CONTENTS

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 multimeter is a handheld, 2000-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. The Protective Holster (optional accessory) combined with rugged case make it a durable and reliable instrument.

UNPACKING AND INSPECTION

Upon removing your new Digital Multimeter (DMM) from its 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 (0.5A/600V, 6.35 x 25.4 mm, fast acting ceramic)

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 INFORMATION

Injury or death can occur even with low voltages and low currents. It is extremely important that you read these safety information before using your multimeter. Follow all safety practices and proper operating procedures for equipment being tested.

1. Exercise extreme caution when:
   Measuring voltage above 20 volts, measuring current greater than 10mA, measuring AC power line with inductive loads, measuring AC power line during electrical storms.

2. Always inspect your DMM, test leads and accessories for any sign of damage or abnormality before every use. If any abnormal conditions exist (i.e., broken or damaged test leads, cracked case, display not reading, etc.), do not attempt to take any measurements.

3. 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.

4. Never touch exposed wiring, connections, test probe tips, or any live circuit conductors when attempting to make measurements.

5. Never replace the protective fuse inside the DMM with a fuse other than the specified or approved equal fuse.

6. Do not operate this instrument in an explosive atmosphere (i.e., in the presence of flammable gases or fumes, vapor or dust.)

7. Measuring voltage which exceeds the limits of the multimeter may damage the meter and expose the operator to a shock hazard. Always recognize the meter voltage limits as stated on the front of the meter.

8. Never apply more than 500VDC between the COM jack and earth ground.

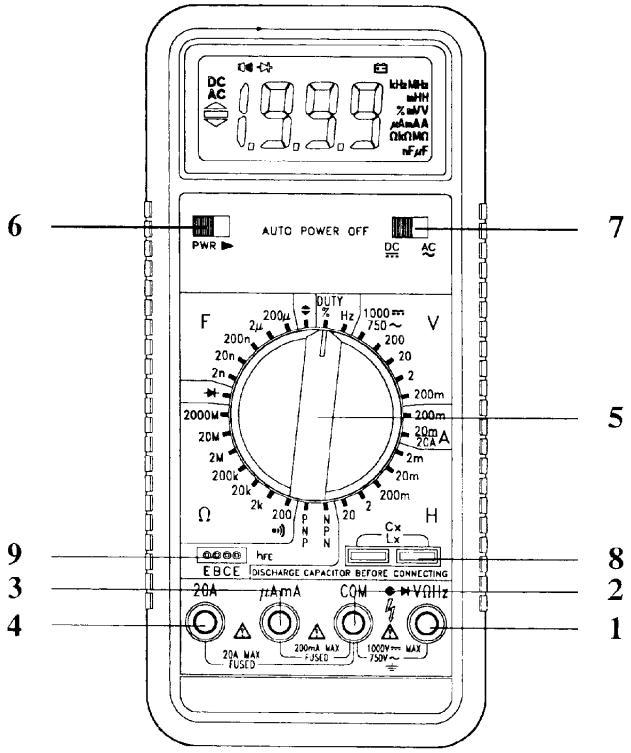
9. Never touch a voltage source when the test leads are plugged into a current jack.

10. When testing for the presence of voltage or current, make sure the voltage or current ranges are functioning correctly. Take a reading of a known voltage or current before assuming a zero reading indicates no current or voltage.

SYMBOL EXPLANATION

	Attention! Refer to the Operating Instructions
	Dangerous Voltage May Be Present at terminals
	Ground
	AC - Alternating Current
	DC - Direct Current
	Audible Continuity / Diode
	Logic Test
	Double Insulation

INSTRUMENT LAYOUT



1 V ΩHz⊣◆ Volt, Ohms, Frequency, Diode, Logic Input Terminal

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

2 COM Common Terminal

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

3 μA mA Microamp/Milliamp Input Terminal

This is the positive input terminal for current measurement (ac or dc) up to 200 mA. Connection is made to it using the Red test lead.

4 20A 20 Amperes 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.

5 Function / Range Selector Rotary Switch

This rotary switch selects the function, and selects the desired range.

6 Power Switch

This switch is used to turn meter on or off.

7 DC/AC Switch

In the voltage or current measurements function, used to selects DC or AC type.

8 Capacitor/ Inductor Test Socket

In the capacitance or inductance measurements, insert the capacitor or inductor leads into this socket.

