

METEX[®]



**DIGITAL
MULTIMETER**

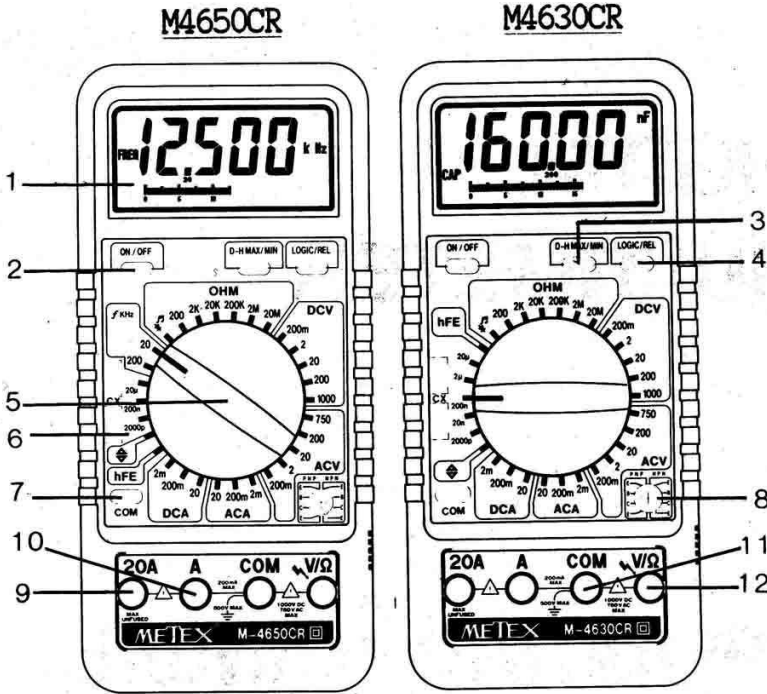
OPERATING MANUAL

M 4650 CR

M 4630 CR



M4600 (CR) Series Familiarization



1. LCD (4½ digit, Max 19999) with 41 point Bargraph
2. Power ON/OFF switch (Auto power-off)
3. Data-Hold & Max/Min-Hold switch
4. Logic & Relative offset switch
5. Function/Range switch
6. Capacitance socket
7. Communication(COMM) switch
8. Transistor socket (h_{FE} measurement only)
9. 20A Terminal
10. A Terminal
11. COM Terminal
12. V/Ω Terminal
13. Tilt Stand (located on the back case, convertible for standing or hanging position)

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Due to our policy to refine the products continuously, this manual may contain minor differences in specification, components, parts and circuit design to the instrument actually delivered.

1. Introduction

With this Digital Multimeter, you have acquired a high-quality, powerful performance, heavy-duty rugged and handheld multimeter that will give you confidence and peace of mind in your every measuring job.

Please read these operating instructions very carefully, before commencing your measurement.

2. Safety Information

2-1. This meter has been manufactured and tested in accordance with IEC 348 and DIN57411/VDE0411 Part 1: Safety Requirements for Electronic Measuring Apparatus, Safety Class II.

This manual contains information and warnings which must be observed to assure safe operation and maintain the meter in safe condition.

2-2. Safety symbols



on the front panel warns that the input voltage or current should not exceed the indicated values on the front panel.



on the front panel indicates that dangerous voltages may exist at the terminals.



for Fuse replacement



for Battery replacement

on the front panel indicates double insulation.

2-3. Safety Warnings

2-3-1. To prevent electric shock hazard and/or damage to the meter, do not measure voltages exceeding 1000V DC or 750V AC.

2-3-2. To avoid damage to the meter and/or injury observe the input limits as stated hereunder.

<< INPUT LIMITS >>

FUNCTION	TERMINALS	INPUT LIMITS
V DC	V/ Ω + COM	1000V DC
V AC	V/ Ω + COM	750V AC
Ω	V/ Ω + COM	250V DC/AC
A DC/AC	A + COM	2A DC/AC
20A DC/AC	20A + COM	20A DC/AC
Freq. \blacktriangle \blacktriangleright \blacktriangleleft \blacktriangleleft	V/ Ω + COM	250V DC/AC
Logic	V/ Ω + COM	250V DC/AC

2-3-3. To avoid damage to the meter, disconnect test leads from test points before changing the function/range.

2-3-4. To avoid electric shock, be careful when working above 6000V DC or 250V AC. Such voltages pose a shock hazard.

2-3-5. The 20A range is not protected by the fuse. To avoid damage or injury, use the meter only in circuits limited by fuse or circuit-breaker to 20A or 4000 VA.

