)$ |
| 2000 μ A | 1 μ A | |
| 20mA | 10 μ A | |
| 200mA | 100 μ A | $\pm (1.2\% + 2)$ |
| 10A | 10mA | $\pm (2.0\% + 2)$ |

Overload Protection: 250mA / 250V fused (Range 10A unfused).

Measuring Voltage Drop: 200mV

RESISTANCE

| RANGE | RESOLUTION | ACCURACY |
|--------|------------|-------------|
| 200Ω | 100mΩ | ± (1.0% +2) |
| 2000Ω | 1Ω | ± (0.8% +2) |
| 20KΩ | 10Ω | |
| 200KΩ | 100Ω | |
| 2000KΩ | 1KΩ | ± (1.2% +2) |

Maximum Open Circuit Voltage: 3.2V.

TEMPERATURE (TYPE K THERMOCOUPLE)

| RANGE | RESOLUTION | ACCURACY |
|----------|------------|-------------|
| 0~1000°C | 1°C | ± (2.0% +3) |

DIODE & AUDIBLE CONTINUITY

| RANGE | DESCRIPTION |
|-------|----------------------------------------------------------------------------------------------|
| •))) | The built-in buzzer will sound if the resistance of the circuit under test is less than 50Ω. |
| ➔+ | The approximate forward voltage of the diode under test will be displayed on the LCD. |

Signal output:

Signal output: 50Hz square wave

level output: 3Vpp

TRANSISTOR TEST

| Range | hFE | Test Current | Test Voltage |
|-----------|--------|---------------|--------------|
| PNP & NPN | 0~1000 | 1b=10 μ A | Vce=2.8V |

GENERAL SPECIFICATIONS

Maximum Display: 1999 counts (3 1/2 digits) with automatic polarity indication

Indication Method: LCD display

Measuring Method: Dual-slope integration A/D converter system

Overrange Indication: Only figure "1" displayed on the LCD

Reading Rate: 2-3 times/second (approximate)

Operating Temperature: 0°C ~ 40°C (32°F~104°F) , <75% R.H.

Storage Temperature: -10°C ~ 50°C (14°F~122°F) , <75% R.H.

Power Supply: One 12-volt battery (23A)

Low Battery Indication: "  " displayed on the LCD

Dimensions: 120 × 58 × 28(mm)

Weight: 95g (including one 9V battery)

OPERATING INSTRUCTIONS

DC VOLTAGE MEASUREMENT

1. Connect the red test lead to "VΩmA" jack and the black test lead to "COM" jack.
2. Set the Function/Range switch to desired V_{DC} range, if the voltage to be measured is not known beforehand, set the range switch to the highest range and then turn it down range by range until satisfactory reading is obtained.
3. Connect the test leads to the device or circuit to be measured.
4. Turn on the power of the device to be measured.
The voltage value will appear on the LCD along with the polarity of the red test lead .

AC VOLTAGE MEASUREMENT

1. Connect the red test lead to "VΩmA" jack and the black test lead to "COM" jack.
2. Set the Function/Range switch to desired V_{AC} range, if the voltage to be measured is not known beforehand, set the range switch to the highest range and then turn it down range by range until satisfactory reading is obtained.
3. Connect the test leads to the device or circuit to be measured.

4. Turn on the power of the device to be measured.
The voltage value will appear on the LCD.

DC CURRENT MEASUREMENT

1. Connect the red test lead to "V Ω mA" jack and the black test lead to "COM" jack (for current between 200mA and 10A, connect the red test lead to "10A" jack).
2. Set the Function/Range switch to desired A $\overline{=}$ range.
3. Open the circuit to be measured, and connect the test leads in series with the load in which the current is to be measured
4. Read the current value on the LCD.

RESISTANCE MEASUREMENT

1. Connect the red test lead to "V Ω mA" jack and the black test lead to "COM" jack.
2. Set the Function/Range switch to desired " Ω " range
3. If the resistance being measured is connected to a circuit, turn off power and discharge all capacitors before making measurement.
4. Connect the test leads to the circuit to be measured.
5. Read the resistance value on the LCD.

DIODE MEASUREMENT

1. Connect the red test lead to "VΩmA" jack and the black test lead to "COM" jack.
2. Set the Function/Range switch to " \rightarrow +" range.
3. Connect the red test lead to the anode of the diode to be measured and the black test lead to the cathode of it.
4. The forward voltage drop in mV will be displayed. If the connection is reversed, only figure "1" will be shown.

TEMPERATURE MEASUREMENT

1. Connect the type K thermocouple to "VΩmA" and "COM" jacks.
2. Set the Function/Range switch to TEMP range.
3. Connect the type K thermocouple to the object to be measured.
4. Read the temperature value in °C on the LCD.

AUDIBLE CONTINUITY TEST

1. Connect the red test lead to "VΩmA" jack and the black test lead to "COM" jack.
2. Set the Function/Range switch to " \bullet)))" range.
3. Connect the test leads to the two terminals of the circuit to be tested. If the resistance is less than about 50Ω, the built-in buzzer will sound.


SIGNAL OUTPUT

1. Set the Function/Range switch to " $\square\square$ " range.
2. A test signal will be output between "V Ω mA" and "COM" jacks, the output voltage is approx. 5V p-p with 50K Ω impedance.

TRANSISTOR TEST

1. Set the Function/Range switch to "hFE" range.
2. Determine whether the transistor to be tested is NPN or PNP, and locate the E, B, C leads. Insert the leads into the proper holes of the hFE socket on the front panel.
3. Read the approximate hFE value at the test condition of base current 10 μ A and Vce 2.8V.

BATTERY AND FUSE REPLACEMENT

If " "appears on the LCD, it indicates that the battery should be replaced. To replace the battery, remove the battery compartment cover, and remove the exhausted battery with a new one of the same ratings.

Fuse rarely needs replacement and is blown generally as a result of operator's error. To replace the fuse (F 250mA / 250V), remove the 2 screws in the bottom of the case, remove the old one, and replace it with a new one of the same ratings.

ACCESSORIES

Owner's Manual: 1piece

Test leads: 1pair

Type K thermocouple (For 312 only): 1piece

12-volt battery (23A): 1piece

Fuse (F250mA/250V): 1piece