

**METEX<sup>®</sup>**  
Instruments

**METEX<sup>®</sup>**

**DIGITAL  
MULTIMETER**

**OPERATING MANUAL**  
**M 4650 CR**  
**M 4630 CR**

Specification subject to change  
without prior notice

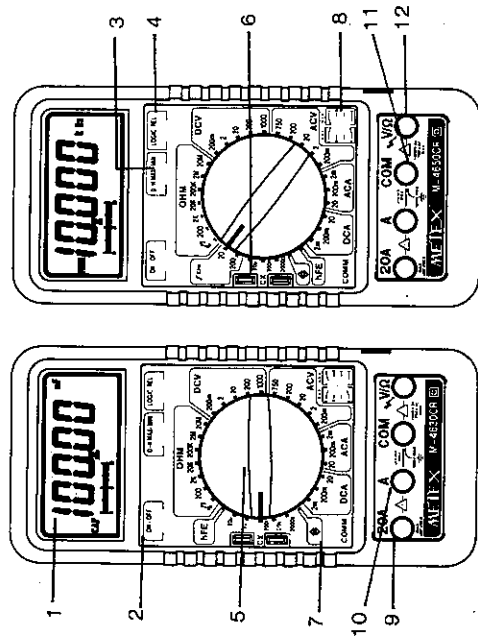
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## M4650CR/M4630CR Familiarization

1. LCD, (4 1/2 Digit; Max 9999) with 4.1 point bar graph.
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 switch



8. TR socket (Transistor hFE measurement only)
9. 20A terminal
10. A terminal
11. COM terminal
12. V/Ω terminal
13. Tilt stand (on the rear case); movable by squeezing to hanging or standing position

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## 1. Introduction

With this METEX 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 DIN 57411/VDE 0411, 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 terminal 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 electrical 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.

Function	Terminals	Input Limit
V DC 	V/Ω+COM	1000V DC 
V AC 	"	750V AC 
Ω	"	250V DC/AC 
A DC 	A or 20A+COM	200mA, 250V DC/AC 
A AC 	"	
Freq. 	V/Ω+COM	250V DC/AC 
Logic	V/Ω+COM	250V DC/AC 

**2-3-3.** The 20A range is not fuse-protected. 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 and COM terminals. This warning assures protection against injury and/or damage to the meter.

**2-3-4.** To avoid damage to the meter, disconnect test leads from test points before changing function.

**2-3-5.** To avoid electrical shock, be careful when working above 60V DC or 25V AC. Such voltages pose a shock hazard.

**2-3-6.** To avoid electrical shock hazard, do not touch test leads, tips or the circuit under measurement while power is turned on.

**2-3-7.** Do not get the meter and test leads wet.

## 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.

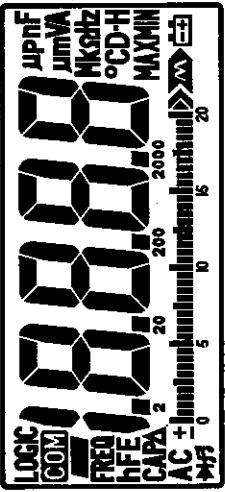


Fig. 3-1.

**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 for Range-Selection & Overflow-Warning**

The meter will beep when changing ranges. If a measured value exceeds the capacity of the selected range, the meter will display "OL" segment for warning overflow, beep repeatedly and flash the analog bar graph, except for, in the resistance ranges, and the diode range. See Figure 3-3.

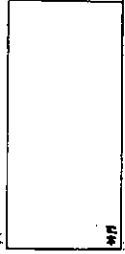


Fig. 3-3.

**3-4. Overload Indication**

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

**3-5. Analog bar Display**

The analog bar graph display is helpful for peaking and null-changing inputs. The bar indicates the magnitude of the input compared to the full scale value of the measurement range in use.

When "OL" is indicated, the bar graph will flash. See Figure 3-5.



Fig. 3-5.

**3-6. Low Battery Indicator**

The "E" 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.

Fig. 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 "D-H" push-button, a read-out is captured on the LCD, instantly. The meter displays "D-H" on the LCD. Press 2 times "D-H" button, you can capture the maximum value in subsequent readings. The meter displays "MAX" on the LCD.

Press 3 times "D-H" button, you can capture the minimum value in subsequent readings.

The meter displays "MIN" on the LCD. These 3 functions will go on sequentially, if the button is pressed without pause. (D-H → MAX → MIN → • → D-H ... →)

To return to normal range, turn the range selector or press "D-H" button until the symbol segment disappears.

