DIGITAL MULTIMETER

OPERATORS MANUAL

CE 81

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1. MULTIMETER SAFETY

Read this information before using the meter, warning denote regards to the operator cautions denote regards to the meter.

1) SAFETY RULES

WARNING

This tester has been designed with your safety in mind. However, no design can completely protect against incorrect use.
Electrical circuits can be dangerous and/or lethal when lack of caution or poor safety practices are used.

2) READ THE MANUAL

Read the instruction manual carefally and completely.
Voltages and currents with in the capability of this test equipment can be regards.
Follow to instructions in this manual for every measurement.
Read and understand the general instructions before attempting to use the tester.
Do not exceed the limits of the tester.

3) SAFETY CHECK

Double check the switch setting and lead connection before making measurements are you following all of the instruction ?
Do not connect to circuit with voltage present when switch is in any ohms or current position, when replacing fuses use only sepecified type fuses and insert in correct fuse holder.

4) DON'T TOUCH

Don't touch exposed wiring, connection or other "Live" parts of an electrical circuit.
If in doubt, check to circuit before connecting test probes to it.
Turn off the power to a circuit before connecting test probes to it.
Be sure there is no voltage present before you touch the circuit.
Do not use cracked or broken test leads.

5) HIGH VOLTAGE IS DANGEROUS

Always start with the power off, be sure there is no voltage present before making connections to do circuit.
Don't touch to tester, its test leads, or any parts of the circuit white it is on.
Before disconnecting the tester, turn the circuit off and wait for the meter to turn to "ZERO"
Distribution circuits pack A punch in high energy circuits such as distribution transformers and bus bars, dangerous arcs of explosive nature can occur if the circuit is shorted.
If the tester is connected across a high energy circuit when set to a low resistance renge, a current range, or any other low impedance range, the circuit is virtually shorted.
Special equipment designed for use with these circuits is available.
Contact a qualfied person for assistance before attempting to make measurement on any high energy circuit.

2. GENERAL SPECIFICATION

1) **Display :** $3^{3/4}$ **digit liquid crystal. MAX, indication 3999 or-3999(frequency 9999) with polarity and range indication.**

2) **Bar-graph display :** 42 segments.

3) **Measurement rate :** Digital : 2 times/sec.
Bargraph : 20 times/sec.
Capacity measurement : 1 times/sec.

4) **Auto power-off :** 30 minutes.

5) **Overrange indication :** Most-significant digit flickered.

6) **Power :** 9V alkaline or carbon-zine battery(NEDA 1.604).

7) **Battery life :** 500 hours typical with alkaline.

8) **Operating temperature :** 0℃ to 40℃ (below 80% RH).

9) Storage temperature : -20℃ to 60℃ (below 70% RH).

10) Dimensions, weight :

11) Standard accessories : Test leads
Alligulator clip assembly.
Thermocouple "K-type" temperature.

3. ELECTRICAL SPECIFICATIONS

1) DC/V

RANGE	RESOLUTION	ACCURACY	INPUT RESISTANCE	OVERLOAD CIRCUIT PROTECTION
400mV	0.1mV	± (0.3% rdg + 1 dgt)	100MΩ	1000V DC/AC peak within 10 seconds.
4V	1mV		10MΩ	
40V	10mV		10MΩ	
400V	100mV		10MΩ	
1000V	1V	± (0.3% rdg + 3 dgt)	10MΩ	

2) AC/V

RANGE	RESOLUTION	ACCURACY 50HZ~500HZ	INPUT RESIS-TANCE	OVERLOAD CIRCUIT PROTECTION
4V	1mV	± (1.2% rdg + 5dagt)	10MΩ	1000V AC peak within 10 seconds
40V	10mV		10MΩ	
400V	100mV		10MΩ	
750V	1V		10MΩ	

3) RESISTANCE

RANGE	RESOL--UTION	ACCURACY	OPEN CIRCUIT VOLTAGE	OVERLOAD CIRC-UIT PROTECTION
400Ω	0.1Ω	± (1.0%rdg+2dgt)	≒ 400mV	250V DC or peck AC (within 10 seconds)
4kΩ	1Ω	± (0.7%rdg+2dgt)	400mV	
40kΩ	10Ω	± (0.7%rdg+2dgt)	400mV	
400kΩ	100Ω	± (0.7%rdg+2dgt)	400mV	
4MΩ	1kΩ	± (0.7%rdg+2dgt)	400mV	
40MΩ	10kΩ	± (2.0%rdg+5dgt)	400mV	

4) INSTANT CONTINUITY

Buzzer sounds at approximately less than 40 ohms.