Do not apply voltage to between the 20A or A and COM terminals. This warning is to assure protection against injury and/or damage to the meter and the user.

- 2-3-6 The common input of the multimeter must never be connected to circuitry which is more than 500V above ground potential. Failure to observe this precaution may result in injury to the user, damage to the meter and connected computer equipment.
- 2-3-7. To avoid electric shock hazard, do not touch test leads, tips or the circuit under measurement while power is turned on.
- 2-3-8. Do not get the meter and test leads wet.
- 2-3-9. Ensure the test leads are in good condition.

3. Features

3-1. Automatic Self-Test

After power has been turned on, a selftest is run automatically, by displaying all segments on the LCD. At the end of the test, the meter beeps and shows read-out. See figure 3-1.

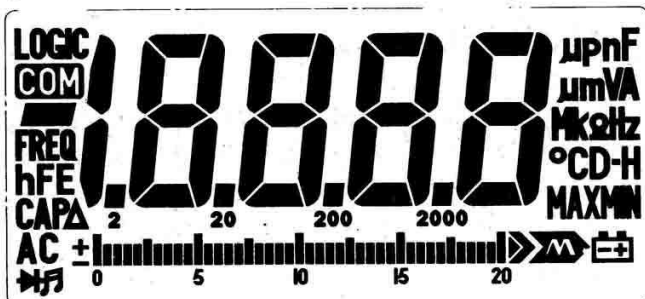


Fig. 3-1

3-2. Auto Power-off

This function increases the hours of battery operation. If a figure on the LCD remains stabilized for about 15 minutes, then the meter will turn off automatically. However during communication with a PC and/or "COMM" mode activated, power will not be turned off automatically.

3-3. Beeper in Selecting ranges & Warning overflow

The meter will beep when changing ranges, and functions.

If a measured value exceeds the capacity of the selected range, the meter indicates a overload on the LCD and beeps repeatedly. However, the beep will not sound in the resistance and diode ranges, under the overload condition. See Figure 3-3.

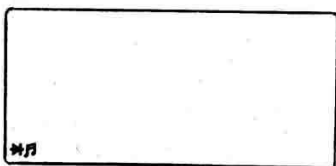


Fig 3-3



Fig 3-4

3-4. Overload Indication

" OL " is displayed with flashing the bar-graph and beeping, when input is too excess to display. See Figure 3-4.

3-5. Analog Bargraph Display

The analog bargraph display is helpful for observing rapidly changing inputs. The bargraph indicates the magnitude of the input compared to the full scale value of the measurement range in use. When "OL" is displayed the bargraph will flash. See Figure 3-5.

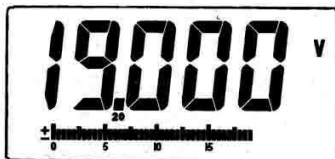


Fig 3-5

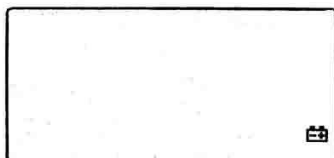



Fig 3-6

3-6. Low Battery Indication

The "  " symbol appears when the battery voltage drops to certain limits. For proper operation, replace the battery as soon as possible. Continued use with a low battery will lead abnormal readings. See Figure 3-6.

3-7. Data-Hold and Max/Min-Hold

When this function is activated, a read-out on the LCD will be captured and remain appearing, even after the test leads are disconnected from the test points.

Press 1 times the "D-H" button, and a read-out is captured on the LCD instantly. The meter displays "D-H" annunciator on the LCD.

Press 2 times the button, you can capture the maximum value in subsequent readings. The meter displays "MAX" annunciator on the LCD.

Press 3 times the button, then you can capture the minimum value in subsequent readings. The meter displays "MIN" annunciator on the LCD. These 3 functions will go in turn sequentially if the button is pressed without pause. To return to a normal range, turn the range switch or press the "D-H" button, until the annunciator disappears.

3-8. Interfacing the meter with a PC

The CR series can be hooked into data acquisition system run on Personal Computers, printer pen-plotters, etc, by using its bi-directional MT/RS-232C serial interface cable. For further information, see the section 4-13.

3-9. Relative off-set

During measurements, if you press "REL" button the data is stored in memory to compare with the subsequent readings. The LCD will show " Δ " segment. The digital display and the analog bargraph will now show only the difference of the measured value subtracted by the value memorized in REL mode.

To return to a normal mode, press the REL key, or turn the range switch.