**3-8. Interfacing the meter with a PC.**

The CR models can be hooked into data acquisition system run on personal computers or to printers, pen-plotters etc using its bi-directional MT/RS-232C interface cable. For further information see 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 display will show "Δ" segment on the lower left side of the LCD. The digital display and the analog bar graph will now show only the difference between the measured value minus the value memorized by REL function. To return to normal mode, press REL button again, or turn the range selector.

In this mode, the total range of Relative off set is 2,0000 counts.

The measured value goes over 2,0000 counts, "OL" will be displayed on the LCD, in stead of showing the difference.

## 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 switch must be set to the range before operation.

### 4-2. DC Voltage Measurement

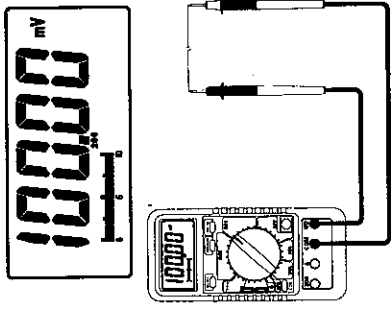
4-2-1. Connect the Black test lead to the COM terminal and the Red test lead to the V/Ω terminal.

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. When the "OL" is displayed and all the bars are flashing, the range is overloaded. The function switch must be set to a higher range.
- 2.

3. Take care to avoid contact with high tension circuits when measuring high voltage.

4-2 DC Voltage measurement



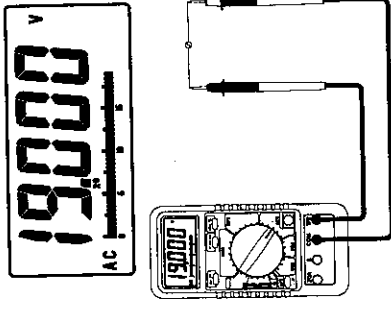
### 4-3. AC Voltage Measurement

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.

4-3 AC Voltage measurement



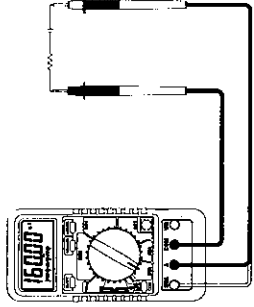
#### 4-4. DC Current Measurement

- 4-4-1.** Connect the Black test lead to the COM terminal and the Red to the A terminal for a maximum of 200mA. 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 200mA or 20A depending on the terminal used. Excessive current will blow the fuse, which must be replaced. The 20A range is not protected by the fuse. The fuse rating should not be over 2A to prevent damage to the internal circuit.

3. Maximum Voltage Drop (under full scale) 200µA-200mA: 300mV 2.0A: 900mV
4. In case of measuring 20A, continuous measurement over 15 minutes may cause damage to the meter.

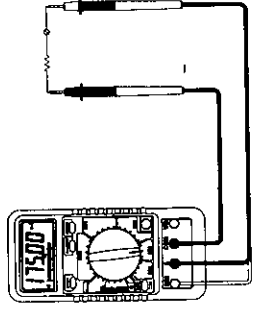


4-4 DC Current measurement

#### 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 200mA. 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.



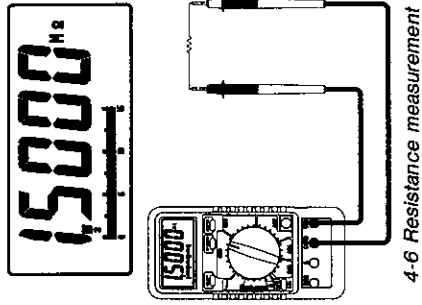
4-5 AC current measurement

#### 4-6. Resistance Measurement

- 4-6-1.** Connect the Black test lead to the 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, OL will be displayed indicating overload and all the bargraph will flash. Select a higher range. In this mode, the beeper does not sound. For a resistance of approximately 1Mohm and above, the meter may take a few seconds to stabilize. This is normal for high resistance readings.

2. When the input is not loaded, i.e. at open circuit, the "OL" will be displayed and all the bargraph will flash.
3. When checking in-circuit resistance, ensure that the circuit under test has all power off and all capacitors are fully discharged.
4. The resistance ranges of this instrument are protected by a resistor above 500V and a resistor network below 500V, except 200ohm range which is protected up to 250V.
5. Some devices may be damaged by the current applied during resistance measurements. The following table shows the voltage and current available on each range.