5) DIODE CHECK

RANGE	RESOL--UTION	ACCURACY	OPEN CIRCUIT VOLTAGE	OVERLOAD CIRC-UIT PROTECTION
DIODE	1mV	± (2%rdg+2dgt)	3.2V	250V DC or peak within 10 seconds

6) TEMPERATURE

RANGE	RESOLUTION	ACCURACY
-20°C to 1370°C	1°C	± (3° + 1d) up to 150°C ± 3% of rdg over 150°C
0°F to 2000°F	1°F	± (5° + 2d) up to 225°F
Sensor; Type K (NiCr–NiAl)		± 3% of rdg over 225°F

* Audiable warning tone for open circuit temperature probe.

7) CAPACITANCE

RANGE	FRE-QUENCY	ACCURACY	RESOLU-TION	MEASURE-MENTS	VOLTAGE CHARGING	O/L PRO-TECTION
4nF	1kHz	±(5%rdg+2dgts)	0.001nF	Manual	1V	250V DC or Ac rms
40nF	1kHz	±(5%rdg+2dgts)	0.01nF			
400nF	1kHz	±(5%rdg+2dgts)	0.1nF	AUTO		
4μF	1kHz	±(5%rdg+2dgts)	1nF			
40μF	120Hz	±(5%rdg+2dgts)	10nF			

8) FREQUENCY

RANGE	ACCURACY	RESOLU-TION	LEVEL	INPUT RE-SISTANCE	MAX INPUT VOLTAGE
100Hz	± (0.1%rdg+ 10dgt)	0.001Hz	1S	10MΩ	500V DC or AC rms
1000Hz	± (0.1%rdg+ 10dgt)	0.1Hz			
10kHz	± (0.1%rdg+ 10dgt)	1Hz			
100kHz	± (0.1%rdg+ 10dgt)	10Hz	0.1S		
1000kHz	UNSPECIFIED	100Hz	0.01S		

FREQUENCY INPUT SENSITIVITY

FREQ (HZ)	0.5~100	100~1k	1K~400k
SENSITIVITY	300mV	1V	5V

9) AC CURRENT

RANGE	ACCURACY	RESOLU-TION	OVERLOAD CIRCUUIT PROTECTION
4mA	± (2%rdg+5dgts) 50Hz~500Hz	0.001mA	250V/2A fused
40mA		0.01mA	
400mA		0.1mA	
2000mA		1mA	
10A	± (2%rdg+5dgts) (50Hz~500Hz)	0.01A	unfused 15SEC.ON/30SEC.OFF

