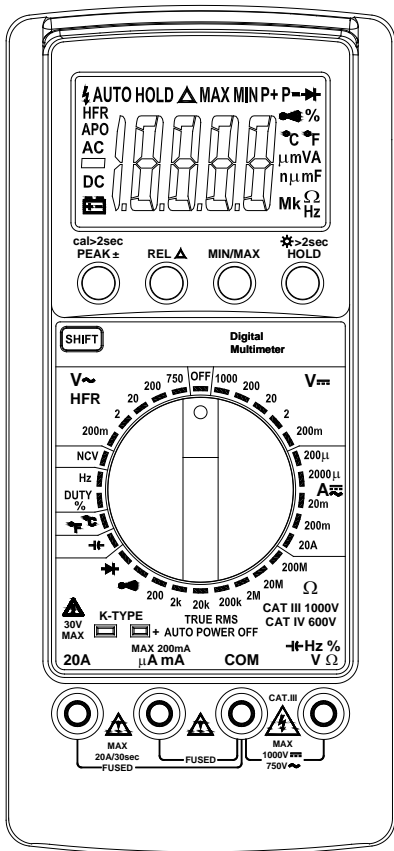


OPERATING INSTRUCTIONS

DIGITAL MULTIMETER



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INTRODUCTION

This manual contains information and warnings which must be followed to ensure safe operation and retain the meter in safe condition.

WARNING

READ "SAFETY INFORMATION" BEFORE USING THE
METER.

This Digital Multimeter is a handheld 20000-count instrument that is designed for use in the laboratory, field servicing, and at home. This meter features compact design with rounded corners for easy handling and has a rugged case in shock resistant and fire-retardant. Electronic overload protection for all functions and ranges.

UNPACKING AND INSPECTION

Upon removing your new Digital Multimeter (DMM) from it's packing, you should have the following items:

1. Digital Multimeter
2. Test Lead Set (one black, one red)
3. 9-Volt Battery (installed in meter)
4. Instruction Manual
5. One Spare Fuse
(500mA / 500V, 6.3mmx32mm, fast acting)
6. Type-K thermocouple

If any of the above items are missing or are received in a damaged condition, please contact the distributor from whom you purchased the unit.

SAFETY PRECAUTIONS:

The following safety precautions must be observed to ensure maximum personal safety during the operation, service and repair of this meter:

1. Read these operating instructions thoroughly and completely before operating your meter. Pay particular attention to WARNINGS which will inform you of potentially dangerous procedures. The instructions in these warnings must be followed.
2. Always inspect your meter, test leads and accessories for any sign of damage or abnormality before every use. If any abnormal conditions exist (eg-broken test leads, cracked cases, display not reading, etc.), do not attempt to take any measurements.
3. Do not expose the instrument to direct sunlight, extreme temperature or moisture.
4. Never ground yourself when taking electrical measurements. Do not touch exposed metal pipes, outlets, fixtures, etc., which might be at ground potential. Keep your body isolated from ground by using dry clothing, rubber shoes, rubber mats, or any approved insulating material.
5. To avoid electric shock use CAUTION when working with voltages above DC40V or AC20V rms. Such voltages pose a shock hazard.
6. Never exceed the maximum allowable input value of any function when taking a measurement. Refer to the specifications for maximum inputs.
7. Never touch exposed wiring, connections or any live circuit when attempting to take measurements.
8. Do not attempt to operate this instrument in an explosive atmosphere (i.e. in the presence of flammable gases or fumes, vapor or dust).
9. When testing for the presence of voltage, make sure the voltage function is operating properly by reading a known voltage in that function before assuming that a zero reading indicates a no-voltage condition. Always test your meter before and after taking measurements on a known live circuit.
10. Calibration and repair of any instrument should only be performed by qualified and trained service technicians.
11. Do not attempt calibration or service unless trained and another person capable of rendering first aid and resuscitation is present.
12. Remember: Think Safety, Act Safely.

SAFETY INFORMATION

Cleaning

Wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents. Dirt or moisture in the terminals can affect readings.









Safety : Conforms to EN 61010-1, EN 61010-2-033, CAT III 1000V, CAT IV 600V, Class II, Pollution degree 2 Indoor use.

CAT III : Is for measurements performed in the building installation.