In this mode, the full range of Relative off-set is 20000 counts. In case that the measured value goes over 20,000 counts, "OL" will be displayed, instead of showing the difference.

3-10. Memory Recording

The CR series can store upto 5 numbers of measured value and send the data to the computer.

From a 6th reading, the meter can not store it in the memories.

This feature is useful for recording readouts remoted away from a computer.

RECORDING

To store data in the memories of the meter, set the Function/Range switch, press the COMM switch once, after the reading achieved, and shown on the LCD. The reading is now memorized. Press the COMM switch once again to return to a normal mode. If you need more readings recorded, repeat this procedure. This memorization process is also possible in the Data-Hold mode.

Note that the meter will not memorize the reading, if it is overloaded, or in the Logic range, or in the Diode/Continuity test range.

4. Measuring Instructions

4-1. Preliminary Notes

4-1-1. Sometimes the last digit will not register " 0 ". This, however, will have no effect on the measured value.

4-1-2. The function/range switch must be set to the range before operation. Do not turn around the switch, whilst sourcing a power to the meter. To do so may cause a damage and/or injury.

4-2. DC Voltage Measurement

- 4-2-1. Connect the Black test lead to the COM terminal and the Red test lead to the V/ Ω terminal.
- 4-2-2. Set the function switch to your desired DC V range and connect the test leads across the source or load under measurement. In case of negative voltage, " - " segment will appear on the left side of LCD. See Figure 4-2.

- Note:
1. If the voltage is unknown before measurement, set the function switch to the highest range first and move down the ranges, step by step.
 2. When the " OL " is displayed, and the bar graph is flashing and beeping, the range is overloaded. The function switch must be set to a higher range.
 3. Take care to avoid contact with high tension circuits when measuring high voltage.
 4. Input impedance: 10 Mohm on all ranges.
 5. Overload Protection: 1000V DC or peak AC on all ranges.

4-3. AC Voltage Measurement

- 4-3-1. Connect the Black test lead to the COM terminal and the Red test lead to the V/ Ω terminal.

4-3-2. Set the function switch to your desired AC V range and connect the test leads across the source or load under measurement See Figure 4-3.

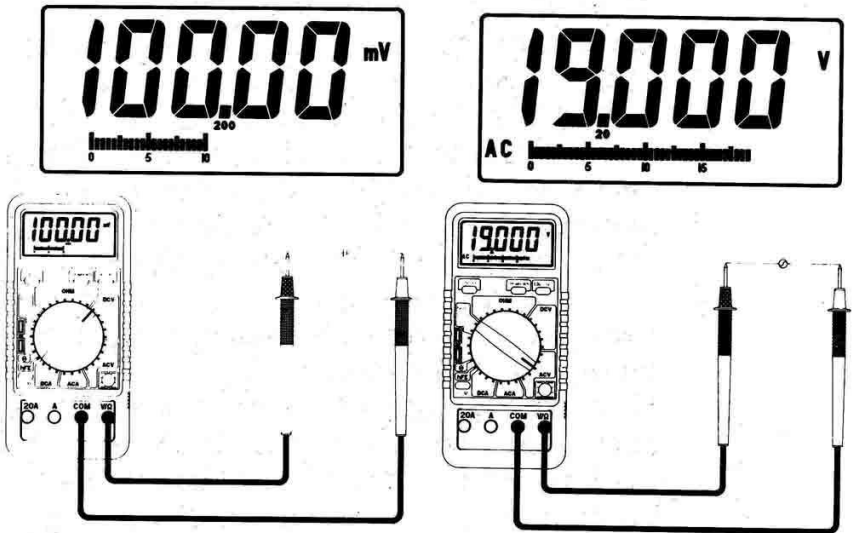
Note: 1. See DC voltage measurement Note 1, 2, 3.

2. Input impedance : $< 10\text{Mohm}$ in parallel with $> 50\text{PF}$ (AC coupled).

Frequency Range : 40Hz to 400Hz

3. Overload Protection: 750V rms or 1000V peak continuous on AC ranges except 200mV AC range(15 seconds maximum above 300V rms).