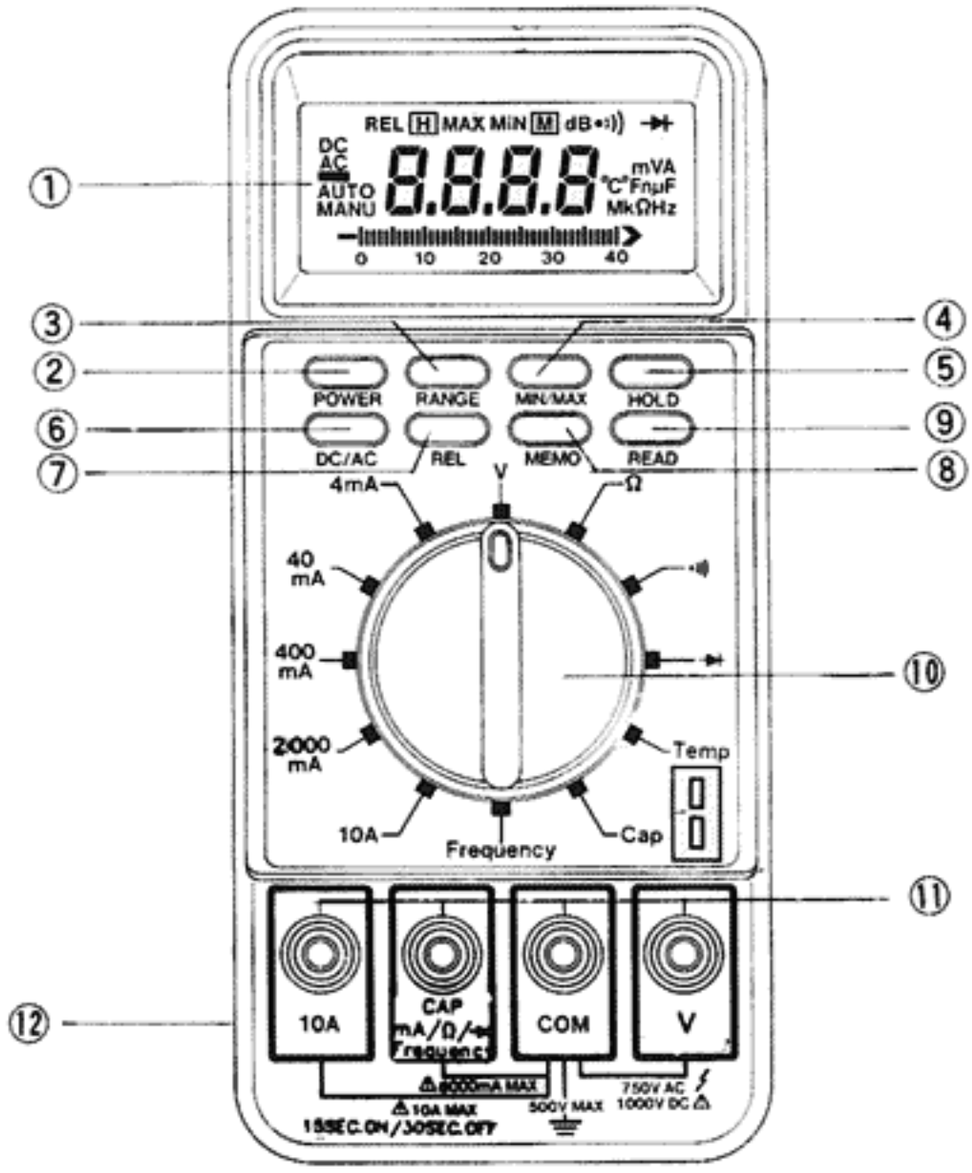
10) DC CURRENT

RANGE	ACCURACY	RESOLU-TION	OVERLOAD CIRCUUIT PROTECTION
4mA	±(1.5%rdg+2dgts)	0.001mA	250V/2A fused
40mA	±(1.5%rdg+2dgts)	0.01mA	
400mA	±(1.5%rdg+2dgts)	0.1mA	
4000mA	±(1.5%rdg±2dgts)	1mA	
10A	±(2%rdg±2dgts)	0.01mA	unfused 15SEC.ON/30SEC.OFF

⚠ WARNING ⚠

Hazardous voltages are present on the Temp test socket terminal and any attached probe when measuring voltages greater than 30V rms or 60V do.

4. PANEL FUNCTION



① Display

② Power S/W

③ Manual range S/W

④ MIN/MAX S/W

⑤ Data hold S/W

⑥ DC/AC selector S/W

⑦ REL S/W

⑧ Memo S/W

⑨ Read S/W

⑩ Function selector S/W

⑪ Input terminals

⑫ Skid-resistant feet

5. HOW TO USE THE METER

These buttons are used to select operating modes and power ON/OFF. When button is pushed the beeper sounds(unless the beeper has been turned off). An annunciator is displayed to indicat that a mode or option has been selected.

② POWER ON/OFF

Press the red button to turn ON the meter.

③ MANUAL RANGING

Press RANGE to select the manual range mode and turn off the auto annunciator (the meter remains in the range it was in when manual ranging was selected). In the manual range mode, each time for press range button, the range increments, and a new value is displayed. If you are already in the highest range the meter "WRAPSAROUND" the lowest range. To exit the manual range mode and turn to the auto ranging, press and hold down range S/W for 2 seconds, the "AUTO" annunciator turns back on.