Range	A	B	C
200 ohm	1.2	0.8	0.44
2 Kohm	1.2	0.3	0.27
20 Kohm	1.2	0.42	0.06
200 Kohm	1.2	0.43	0.007
2 Mohm	1.2	0.43	0.001
20 Mohm	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.

#### 4-7. Diode Measurement

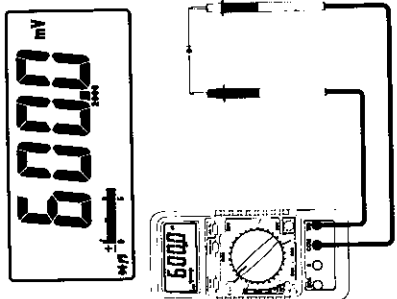
**4-7-1.** Connect the Black test lead to the COM terminal and the Red test lead to the V/Ω terminal. (Note: The polarity of the RED test lead is "+").

**4-7-2.** Set the function switch to the  $\rightarrow \Omega$  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, only "OL" on the center of the LCD is displayed and all 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.

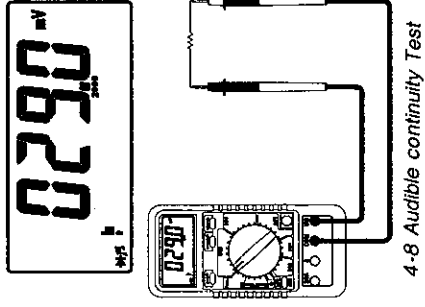
3. The meter displays the forward voltage drop in millivolts, and overload when the diode is reversed.



#### 4-8. Audible Continuity Test

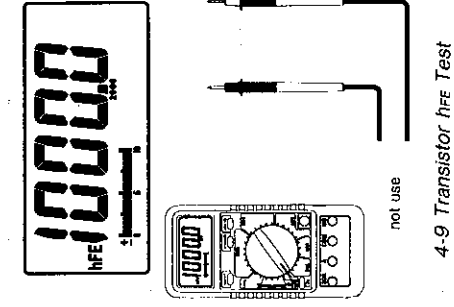
- 4-8-1.** Connect the Black test lead to the COM terminal and the Red test lead to the  $V/\Omega$  terminal.
- 4-8-2.** Set the function switch to the  $\rightarrow \Omega$  range (the same range as diode) and connect test leads across the resistance under measurement. See Figure 4-8.
- 4-8-3.** The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

- Note: 1. See Diode measurement Note 1.
2. The circuit to be tested must be in power-off condition whilst performing the continuity test.



#### 4-9. Transistor hFE Test

- 4-9-1.** Change 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.



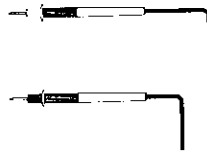
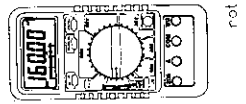
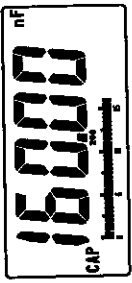
- 4-9-3.** The meter will read the approximate hFE value at the test condition of base current 10uA  $V_{CE}$  2.8V.

#### 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.





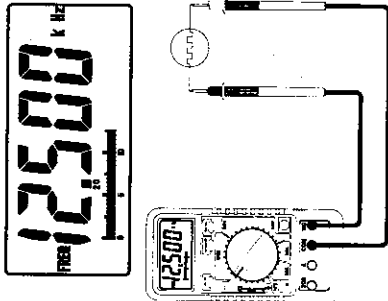
3. Capacitor should be discharged before being inserted into the "CAP" Sockets.
4. When testing polarized capacitors, for example, the tantalum type, particular attention must be paid to the polarity connections. This is to avoid possible damage to the capacitor.
5. When testing large capacitors, note that there will be a certain time lag before displaying final indication.
6. Units:  $1\text{pF} = 10^{-12}\text{F}$ ,  $1\text{nF} = 10^{-9}\text{F}$ ,  $1\mu\text{F} = 10^{-6}\text{F}$ ,  $1\text{mF} = 10^{-3}\text{F}$ .
7. Do not connect an external voltage or a charged capacitor (especially large capacitors) to the measuring terminal. It can damage the internal circuit.