9 Transistor Test Socket

In the transistor measurements, insert the transistor leads into this socket.

10 Other Functions

- **Auto Power Off**

Automatic power-off extends the life of the battery by turning the meter off. After approximately 45 minutes of inactivity.

- **Input Warning Beeper**

The Input Warning Beeper is a feature to protect the meter and you from unintentional misuse. If the DMM is set to measure a voltage while the test leads are plugged into a current jack, very high current could result when the test lead tips are placed to the voltage test point. This feature warns you that the test lead needs to be changed from a current jack to the voltage jack.
All current ranges are fused with fast acting ceramic fuses as an added protection.

HOW TO MAKE MEASUREMENTS

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

VOLTAGE MEASUREMENTS

1. Insert the black and red test leads into the COM and V-Ω input terminals respectively.
2. Select the desired AC voltage range, or DC voltage range.

> **WARNING**
> To avoid possible electric shock, instrument damage and / or equipment damage, do not attempt to take any voltage measurements if the voltage is above 1000Vdc / 750Vac. 1000Vdc and 750Vac are the maximum voltages that this instrument is designed to measure. The "COM" terminal potential should not exceed 500V measured to ground.

3. When the magnitude of the voltage to be measured is unknown, always start with the highest range.
4. Connect the test lead tips in parallel with the circuit to be measured. Be careful not to touch any energised conductors. Note the reading.
5. For DC voltage readings, the RED lead tip should be connected to the positive side of the circuit, the BLACK lead to the negative side. A minus sign on the left hand side of the LCD will appear if the leads are connected the other way round.
6. When all measurements are completed, disconnect the test leads from the circuit under test. Remove test leads from the multimeter.

Note: Use a High Voltage Probe for measurement needs > 1000V.

CURRENT MEASUREMENTS

These are made in series with the test circuit. All the current to be measured flows through the multimeter.

WARNING

Do not attempt to measure currents in high energy circuits. Use a current clamp for measurement needs > 20A. The 20A input terminal is protected by a 20A/600V high energy, fast blow fuse. The mA input terminal is protected by a 500mA/600V fast blow ceramic fuse.

CAUTION

A common abuse of multimeters is to attempt to measure a voltage while the test leads are still plugged into the current input terminals. This basically puts a short circuit across the voltage source since current ranges have a low impedance. If the voltage source is typically 240VAC or a 3-phase industrial voltage (415V), very high fault currents can result. This is why all current input terminal are fused. If the fuses blow they must only be replaced by the equivalent ones otherwise the safety of the instrument may be impaired.

1. Insert the BLACK test lead in the COM input terminal.
2. For measuring currents less than 200mA, connect the RED test lead to the μA/mA input terminal. For measuring currents between 200mA and 20A connect the RED test lead to the 20A terminal.
3. Select the desired AC current range or DC current range.
4. Turn OFF or disconnect the circuit to be measured from all power sources, connect the multimeter in series with the conductor in which the current to be measured flows.
5. Turn on power to the circuit under test. Note the reading.
6. After completing the measurement, turn off power to the circuit under test, disconnect the test leads from multimeter.

RESISTANCE MEASUREMENTS

1. Turn off any power to the resistor to be measured. Discharge any capacitors. Any voltage present during a resistance measurement will cause inaccurate readings and could damage the meter if exceeding the overload protection of 500VDC or AC.
2. Insert the BLACK and RED test leads into the COM and VΩ input terminals respectively.
3. Select the desired ohms (Ω) range.
4. Connect the BLACK and RED test probe tips to the circuit or device under test, making sure it is de-energised first.
5. Open circuits will be displayed as an overload condition.
6. Test lead resistance can interfere when measuring low resistance readings and should be subtracted from resistance measurements for accuracy. Select lowest resistance range and make the test leads short together. The display value is the test lead resistance to be subtracted.
7. After completing the measurement, disconnect the DMM test leads.

Note when using 2000MΩ Range

The 2000MΩ range has a fixed 10-count offset in the reading. When the test leads are shorted together in this range, the meter will display 010. This residual reading must be subtracted from the reading when this range is used. For example, when measuring 1500MΩ on the 2000MΩ range, the display will read 1510, from which the 10 residual is subtracted to obtain the actual resistance of 1500MΩ .