4. Indication: Average



4-2 DC Voltage measurement

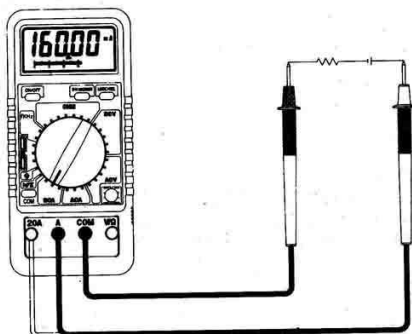
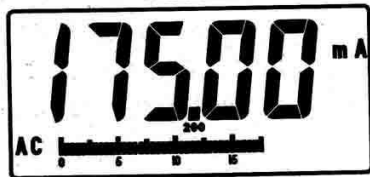
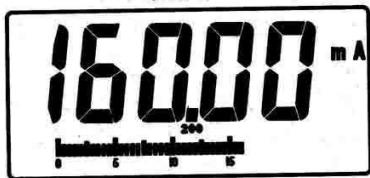
4-3 AC Voltage measurement

4-4. DC Current Measurement

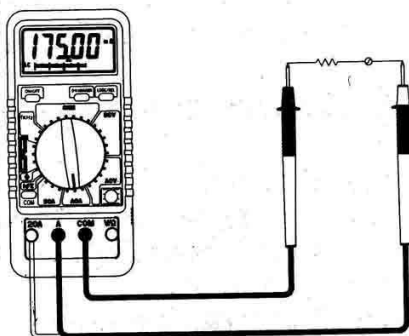
- 4-4-1. Connect the Black test lead to the COM terminal and the Red to the A terminal for a maximum of 2A. For a maximum of 20A, move Red test lead to the 20A terminal.
- 4-4-2. Set the function switch to the DC A range to be used and open circuit in which current is to be measured. Connect the test leads in series with the load under measurement. See Figure 4-4.
- 4-4-3. " - " sign for a negative current will appear on the left side of the LCD.

- Note:
1. See DC voltage measurement Note 1,2,3.
 2. The maximum Input Current is 2A or 20A depending on the terminal used.
Excessive current will blow the fuse, which must be replaced. The fuse rating should not be over 2A to prevent damage to the internal circuit. The 20A range is NOT protected by the fuse.
 3. Maximum Voltage Drop (under full scale)
200 μ A-200mA : 300mV 20A: 900mV
 4. In case of measuring 20A, continuous measurement over 15 minutes may cause damage to the meter.
 5. When making current measurements, make sure that the multimeter is connected in series with the load in which the current is to be measured. Never connect the multimeter across a voltage source. To do so can result in either blowing the overload protection fuse or damaging the device being tested, or injury.

6. Overload Protection : 2A/250V fuse of fast blow type. 20A range is unfused.
7. Maximum Input Current: 20A (Maximum of 15 Minutes, in case of continued use.)



4-4 DC Current measurement



4-5 AC Current measurement

4-5. AC Current Measurement

- 4-5-1. Connect the Black test lead to the COM terminal and the Red test lead to the A terminal for a maximum of 2A. For a maximum of 20A, move the Red test lead to the 20A terminal.
- 4-5-2. Set the function switch to your desired AC A range and open circuit in which current is to be measured. Connect the test leads in series with the load under measurement. See Figure 4-5.

- Note: 1. See DC Current measurement Note 1,2,3,4, 5.
2. Maximum Voltage Drop (under full scale)
200 μ -200mA : 300mV
20A : 900mV
3. Overload Protection: 2A/250V fuse of fast blow type. 20A range is unfused.
4. Maximum Input Current: 20A (Maximum of 15 Minutes, in case of continued use.)
5. Frequency Range: 40Hz to 400Hz
6. Indication: Average

4-6. Resistance Measurement

4-6-1. Connect the Black test lead to COM terminal and the Red test lead to the V/ Ω terminal.

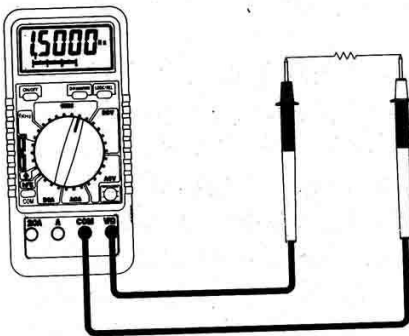
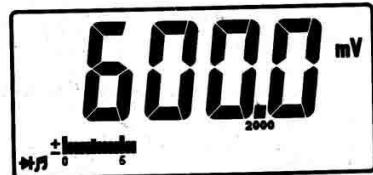
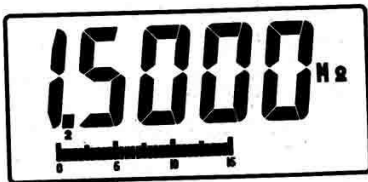
4-6-2. Set the function switch to your desired ohm range and connect the test leads across the resistance to be measured.
See Figure 4-6.