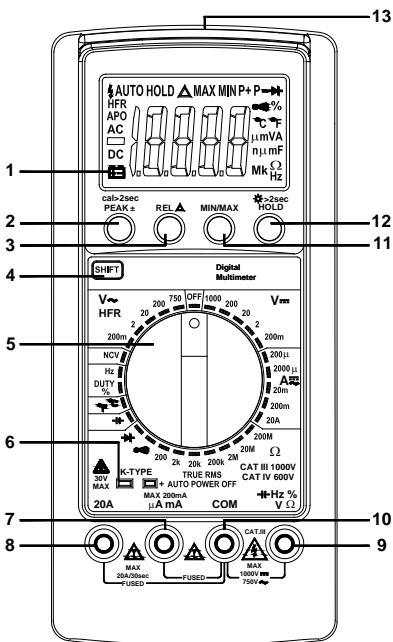
CAT IV: Is for measurements performed at the source of the low-voltage installation.

EMC: Conforms to EN 61326-1.

The symbols used on this instrument are:

-  Dangerous voltage.
-  Caution, refer to accompanying documents
-  Equipment protected throughout by Double insulation (Class II)
-  Alternating current
-  Direct current
-  Ground

INSTRUMENT LAYOUT



1. Display

The display indicates the measured value of a signal, function mode, and annunciator.

2. PEAK± cal>2sec Button

- (1) Record the peak+ or peak- value in a measurement. It is usable with AC voltage, AC current measurements. If the pressed time >2 sec, the PEAK function will enter to calibration mode, the LCD will show " CAL " and the internal buffer will remember the internal offset voltage then back to the measure mode.
- (2) Press PEAK± button for more than 2 seconds to exit.
- (3) Response time: more than 1ms.

3. REL△ Button

Press (△) button to enter the Relative mode. The (△) annunciator is displayed, and residual value on the display is subtracted and stored as a reference value. In the Relative mode, the value shown on the display is always the difference between the stored reference value and the present reading. Press (△) button again to exit the relative mode.

4. SHIFT Button

- (1) Shift A \leftrightarrow A \sim ranges.
- (2) Shift °C \leftrightarrow °F ranges.
- (3) Shift V \sim High Frequency reject: >100kHz \leftrightarrow (HFR) High Frequency reject: >1kHz .

5. Function/Range selector rotary switch

This rotary switch selects the function and range desired.

6. Temperature Input Jacks

Remove test leads. Plug any K-type thermocouple directly into the meter to measure temperature.

7. μ A/mA Current, Input Terminal

This is the positive input terminal for current measurements (DC or AC) up to 400mA. Connection is made to it using the red test lead.

8. 20A Current, Input Terminal

This is the positive input terminal for current measurement (AC or DC) up to 20A. Connection is made to it using the red test lead.

9. V Ω Hz% $\frac{1}{f}$, Voltage, Ohms, Frequency, Duty cycle, Capacitance, Continuity, Diode Test Input Terminal

This is the positive input terminal for all functions except current, temperature, NCV measurements. Connection is made to it using the red test lead.

10. COM Common Terminal

This is the negative (ground) input terminal for all measurement modes. Connection is made to it using the black test lead.

11. MAX / MIN Button

The " MAX " displays the maximum value of measurements. The " MIN " displays the minimum value of measurements. Press MAX/MIN button for more than 2 seconds to exit.

12. Data HOLD / *>2sec Button

- (1) Press [HOLD] button to toggle in and out of the Data Hold mode. In the data hold mode, the " HOLD " annunciator is displayed and the last reading is held on the display. Press [HOLD] button again to exit and resume readings.
- (2) Press [HOLD] button for more than 2 seconds to Backlight ON/OFF. Backlight auto-off approx. 5 minutes.

13. Aim the NCV sensor (on top of the meter) at the object to be measured.

14. Other Functions

(1) Disable Auto Power off

Set the DMM to off position, press (MAX/MIN) button, and hold the (MAX/MIN) button while turning the rotary knob to the desired range position. Release the button when LCD displays normally. Note "APO" annunciator is missing from the LCD. The Auto Power Off mode is activated with an "APO" symbol indicating on LCD.

(2) High Voltage Warning (Hi-V)

The "⚡" lightning bolt symbol appears in the display when > 30V AC/DC voltage is present.

HOW TO MAKE MEASUREMENTS

Before making any measurements read safety precautions. Always examine the instrument and accessories used with the instrument for damage, contamination (excessive dirt, grease, etc.) and defects. Examine the test leads for cracked or frayed insulation and make sure the lead plugs fit snugly into the instrument terminals. If any abnormal conditions exist, do not attempt to make any measurements.