④ MIN/MAX

Press MIN/MAX button to enter the MIN/MAX recoding mode. The MIN/MAX are then reset to the present input in the MIN/MAX recording mode, the MIN/MAX are stored in memory.

Push MIN/MAX button. to cycle through the MAX/MIN and present readings at normal record speed, charges to the voltage, current or resistance inputs that last at least 100 milliseconds are recorded.

⑤ HOLD(display hold)

Press hold S/W to toggle in and out of the touch hold mode. In the touch hold mode, the "H" annunciator is displayed and the last readinng is hold on the display.

When a new stable reading is detected, the bepper emits a tone, and the display is automatically updated.

In the MIN/MAX recording mode, press "HOLD" to stop the recording of reading, press "HOLD" to stop display, press "HOLD" again to start it.

⑥ **DC/AC**

Press Push button switch to select between DC/AC when measuring current or voltage, when the rotary switch is set to voltage, current.

⑦ **REL(relative reading)**

Press REL to enter the relative mode, zero the display, and store the displayed reading as a reference value. The relative mode annunciator (-) is displayed, press and hold down REL for 2seconds to exit in the relative mode, the value shown on the LCD is always the difference between the stored reference value and the present reading for exiample, if the reference value is 15.00V and the present reading is 14.10V, the display will indicate -0.90V. If the new reading is the same as the reference value, the display will be zero.

⑧ **MEMO,** ⑨ **READ**

Press MEMO to enter the memory mode on the "MEMO" mode the M annunciator is displayed and memory the displayed reading. Press "READ" to enter the read mode, the "H" annnciator is displayed and "M" annunciator is flashed the value shown on the LCD is always the stored memory value press "when you are is the read mode causes you to exit read mode and enter the memory mode.

⑩ **FUNCTION SELECTOR ROTARY SWITCH**

When ⑩ describes functions that are selected by setting the rotary switch, each time the rotary switch is moved from function to function setting, All LCD segments will turn on for one second as part of a selftest routine.

The meter is then ready for normal operating and will respond to the rotary switch and push buttons.

⑪ **INPUT TERMINALS**

1) item

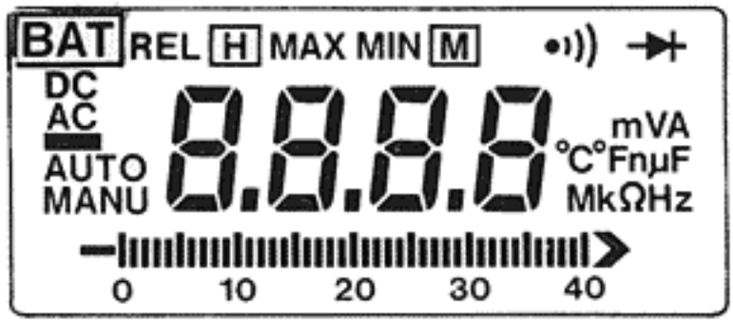
Describe the input terminals, input terminal used in conjection with the volts (AC or DC), ohms or mA, Temperature, Capacitance, Test position of the function selector rotary switch.

2) Com. Common terminal

Common or return terminal used for all measurements.

3) 10A. 10A input terminal
For current measurements (AC/DC) up to 10A continuous (10A for 30 seconds) when function selector switch set to 10A.

6. DIGITAL AND ANALOG DISPLAYS



1) DIGITAL DISPLAY
Digital reading are displayed on a 4000 count display with polarity indication and automatic decimal point placement.
When the meter is turned on, all display segments and annonciators appear briefly during a selftest.

2) ANALOG DISPLAY

The analog display provides an analog represenation of readings and updates 20 times per seconds, But it does'nt operate at the capacitance function the frequency count mode.

3) AUTO AUTO-RANGE

Meter is the auto-range mode and will automatically select range with the best resolution.
Meter powers on in auto-range mode.

4) [−] NEGATIVE POLARITY

Automatically indicates negative inputs.
When REL is enabled, indicates negative requests of math calculations.