- Note: 1. If the resistance value being measured exceeds the maximum value of the range selected, " O L " will be displayed indicating overload with the bargraph flashing. Select a higher range. In this mode, the beeper does not sound.
2. For a resistance of approximately 1 Mohm and above, the meter may take a few seconds to stabilize. This is normal for high resistance readings.

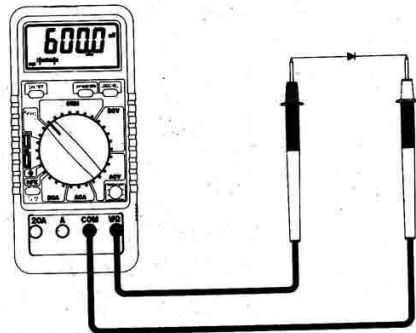
3. When the input is not loaded, i.e. at open circuit, " OL " will be displayed and all the bargraph will flash.
4. When checking in-circuit resistance, ensure that the circuit under test has all power off and all capacitors are fully discharged.
5. The resistance ranges of this instrument are protected by a diode above 500V and a resistor network below 500V, except 200 Ω range which is protected up to 250V only.
6. Some devices may be damaged by the current applied during resistance measurements. The following table shows the voltage and current available on each range.
7. Overload Protection: 500V DC/250 V AC rms on all ranges, except 200 Ω range.
8. Open Circuit Voltage: Less than 900 mV
9. Due to the sensitive nature of the 200 Ω range, a residual resistance is present. This resistance will display itself, if the probes are shorted. This residual resistance is due to the lead, track and switch resistance. To obtain measurement within the stated accuracy when using the 200 Ω range subtract from your value the residual resistance reading.

RANGE	A	B	C
200 Ω	1.2	0.08	0.44
2K Ω	1.2	0.3	0.27
20K Ω	1.2	0.42	0.06
200K Ω	1.2	0.43	0.007
2M Ω	1.2	0.43	0.001
20M Ω	1.2	0.43	0.0001

- A. is open circuit voltage at the terminals.
 B. is voltage across a resistance equal to full scale value.
 C. is current in milliamperes through a shorted circuit at the input terminals. All values are typical.




4-6 Resistance measurement



4-7 Diode measurement

4-7. Diode Measurement

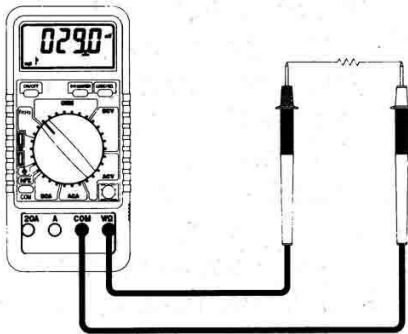
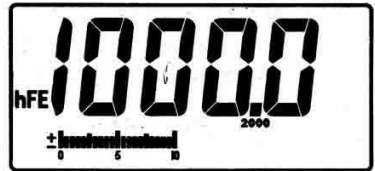
- 4-7-1. Connect the Black test lead to the COM terminal and the Red test lead to the V/ Ω terminal.
- 4-7-2. Set the function switch to the  range and connect the test leads across the diode under measurement. See Figure 4-7.

- Note:
1. When the input is not loaded, i.e. at open circuit, " OL " on the center of the LCD is displayed and the bargraph will flash, indicating overload. In this mode, the beeper does not sound.
 2. There is 1mA Current flow through the device under test.
 3. The meter displays the forward voltage drop in millivolts, and overload when the diode is reversed.
 4. The polarity of the Red test lead is "+".

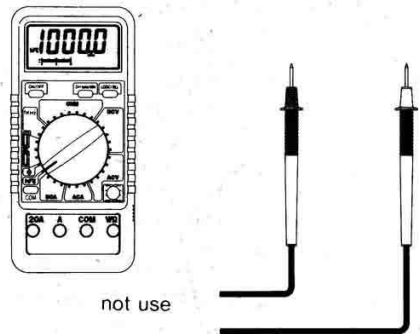
4-8. Audible Continuity Test

- 4-8-1. Connect the Black test lead to the COM terminal and the Red test lead to the V/ Ω terminal.
- 4-8-2. Set the function switch to the range (the same range as diode) and connect test leads across the resistance under measurement. See Figure 4-8.
- 4-8-3. The buzzer sounds if the resistance between two leads is less than approximately 30 ohms.

- Note: 1. See Diode measurement Note 1.
 2. The circuit to be tested must be in power-off condition whilst performing the continuity test.
 3. Overload Protection: 250V DC/AC rms



4-8 Audible
Continuity Test



4-9 Transistor
hFE Test

4-9. Transistor hFE Measurement

- 4-9-1. Set the function switch to the hFE range.
- 4-9-2. Determine whether the transistor is NPN or PNP and locate the Emitter, Base and Collector leads. Insert the leads of the transistor into the correct holes in the socket on the front panel. See Figure 4-9.