VOLTAGE MEASUREMENTS

1. Turn off power to the device under test and discharge all capacitors.
2. Plug the black test lead into the COM input jack on the meter and connect the test lead tip to a grounded point (the reference point for measurement of voltage).
3. Set the Function/Range switch to the " V_{\sim} or V_{\equiv} " position.
4. Plug the red test lead into the V_{Ω} input jack on the meter and connect the circuit where a voltage measurement is required. Voltage is always measured in parallel across a test point.
5. Turn on power the circuit /device to be measured and make the voltage measurement reduce the range setting if set too high until a satisfactory reading is obtained.
6. After completing the measurement, turn off power to the circuit / device under test , discharge all capacitors and disconnect the meter test leads.


CURRENT MEASUREMENTS

1. Set the Function / Range switch to the " A $\overline{\sim}$ " position. Use the " SHIFT " button to select the DC or AC current test.
2. Connect the red test lead to the " μA mA or 20A " jack and the black test lead to the " COM " jack.
3. Connect the test leads to the point of measurement and read the current from the display.


RESISTANCE MEASUREMENTS

1. Set the Function / Range switch to the " Ω " position.
2. Turn off power to the circuit under test. External voltage across the components causes invalid reading.
3. Connect the red test lead to the " V_{Ω} " jack and the black test lead to the " COM " jack.
4. Connect the test leads to the points of measurements and read the value from the display.



CONTINUITY MEASUREMENTS

1. Set the Function switch to the "  " position.
2. Turn off power to the circuit under test. External voltage across the components causes invalid reading.
3. Connect the test leads to the two points at which continuity is to be tested. The buzzer will sound if the resistance is less than approximately 30Ω .

DIODE TESTS

1. Set the Function / Range switch to the "  " position.
2. Turn off power to the circuit under test. External voltage across the components causes invalid reading.
3. Connect the red test lead to the " VΩ " jack and the black test lead to the " COM " jack.
4. Touch probes to the diode. A forward-voltage drop is about 0.6V (typical for a silicon diode).
5. Reverse probes. If the diode is good, " OL " is displayed. If the diode is shorted, "0.00" or another number is displayed.
6. If the diode is open, " OL " is displayed in both directions.
7. Audible Indication: Less than 0.03V.

CAPACITANCE MEASUREMENTS

1. Set the Function / Range switch to the "  " position.
2. Connect the red test lead to the " VΩ " jack and the black test lead to the " COM " jack.
3. Touch the probes to the capacitor. Observe polarity when measuring polarized capacitors.
4. Read the capacitance directly from the display.
5. Discharge the capacitor before taking capacitance measurements.
6. The meter has a residual capacitance in the 6nF and 600nF ranges, which is a normal status. Before taking measurements, press the Relative  button to zero the residual capacitance.
7. When the capacitor to be tested is connected, if " dIS.C " symbol indicate on LCD, it means there is voltage existing in the tested capacitor and to be discharged before testing.

FREQUENCY % DUTY CYCLE MEASUREMENTS

1. Set the Function/Range switch to the " Hz or % DUTY " position.
2. Connect the red test lead to the " VΩ " jack and the black test lead to the " COM " jack.
3. Connect the test leads to the point of measurement and read the frequency from the display.


TEMPERATURE MEASUREMENTS

1. Set the Function / Range switch to the " °C / °F " position. Use the " SELECT " button to select the °C or °F Temp test.
2. Remove test leads.
3. Plug any K-type thermocouple directly into the meter to measure temperature.
4. Take temperature measurement using the thermocouple probe and read the temperature from the display.

NON-CONTACT VOLTAGE INDICATOR (NCV)

1. Set the function/range switch to the NCV position. The meter displays "EF" when the NCV function is selected.
2. Aim the NCV sensor (on top of the meter) at the object to be measured. The display will indicate "----" and beeper sounds when NCV function is in operation. The beep sound would change from an intermittent sound to a continuous tone when the signal source being measured is getting stronger.
3. The NCV function indicates AC voltage from 70V to 600V (50Hz~60Hz).

SPECIFICATIONS

- **Display:** 4¹/₂ digits, 20000 counts.
- **Polarity:** Automatic, (-) negative polarity indication.
- **Overrange Indication:** " OL " mark indication.
- **Low Battery Indication:** The "  " is displayed when the battery voltage drops below the operating level.
- **Auto Power Off:** Meter automatically shuts down after approx. 30 minutes of inactivity.
- **Altitude:** 6561.7 Feet (2000M)
- **Measurement Rate:** 2.5 times per second, nominal.
- **Operating Environment:** 0°C to 50°C at < 70% R.H.
- **Storage Environment:** -20°C to 60°C at < 80% R.H. with battery removed from meter.
- **Temperature Coefficient:** 0.1 × (specified accuracy) Per °C. (0°C to 18°C, 28°C to 50°C).
- **Power:** Single 9V battery, NEDA 1604, JIS 006P, IEC 6F22.
- **Battery Life:** 100 hours typical with carbon-zinc
200 hours typical with alkaline.
- **Size (H × W × D) :** 7.8 × 3.6 × 1.7 inches (198 × 90 × 44 mm).
- **Weight:** Approx. 14.1 OZ / 400g grams (including battery)

Accuracy is given as ± ([% of reading] + [number of least significant digits]) at 18°C to 28°C, with relative humidity up to 70%.