5) [°)))] BEEPER

Continuity test is enabled.

6) [REL] RELATIVE MODE

The value displayed is the difference between the present measurement and the previously stored reading.

7) [MIN/MAX] MODE.

MIN/MAX value in MIN/MAX recording mode.
The value displayed is the maximum or minimum reading taken since the minimum and maximum recording mode was entered.

8) THE FOLLOWING ANNUNCIATORS INDICATE

The unit of the value displayed.

AC ····· alternating current or voltage
DC ····· direct current or voltage
V ····· volts
mV ····· milivolts(1×10^{-3} volt)
A ····· ampere(amps). current
mA ····· miliampere(1×10^{-3} amps)
Ω ····· ohms, resistance
kΩ ····· kilohm(1×10^{3} ohms], frequency
MΩ····· megohm(1×10^{6} ohms], resistance
Hz ····· hertz(1 cycles/sec), frequency
kHz····· kilo hertz(1×10^{3} cycles/sec), capacitance
μF ····· micro farads(1×10^{-6} farads], capacitance
nF ····· nano farads(1×10^{-9} farads], capacitance
℃,°F ····· degrees centigrade (fahrenheit)

* HOLDSTER AND FLEX-STAND

The meter comes with a snap-on holdster that absorbs shocks and protects the meter from rough handling.
The holdster is equipped with a Flex-stand.

7. APPLICATIONS

This selection dicusses some common applications for your meter, and alerts you to some considerations to keep in mind when taking measurements.

7−1. MEASURING VOLTAGE(AC/DC)

To measure voltage, connect the meter in parallel with the load or circuit under test.
Each of the four and five AC/DC voltage ranges presents an input impedance of approximately 10MΩ.
AC voltage is AC-coupled to the 10 MΩ input.
To inprove the accuracy of DC voltage measurements made in the presence of AC voltages, measure the AC voltage first, note the AC voltage range and manually select a DC voltage range is that the same or higher than the AC voltage range, this method improves DC voltage accuracy by ensuring that the input protection circuits are not being activated.
A typical application is measuring the DC offset voltage of an amplifier in the presence of an AC signal.

7−2. MEASURING CURRENT(AC/DC)

To measure current, connect the meter in series with the load or circuit under test, press the push button between alternating and direct current.
When measuring current, the meter internal shunt resistors develop a voltage across the meters terminal called "burden voltage"
This voltage drop is very low in your meter.
But it may affect precision circuits or measurements.

7−3. CONTINUITY TESTING

Continuity testing verifies that circuit connections are intact.
To perform audible continuity test, set the rotary switch to °))) and connect the meter to your circuit, test resistance below the 40 ohms cause the meter to emit a continuous tone, this can be a valuable trouble shooting aid when looking for intermitents associated with cable, connections, switches. relay, etc.

7−4. MEASURING RESISTANCE

CAUTION

Turn off power on the test circuit and discharge are capacitors before attempting in circuit resistance measurements.
If an external voltage is present across a component, it will be immpossible to take an accurate measurement of the resistance of that component.
The meter measures resistance by passing a known current through the external circuuit or component measuring the voltage drop, and calcurating the resistance using ohm's law.
Remember, the resistance displayed by the meter is the total resistance through all possible paths between the probes.
This examples with in circuit measurement of resistors does not often yield the ohms value indicated by the resistors color code.
The resistance in the test leads can diminish accuracy on the lowest (400-ohm) range. The error is usually 0.1 to 0.3 ohms for a standard of test leads.
To determine the error, short the test leads together and read the resistance of the leads.
Use the relative (REL) mode to automatically subtract the lead resistance from resistance measurement, when measuring, be sure that the contact between the probes and the circuit under testing good dirt, oil, solder flux or other foreign matter seriously affect resistance.