4-9-3. The meter will read the approximate h_{FE} value at the test condition of base current $10\mu A$ V_{CE} 2.8V.

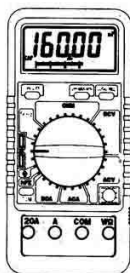
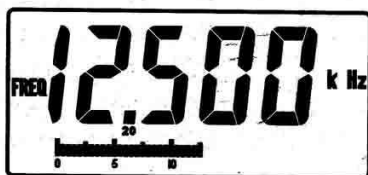
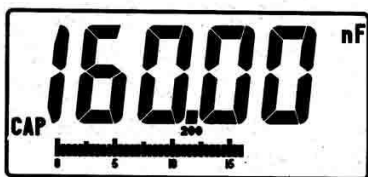
4-10. Capacitance Measurement

4-10-1. In this range, the display will be 0000 automatically. If "0000" is not on the LCD, push down "REL" button to obtain 0000 display. Subsequent measurements will be made relative to this zero.

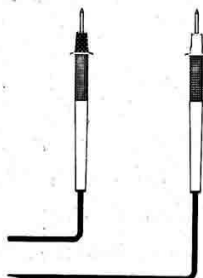
4-10-2. Insert the capacitor into the "CAP" sockets directly without using test leads. See Figure 4-10.

- Note:
1. If the working voltage of the capacitor is less than about 3.0V peak, do not measure the capacitance with this meter.
 2. When measuring a capacitor, insert the " + " lead into the upper CAP socket and the " - " lead to the lower socket.
 3. Capacitor should be discharged before being inserted into the "CAP" Sockets.
 4. When testing polarized capacitors, for example, the tantalum type, particular attention must be paid to the polarity connections. This is to avoid possible damage to the capacitor.
 5. When testing large capacitors, note that there will be a certain time lag before displaying final indication.
 6. Units : $1pF=10^{-12}F$, $1nF=10^{-9}F$, $1\mu F=10^{-6}F$,
 $1mF=10^{-3}F$.

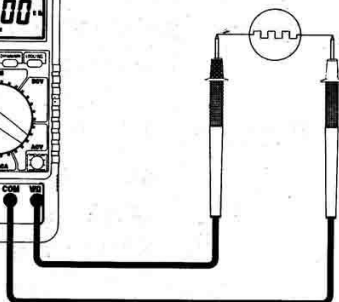
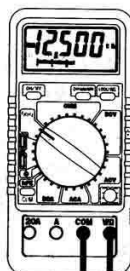
7. Do not connect an external voltage or a charged capacitor (especially large capacitors) to the measuring terminal. It can damage the internal circuit.
8. Open Circuit Voltage : less than 3V
9. Overload not protected.



not use



4-10 Capacitance
Measurement



4-11 Frequency
measurement

4-11. Frequency measurement (M4650 CR only)

- 4-11-1. Connect the Black test lead to the COM terminal, the Red test lead to the V/Ω terminal.
- 4-11-2. Set the function switch to the f KHz range and connect the test leads across the frequency under measurement.
See Figure 4-11.

- Note: 1. When the test leads are connected to an AC outlet, do not turn the Function/Range switch to other range. It may damage the internal components, or the user.
2. Overload Protection: 250V DC/AC rms
 3. Input Sensitivity: 50 mV

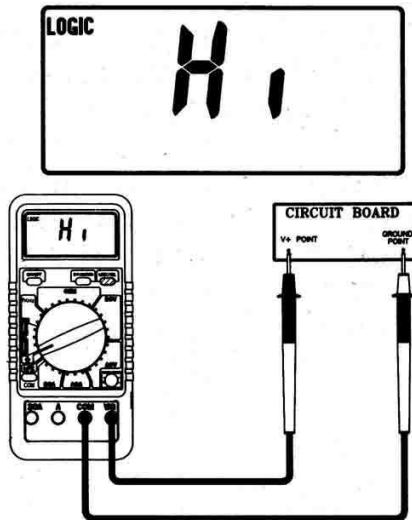
4-12. Logic Test

- 4-12-1. Connect the Black test lead to the COM terminal and the Red test lead to the V/ Ω terminal.
- 4-12-2. Set the function switch to the Logic range "rdy" (READY) will be displayed on the LCD. See Figure 4-12.
- 4-12-3. After reading "rdy" on the LCD, connect the Black test lead to the Ground point of the circuit to be tested and the Red test lead to the supplying voltage point (V^+). While keeping the test leads firmly contacted to each point, push down the Logic button.
- 4-12-4. The meter will indicate the level on the LCD, and beep.
- 4-12-5. While keeping the Black test lead touched to the GND point of the circuit under test move the Red test lead to your desired other points. The meter will immediately display one of the 3 modes, as follows;-