CONTINUITY TESTING

1. Select the ( ) position by turning the rotary selector switch.
2. Follow steps 2 and 4 as for resistance measurements.
3. An audible tone will sound for resistance less than approximately 150Ω . After all measurements are completed, disconnect the test leads from the circuit and from the multimeter input terminals.

DIODE TESTING

CAUTION

Turn off power to the device under test and discharge all capacitors.

1. Set the rotary selector switch to the ( ) position.
2. Follow steps 2 and 4 as for resistance measurements.
3. The RED lead should be connected to the anode and the BLACK lead to the cathode of the diode. The typical forward voltage drop should be about 0.7V for silicon diode or 0.4V for germanium diode.
4. If the diode is reverse biased or there is an open circuit the reading display shows "**OL**".

CAPACITANCE MEASUREMENTS

1. Turn off power to the device under test and discharge all capacitors.
2. Discharge all voltage from the capacitor before measuring its capacitance value.
   NOTE: A safe way to discharge a capacitor is to connect a 100kΩ resistor across the two capacitor leads.
3. Set the rotary selector switch to the capacitance range that gives the most accurate measurement reading.
4. Plug the capacitor leads into the capacitor/inductor test socket.
5. Read capacitance value directly from the display.

TRANSISTOR h_{FE} MEASUREMENTS

1. Transistor must be out of circuit. Set the rotary selector switch to the PNP or NPN position, according to the type of transistor to be measured.
2. Plug the emitter, base and collector leads of the transistor into the correct holes in either the NPN or the PNP transistor test socket. Read the h_{FE} beta, (DC current gain) in the display.

INDUCTANCE MEASUREMENTS

1. Turn off power to the device under test and discharge all capacitors.
3. Set the rotary selector switch to the capacitance range that gives the most accurate measurement reading.
4. Plug the inductor leads into the capacitor/inductor test socket.
5. Read inductance value directly from the display.

FREQUENCY AND DUTY CYCLE MEASUREMENTS

1. Set the rotary selector switch to the (Hz) position. It is not necessary to know the range as the meter will automatically range up or down to display the best resolution.
2. Insert the BLACK and RED test leads into the "COM" and "VΩ" input terminals respectively.
3. Determine that the amplitude level of the signal to be measured is not greater than the input voltage limit (500Vac/Vdc). The signal amplitude must also be greater than the sensitivity level.
4. Attach the probe tips to the points across which the frequency is to be measured, and read the result directly from the display.
5. To make duty cycle test during frequencymeasurements, place the range selector switch into the "DUTY %" position. The display will indicate 1% to 90.0% of the frequency duty cycle.

LOGIC TESTING

1. Insert the BLACK and RED test leads into the "COM" and "VΩ" input terminals respectively.
2. Select the logic function by rotating the selector dial to the ( ) logic position.
3. Connect the BLACK probe tip to the Common Bus of the logic circuitry to be measured.
4. Connect the RED probe tip to the point to be tested.
5. With a logic high pulse (1), the ▲ indicator will display in the LCD. With a logic low pulse (0), the ▼ indicator will appear in the LCD and a beeping sound will emit.

SPECIFICATIONS

- **Display:** 3½ digits, 17mm large LCD maximum reading 1999 with function and units sign annunciators.
- **Polarity Indication:** Automatic, positive implied, negative indicated.
- **Overrange Indication:** "OL" is displayed.
- **Low Battery Indication:** The " ⊟ " is displayed when the battery voltage drops below accurate operating level.
- **Display Update Rate:** 2.5 per second, nominal.
- **Operating Environment:** 0°C to 50°C, 0 to 70% Relative Humidity.
- **Storage Environment:** -20°C to 60°C, 0 to 80% RH with battery removed from meter.
- **Power:** Standard 9-volt battery, NEDA 1604, IEC 6F22, JIS 006P.
- **Auto Power Off:** After 45 minutes of no function or range change.
- **Battery Life:** 200 hours typical with alkaline battery.
- **Size** (H x W x D): 7.5 x 3.4 x 1.5 inches (18.9 x 8.7 x 3.7 cm).
- **Weight:** Approx. 330 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	100μV	±(0.5% rdg+1d)	10MΩ
2V	1mV	±(0.5% rdg+1d)	10MΩ
20V	10mV	±(0.5% rdg+1d)	10MΩ
200V	100mV	±(0.5% rdg+1d)	10MΩ
1000V	1V	±(0.5% rdg+1d)	10MΩ