DC Volts

| Range | Resolution | Accuracy | Input Impedance |
|-------|-------------|---------------------------|-----------------|
| 200mV | 10 μ V | \pm (0.05% rdg+5d) | 10M Ω |
| 2V | 100 μ V | | 11M Ω |
| 20V | 1mV | | 10M Ω |
| 200V | 10mV | | |
| 1000V | 100mV | | |

Overload protection: 600V DC / AC RMS on 200mV range
1000V DC / 750V AC RMS on all other ranges

AC Volts (True RMS)

| Range | Resolution | Accuracy (50 to 500Hz) | Accuracy (500 to 2kHz) | HFR (50 to 60Hz) |
|-------|-------------|----------------------------|----------------------------|----------------------------|
| 200mV | 10 μ V | \pm (1.0% rdg +10d) | \pm (2.0% rdg +20d) | \pm (2.0% rdg +20d) |
| 2V | 100 μ V | | | |
| 20V | 1mV | | | |
| 200V | 10mV | | | |
| 750V | 100mV | \pm (2.0% rdg +20d) | Unspecified | |

Input Impedance: 200mV:10M Ω ; 2V: 11M Ω ;
20V,200V,750V:10M Ω

Crest Factor: ≤ 3

AC coupled true RMS specified from 2% to 100% of range

PEAK \pm HOLD: \pm (3.0% rdg +60 dgts) 50Hz to 500Hz.
(2000 counts)

Overload protection: 600V DC / AC RMS on 200mV range
1000V DC / 750V AC RMS on all other ranges

DC Current

| Range | Resolution | Accuracy | Voltage Burden |
|-------------|------------|------------------------|----------------|
| 200 μ V | 10nA | \pm (0.5% rdg+5d) | 300mV |
| 2mA | 100nA | | |
| 20mA | 1 μ A | | |
| 200mA | 10 μ A | \pm (1.0% rdg+5d) | 400mV |
| 20A ** | 1mA | \pm (2.0% rdg+10d) | 600mV |

Input protection: 500mA / 500V fast blow ceramic fuse (6.3x32mm) on μ A / mA input. 20A / 600V fast blow ceramic fuse (10x38mm) on 20A input.

** **20A Input:** 20A for 30 seconds maximum. Followed by a 10 minutes cooling period.

AC Current (True RMS)

| Range | Resolution | Accuracy | Voltage Burden |
|-------------|------------|--|----------------|
| 200 μ V | 10nA | $\pm (1.2\% \text{ rdg}+10\text{d})$ | 300mV |
| 2mA | 100nA | | |
| 20mA | 1 μ A | | |
| 200mA | 10 μ A | $\pm (1.5\% \text{ rdg}+10\text{d})$ | 400mV |
| 20A ** | 1mA | $\pm (2.5\% \text{ rdg}+10\text{d})$ | 600mV |

Crest Factor: ≤ 3

AC coupled true RMS specified from 2% to 100% of range

PEAK \pm HOLD: $\pm (3.5\% \text{ rdg} +60 \text{ dgts})$ 50Hz to 500Hz.
(2000 counts)

Input protection: 500mA / 500V fast blow ceramic fuse (6.3x32mm) on μ A / mA input. 20A / 600V fast blow ceramic fuse (10x38mm) on 20A input.

**** 20A Input:** 20A for 30 seconds maximum. Followed by a 10 minutes cooling period.

Resistance (DCR)

| Range | Resolution | Accuracy | Open Circuit Volts |
|---------------|--------------|--|--------------------|
| 200 Ω | 10m Ω | $\pm (0.25\% \text{ rdg}+10\text{d})$ | -3.0Vdc |
| 2k Ω | 0.1 Ω | $\pm (0.25\% \text{ rdg}+5\text{d})$ | -1.1Vdc |
| 20k Ω | 1 Ω | | |
| 200k Ω | 10 Ω | | |
| 2M Ω | 100 Ω | $\pm (0.5\% \text{ rdg}+10\text{d})$ | |
| 20M Ω | 1k Ω | $\pm (2.0\% \text{ rdg}+10\text{d})$ | |
| 200M Ω | 10k Ω | $\pm (5.0\% \text{ rdg}+20\text{d})$ | |