- A. In case of any values exceeding 70% of (V⁺) value, "Hi" (HIGH) is displayed.
- B. In case of any values less than 30% of (V⁺) value, "Lo" (LOW) is displayed.
- C. In case of any values between 30% thru 70%, " ---- " segment is displayed.

4-12-6. In this mode activated, the functions of Data-Hold and Max/Min-Hold will not work.

4-12-7. The supplying voltage from 0.5V upto 19.9V is limited for testing a Logic.

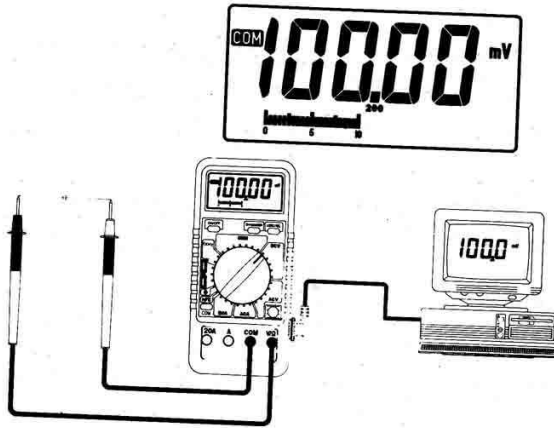


4-12 Logic Test

Note: 1. The meter can read the levels by using the normal test leads, without need of any special logic probes.

4-13. Interfacing the meter with a PC

- 4-13-1. Connect the MT/RS-232C cable between the socket of the meter and the COM port of your Personal Computer. See Figure 4-13.



4-13 Interfacing the meter with a PC

- 4-13-2. After connection, power on the meter. Then load the programmed disc on your PC. In case that your PC is the monochrome monitor, execute the file named "MONO.BAT" in the disc, prior to taking a next step. Run the demonstration program in the disc, and press [ENTER] key on the PC when the logo screen appears.

To stop during execution or to escape from under a device I/O error status, press [CTRL+BREAK] keys on the PC, at a time.

4-13-3. Transmission of the data

To activate transmission of the data, the host computer must give the meter [D] command.

To clear the memories on the meter, the host computer must give the meter [C] Memory-Clear command.

To transmit the memories on the meter to the software, the host computer must give the meter [M] Memory-Call command

A data format consists of 14 bytes in length. The frames are set, as follows :-

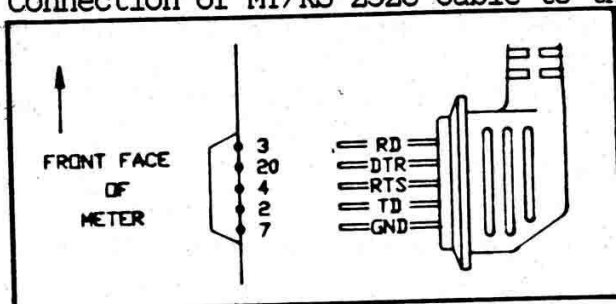
BYTE)	1	2	3	4	5	6	7	8	9	A	B	C	D	E
Ex.1)	D	C	-	1	.	9	9	9	9	V				CR
Ex.2)				1	.	9	9	9	9	M	o	h	m	CR

Note ***

1. You must turn off the communication switch on the meter, when transmitting the data to the PC.
Do not activate both modes of the COM function of the meter and the transmission commands of the PC at a time.
2. This meter can be used with any computer equipped with an RS-232C serial interface, but the software supplied is for IBM compatible computers.

4-13-4. To release "COM" function, turn the range switch or press the communication switch. The COM segment disappears from the LCD.

4-13-5. Connection of MT/RS-232C cable to the DMM



4-13-6. Example of a program by IBM PC GWBASIC

```
10 OPEN "COM1:1200,N,7,2,RS,CD,DS,CD" AS #2
20 A$="D"
30 PRINT #2,A$;
40 IN$=INPUT$ (14, #2)
50 PRINT IN$
60 CLOSE #2
70 END
```

* The copyright for GWBASIC belongs to the Microsoft Corporation.