Overload Protection: 500VDC/350VRMS 15sec on 200mV range
1000VDC / 750VRMS on all other ranges

AC Volts (Average sensing RMS indicating)

Range	Resolution	Accuracy (50Hz - 500Hz)	Input Impedance
200mV	100μV	±(1.2% rdg+3d)	10MΩ
2V	1mV	±(1.2% rdg+3d)	10MΩ
20V	10mV	±(1.2% rdg+3d)	10MΩ
200V	100mV	±(1.2% rdg+3d)	10MΩ
750V	1V	±(2.0% rdg+3d)	10MΩ

Overload Protection: 500VDC/350VRMS 15sec on 200mV range
1000VDC / 750VRMS on all other ranges

DC Current

Range	Resolution	Accuracy	Burden Voltage
20mA	10μA	±(1.0% rdg+1d)	250mV
200mA	100μA	±(1.0% rdg+1d)	450mV
20A**	10mA	±(3.0% rdg+2d)	750mV

Overload Protection: 500mA/600V fuse on mA inputs (fast blow ceramic fuse). 20A/600V fuse on 20A inputs(fast blow ceramic fuse).
**10A continuous, 20A for 30 seconds maximum.

AC Current (Average sensing RMS indicating)

Range	Resolution	Accuracy (50Hz to 500Hz)	Burden Voltage
20mA	10μA	±(1.5% rdg+4d)	250mV
200mA	100μA	±(1.5% rdg+4d)	450mV
20A**	10mA	±(3.5% rdg+4d)	750mV

Overload Protection: 500mA/600V fuse on mA inputs (fast blow ceramic fuse). 20A/600V fuse on 20A inputs(fast blow ceramic fuse).
**10A continuous, 20A for 30 seconds maximum.

Resistance

Range	Resolution	Accuracy	Open Circuit Volts
200Ω	0.1Ω	±(1.0% rdg+4d)	3.0Vdc
2kΩ	1Ω	±(0.8% rdg+2d)	0.3Vdc
20kΩ	10Ω	±(0.8% rdg+2d)	0.3Vdc
200KΩ	100Ω	±(0.8% rdg+2d)	0.3Vdc
2MΩ	1kΩ	±(0.8% rdg+2d)	0.3Vdc
20MΩ	10kΩ	±(2.0% rdg+5d)	0.3Vdc
2000MΩ	1000kΩ	±[(5% rdg-10d)+10d]	3.0Vdc

Overload Protection: 500V DC or RMS AC

Continuity Test

Audible Threshold	Open Circuit Volts	Response Time
Less than 150Ω	3.0Vdc typical	≈ 500msec

Overload Protection: 500V DC or RMS AC

Diode Test

Resolution	Accuracy	Test Current	Open Circuit Volts
1mV	±(1.0% rdg+1d)	1.0±0.6mA	3.0Vdc typical

Overload Protection: 500V DC or RMS AC

Transistor h_{FE}

Range	Base Current	Voltage C-E	Types
0-1000	≈10μADC	≈3.0VDC	NPN, PNP

Capacitance

Range	Resolution	Accuracy	Test Frequency
2nF	1pF	±(5.0% rdg+10d)	1kHz
20nF	10pF	±(5.0% rdg+10d)	1kHz
200nF	100pF	±(5.0% rdg+10d)	200Hz
2μF	1nF	±(5.0% rdg+10d)	200Hz
200μF	100nF	±(5.0% rdg+10d)	20Hz

NOTE: Never apply voltage to the test sockets. Discharge capacitor before taking measurements.

Frequency

Range (Auto ranging)	2kHz - 20MHz, (20Hz - 20MHz)
Accuracy	±(0.5% rdg+3d) at >20Hz
Resolution	1Hz
Sensitivity	2.0VRMS
Minimum Pulse Width	>25nSec
Overload Protection	500VDC or RMS AC

Duty Cycle

Range	Level	Pulse Width	Accuracy
1% - 90%	5V Logic	>10μSec	±(2.0% rdg + 10d)

Frequency range: 20Hz to 20kHz
Overload protection: 500VDC or RMS AC