Overload protection: 600V DC or 600V AC RMS

Continuity Test

| Range | Audible Threshold | Response Time | Open Circuit Volts |
|--------------|-----------------------|---------------|--------------------|
| 200 Ω | Less than 30 Ω | Approx. 100ms | -3.0Vdc |

Overload protection: 600V DC or 600V AC RMS

Diode Test

| Range | Resolution | Accuracy | Test Current | Open Circuit Volts |
|-------|------------|-------------------------------------|--------------|--------------------|
| 2V | 0.1mV | $\pm (1.0\% \text{ rdg}+5\text{d})$ | 0.8mA | 3.0Vdc typical |

Audible indication: Less than 0.03V

Overload protection: 600V DC or 600V AC RMS

Capacitance

| Range | Resolution | Accuracy |
|-------------|------------|--------------------------------------|
| 2nF | 1PF | $\pm (3.0\% \text{ rdg}+30\text{d})$ |
| 20nF | 10PF | $\pm (3.0\% \text{ rdg}+10\text{d})$ |
| 200nF | 100PF | |
| 2 μ F | 1nF | |
| 20 μ F | 10nF | |
| 200 μ F | 100nF | |
| 2mF | 1 μ F | $\pm (5.0\% \text{ rdg}+20\text{d})$ |
| 20mF | 10 μ F | |

Overload protection: 600V DC or 600V AC RMS

Frequency

| Range | Resolution | Accuracy | Trigger Level |
|--------|------------|-------------------------------------|-------------------------|
| 200Hz | 0.01Hz | $\pm (0.1\% \text{ rdg}+5\text{d})$ | > 2.5V rms |
| 2kHz | 0.1Hz | | |
| 20kHz | 1Hz | | |
| 200kHz | 10Hz | | > 2.5V rms <5.0V rms |
| 2MHz | 100Hz | | |
| 20MHz | 1kHz | | |

Minimum Input Range: > 1Hz

Minimum pluse width: > 25ns

Duty cycle limits: > 30% and < 70%

Overload protection: 600V DC or 600V AC RMS

%Duty Cycle

| Range | Resolution | Pulse Width | Accuracy (5V logic) |
|-----------|------------|--------------|-----------------------|
| 5% to 95% | 0.1% | > 10 μ s | \pm (2.0% rdg+10d) |

Frequency range: 5% to 95% (40Hz to 1kHz),
10% to 90% (1kHz to 10kHz),
20% to 80% (10kHz to 20kHz)

Overload protection: 600V DC or 600V AC RMS

Temperature

| Range | Resolution | Accuracy | Sensor type |
|---------------------------------|------------|-----------------------|------------------------|
| 0°C ~ 400°C | 0.1°C | \pm (1.0% rdg+2°C) | K-type Thermocouple |
| -50°C ~ 0°C, 400°C ~ 1350°C | | \pm (3.0% rdg+3°C) | |
| 32°F ~ 750°F | 0.1°F | \pm (1.0% rdg+4°F) | |
| -58°F ~ 32°F, 750°F ~ 2000°F | | \pm (3.0% rdg+6°F) | |

Overload protection: 30V DC or 30V AC RMS

MAINTENANCE

Maintenance consists of periodic cleaning and battery replacement. The exterior of the instrument can be cleaned with a dry clean cloth to remove any oil, grease or grime. Never use liquid solvents or detergents.

Repairs or servicing not covered in this manual should only be performed by qualified personnel.

BATTERY AND FUSE REPLACEMENT

WARNING

TO AVOID ELECTRICAL SHOCK, DISCONNECT THE TEST LEADS AND ANY INPUT SIGNALS BEFORE REPLACING THE BATTERY. REPLACE ONLY WITH SAME TYPE OF BATTERY.

This meter is powered by a NEDA type 1604 or equivalent 9-volt battery. When the multimeter displays the "🔋" the battery must be replaced to maintain proper operation. Use the following procedure to replacing the battery:

1. Disconnect test leads from any live source, turn the rotary switch to OFF, and remove the test leads from the input terminals.
2. The bottom case is secured to the top case by four screws. Using a Phillips-head screwdriver, remove the screw from the bottom case and remove the bottom case.
3. Remove battery and replace with a new equivalent " NEDA 1604 " 9-volt battery.
4. Fuse: F1 / 500mA / 500V fast blow ceramic fuse (6.3 x 32 mm); F2 / 20A / 600V fast blow ceramic fuse (10 x 38 mm).
5. Replace the bottom case and reinstall the screw.