4-13-7. Communication Specifications

- Transmission rate : 1,200 baud
- Character coding : 7-Bit ASCII
- Parity : none • Stop : 2 stop Bit

5. Maintenance

Your Digital Multimeter is a precise electronic device. Do not tamper with circuit.


To prevent electric shock hazard, turn off the meter and disconnect test leads before removing the back cover, for any adjustment, replacement, maintenance or repair.

After completion of any adjustment, replacement, maintenance or repair, if applying a voltage is necessary, it must be carried out only by a skilled person who is aware of the potential hazard.

To Avoid Damage:

1. Never connect more than 1000 V DC or 750 V rms AC.
2. Never connect a source of voltage with function switch in OHM position, or the terminals between A/20A and COM.
3. Never operate the DMM unless the back case is in place and fully closed.
4. Battery or Fuse replacement should only be done after the test leads have been disconnected and power is OFF.

5-1. 9 Volt Battery Replacement

When the "  " appears on the LCD, please replace the battery as soon as possible for maintaining normal readings. The battery type is NEDA 1604 or 6F22 for 9 voltage.

5-2. Fuse Replacement

If the fuse should be replaced, use only 2A/250V, fast blow type fuse which should be identical in physical size to the original or the spare fuse in the storage compartment inside of the meter.

6. Specifications

6-1. General Characteristics

- * Max Display : 19999 counts (4½ Digit) with automatic polarity indication.
- * Max Input Current of AC & DC :
20A (15 minutes at Max)
- * Reading Time : 1-2 readings per second
- * Operating Temperature :
0°C to 40°C (32°F to 104°F)
- * Storage Temperature :
-10°C to 50°C (14°F to 122°F)
- * Temperature for Guaranteed Accuracy: +23°C±5°C
- * Battery Type : NEDA 1604 9V or 6F22 9V
- * Size (H x W x L Cm) : 3.4 x 8.7 x 18.7
- * Net Weight : 350g ± 10g (Incl 9V Battery)
- * Accessories(supplied): Operating Manual,
a pair of test lead, a spare fuse, a 9V battery.
(optional): Carrying case, Interface cable MT/RS-232C, Floppy disc with software.

6-2 Special Characteristics

	FUNCTION	RANGE	ACCURACY	RESOLUT 'N
M- 4650CR/ 4630CR	DC VOLTAGE	200mV 2V 20V 200V	$\pm 0.05\%$ of rdg + 3 dgt	10 μ V 100 μ V 1mV 10mV
		1000V	$\pm 0.1\%$ of rdg + 5 dgt	100mV
	AC VOLTAGE	200mV 2V 20V 200V	$\pm 0.5\%$ of rdg + 10dgt	10 μ V 100 μ V 1mV 10mV
		750V	$\pm 0.8\%$ of rdg + 10dgt	100mV
	DC CURRENT	2mA	$\pm 0.3\%$ of rdg + 3 dgt	100nA
		200mA	$\pm 0.5\%$ of rdg + 3 dgt	10 μ A
		20A	$\pm 0.8\%$ of rdg + 5 dgt	1mA
	AC CURRENT	2mA	$\pm 0.8\%$ of rdg + 10dgt	100nA
		200mA	$\pm 1.0\%$ of rdg + 10dgt	10 μ A
		20A	$\pm 1.2\%$ of rdg + 15dgt	1mA
	RESIS- TANCE	200 Ω	$\pm 0.2\%$ of rdg + 10dgt	0.01 Ω
		2K Ω 20K Ω 200K Ω 2M Ω	$\pm 0.15\%$ of rdg + 3 dgt	0.1 Ω 1 Ω 10 Ω 100 Ω
20M Ω		$\pm 0.5\%$ of rdg + 5 dgt	1K Ω	
M- 4630CR	CAPACI- TANCE	2000pF 20nF 200nF	$\pm 2.0\%$ of rdg + 20dgt	0.1pF 1pF 10pF
		2 μ F 20 μ F	$\pm 3.0\%$ of rdg + 30dgt	100pF 1nF
M- 4650CR	FREQUENCY	20KHz 200KHz	$\pm 2.0\%$ of rdg + 5 dgt	1Hz 10Hz
	CAPACI- TANCE	2000pF 200nF	$\pm 2.0\%$ of rdg + 20dgt	0.1pF 10pF
20 μ F		$\pm 3.0\%$ of rdg + 30dgt	1nF	

WARRANTY

Warrants this instrument 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 expendable items such as batteries or fuses. If the defect has been caused by a misuse or abnormal operating conditions, the repair will be billed at a nominal cost.