7−5. MEASURING CAPACITANCE

CAUTION

Turn off the power and discharge the capacitor before attempting a capacitance measurement.
The meter masures capacitance by charging the capacitor with a known current measuring the capacitor with a current, measuring the capacitor with a known cuurent voltage, and calculating the capacitance.
For measuring capacitor, turn the rotary switch to cap, and connect the test leads to the capacitor. The meter will select the proper range automatically, each measurement takes about second per range.
When making repeated measurements of similar values, press RANGE to manually select the proper range and to speed up subsegment measurements.
For capacitors less than 10nF or in noisy environments, use short test leads or a text fixture.
The measurement accuracy of capacitors less than 10nF can be improved by first using the relative mode to zero the display and automatically

subtract the residual meter and test lead capacitance.
Since the relative mode use selects manual ranging, zero the residual capacitance only-when measuring small value capacitors.
Residual voltage charges on the capacitor, or capacitors with poor insulation or poor dielectric absorption may cause measurement errors.

7−6. DIODE TESTING

To perform a diode or transistor junction test :
Plug the test leads into the V,Ω, Diode, F and com inputs, turn the rotary switch to diode, and connect the test leads across the diode.
In diode test, Voltage is developed across the components by a test current(approximately 1mA with the test leads shorted) from the meter.
For a silicon diode, the typical forward voltage should be about 0.6V.
If the digital reading is the same in both directions, the diode junction, is probably shorted.
If the display reads = 3V in both direction, the diode junction is probably open.

7−7. TEMPERATURE MEASURING

To perform a temperature test :
Temp probe(type"K") into mA temp cap(+) and COM inputs, turn the rotary switch to temp, and read temperature value on digital display with a standard K-type thermocouple, this DMM is capable of tamperature measurements in the range of −20℃ to 1370℃ (0°F to 2000°F).
Accuracy figures for this DMM includes the nonlinearity of the thermocouple itself.
Therefore, a correction table can be used to increase the overall accuracy following the table shows temperature correction factors when making temperature measurements above 350℃ (600°F) (thermocouple nonlinearity error is minimum between −20℃ and 350℃ as well as between 0°F and 600°F, so correction is not necessary within those ranges).
To calculate the corrected reading.
Simple find the displayed reading in the fault and note the correction factor, add or subtract the fact form the displayed reading to obtain the corrected temperature.
For example, at 600℃, the correction factor is −9℃ resulting in a correction factor at 1500°F is −28°F, resulting in a corrected temperature of 1472°F.

☞ TEMPERATURE CORRECTION FACTORS

READING (℃)	CORRECTION FACTOR (℃)	READING (°F)	CORRECTION FACTOR (°F)
350−362	−0	600−629	+1
363−395	−1	630−669	−0
396−424	−2	670−705	−1
425−451	−3	706−738	−2
477−500	−4	739−768	−3
501−524	−5	769−796	−4
525−547	−6	796−823	−5
558−571	−7	824−850	−6
572−595	−8	851−875	−7
596−619	−9	876−900	−8
620−646	−10	901−924	−9
647−674	−11	925−948	−10
675−707	−12	949−971	−11
708−750	−13	972−995	−12
751−912	−14	996−1018	−13
913−950	−15	1019−1041	−14
951−978	−14	1042−1065	−15
979−1002	−13	1066−1089	−16
1003−1002	−12	1090−1113	−17
1023−1040	−11	1114−1138	−18
1041−1057	−10	1139−1163	−19
1058−1073	−9	1164−1190	−20
1074−0187	−8	1191−1217	−21
1088−1100	−7	1218−1247	−22
1101−1113	−6	1248−1278	−23
1114−1125	−5	1279−1313	−24
1126−1136	−4	1314−1354	−25
1137−1147	−3	1355−1404	−26
1148−1157	−2	1405−1495	−27
1158−1167	−1	1496−1566	−28
1168−1176	−0	1567−1754	−27
1177−1185	+1	1655−1700	−26
1186−1194	+2	1701−1736	−25
1195−1202	+3	1737−1767	−24
1203−1211	+4	1768−1794	−23
1212−1218	+5	1795−1818	−22
1219−1226	+6	1819−1840	−21
1227−1233	+7	1841−1861	−20

READING (℃)	CORRECTION FACTOR (℃)	READING (°F)	CORRECTION FACTOR (°F)
1234−1240	+8	1862−1880	−19
1241−1247	+9	1881−1889	−18
1248−1254	+10	1900−1916	−17
1255−1260	+11	1917−1932	−16
1261−1267	+12	1933−1948	−15
1268−1278	+13	1949−1963	−14
1274−1279	+14	1964−1978	−13
1280−1285	+15	1979−1992	−12
1286−1291	+16	1993−2000	−11
1292−1297	E17		
1298−1302	+18		
1303−1308	+19		
1309−1313	+20		
1314−1318	+21		
1319−1324	+22		
1325−1329	+23		
1330−1334	+24		
1335−1339	+25		
1340−1343	+26		
	+27		

7−8. MEASURING FREQUENCY

In the frequency count mode, the frequency display auto-ranges to one of five range : 99.99Hz, 999.9Hz, 9.999KHz, 99.99KHz, 999.9KHz for frequencies below 10Hz, the update rate slows and follows the input signal. for frequencies below 1Hz, the display shows 0.000Hz for frequencies measurements, turn the rotary switch to the frequency range setting, connect the meter to the signal being measured, connecting the meter to the signal will normally allow the meter to auto-range to an appropriate range.

But the minimum input signal required to trigger the frequency counter varies, depending on the range and frequency.

If the input signal is below the trigger level, frequency measurements will not be taken. If you, readings are unstable.

The input signal may be near the trigger level for that range.

7−9. USING THE ANALOG DISPLAY

The analog display is easy to use and interpret.

It functions much the same as the needle on an analog meter without the mechanical overshoot inherent in needle movements.

The analog display is especially useful for peaking and nulling, and observing rapidly changing inputs.
The analog display response time is fast, and it can be used to make approximate.
The analog display can also be used for limited diagnostic purpose. In, situations where rapidly functions signal levels make the digital display useless, the analog display is ideal.
Like the needle on a volt-ohm-mA, the analog display excels at displaying trends or slowly changing signal, many display diagnostic routines using the analog display required practice.
You will usually be looking for good or bad signal patterns that occur over some span of time.
Noisy resistance measurement, for instance, create such patterns, therefore, familiary with analog display response and movement is necessary to occurately interpret a signal patten.
Compare the analog display response when making measurements on a unit known to be good, to the analog display response when making measurements on a faulty unit.

8. MAINTENANCE

WARNING

To avoid electrical shock, remove test leads before opening case, and close case before operating meter.

8-1. BATTERY REPLACEMENT

1) After disconnecting test leads and turning off the multimeter, remove back cover by removing four screws and than lift off back cover.

2) Disconnect battery from instrument and replace with a standard 9V battery.
3) Replace back cover and secure with four screws.

8-2. FUUSE REPLACEMENT

1) After disconnectiong test leads and turning off multimeter, remove back cover by removing four screws, and then left off back cover.

2) The fuse located with pcb board, remove old fuse and replace with new fuse.
3) Replace back cover and secure with four screws.

8-3. CALIBRATION

Use the following procedure to calibrate the multimeter.

1) Perform calibration at an ambient temperature of 25℃ and relative humidity of 50% or less. Allow instrument to stablize at this temperature for at least 30 minutes.
2) Set function selector rotary switch to DC/V position.
3) Remove the back cover from the instrument by removing four screws and then lifting off top cover.
4) Set the output of the DC calibrator for 390.0mV ± 0.002% and connect it to the V, Ω, diode, F and COM input connectors.
5) Adjust potentiometer(VR3), until multimeter digital display reads 390.0mV.
6) Disconnect DC calibrator from multimeter.
7) Press DC/AC mode push button switch to set AC function. Function and make sure "AC" annenciator activates on the LCD.
8) Set the output of the AC calibrator for 3.9V± 0.05% pure sine wave at a frequency between 50 and 500Hz, and connect it to the V, Ω diode, F and COM input connectors.
9) Adjust potentimoter (VR4) until display reads exactly 3.900V.
10) Disconnect AC calibrator from multimeter.
11) Replace top cover and secure with four screws.

WARNING

"THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONEL ONLY. TO AVOID ELECTRIC, SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT COUTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO "

PROTECTION LEVELS : per IEC1010-1; Install CAT. I

	Dangerous Voltage		Ground
~	AC		See Explanation in manual
⎓	DC		Double Insulation
⎓	DC or AC		Fuse

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