4-10 Capacitance Measurement

**4-11. Frequency measurement for the Model M-4650CR**

- 4-11-1. Connect the Black test lead to the COM terminal, the Red test lead to the V/ $\Omega$  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. Do not connect test leads to AC power outlet. If connected, indication is possible but it will damage the internal circuit. If, however, measurement of an AC power outlet is required, connect test leads to the AC outlet through an attenuator.
2. When the test leads are connected to an AC outlet, do not turn the selector switch to other range. It may damage the internal components.



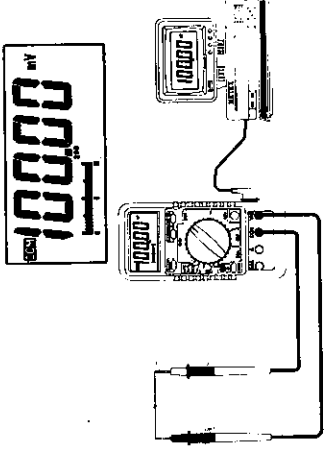
4-11 Frequency measurement

**4-12. Logic Test**

- 4-12-1. Connect the Black test lead to the COM terminal and the Red test lead to the V/ $\Omega$  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.

**4-13. Interfacing the meter with a PC**

**4-13-1.** Connect the MT/RS-232C cable to the terminals built into the PC and meter.  
(See Figure 4-13.)



4-13 Interfacing the meter with a PC

**4-13-2.** Press down "COMM" button. Upon setting this mode, the meter becomes ready to transmit the readings to the PC.

In this mode, the meter is also transmitting the readings on the LCD to the PC in a following data format.

A data format consists of 14 bytes, as shown below.

```

1 2 4 4 5 6 7 8 9 A B C D E
: : : : : : : : : : :
D C - 1 • 9 9 9 9 V : : : : CR
1 • 9 9 9 9 M o h m CR
    
```

**4-12-4.** The meter will indicate the level on the LCD, and beep.

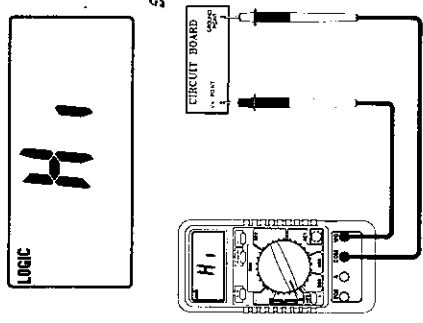
**4-12-5.** While keeping the Black test lead contacted to the Ground point of the circuit to be tested, move the Red test tip to your other desired points. The meter will immediately display one of the three modes, as follows: -

- A) In case of any values exceeding 70% of (V) value, "HI" is displayed on the LCD.
- B) In case of any values less than 30% of the (V) value, "Lo" is displayed on the LCD.
- C) In case of any value between 30% thru 70% of the (V) value, "- - - -" is displayed on the LCD.

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

**4-12-7.** The supplying voltage between 0.5V upto 19.9V is limited for the Logic test.

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



4-12 Logic Test

**4-13-3.** To release "COM" function, turn the selector switch or press "COMM" button. "COM" annunciator disappears from the LCD.

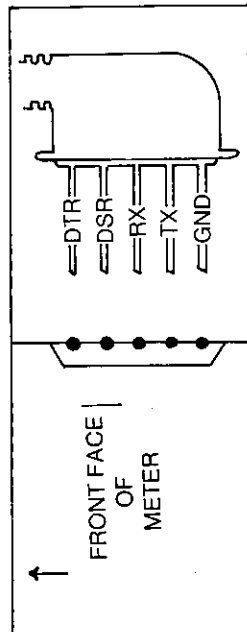
**4-13-4.** The meter can store data up to 5 measured values in the memory by repeating the procedures as explained in 4-13-2 and 4-13-3.

**4-13-5.** The meter can transmit the data memorised in the meter to the PC, according to the direction from the PC.

**4-13-6.** The meter can transmit the data displayed on the LCD to the PC, according to the direction from the PC.

**4-13-7.** The stored data will all be cleared, according to direction from the PC.

**4-13-8.** Connection with MT/RS-232C.



**4-13-9.** Example of the Program by "IBM PC GWBASIC"

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

\* The copyright for GWBASIC belongs to the Microsoft Corporation.

**4-13-10.** Other specifications

- Speed : 1200 BPS
- Parity : None
- Data : 7 Bit ASCII
- Stop : 2 stop Bit

**Note 1:** Do not activate both modes of "COM" in 4-13-2 and "D" in 4-13-6, at a time.

**2.** For further information, refer to the read-me-file prepared in the programmed floppy disk (optional).

**5. Maintenance**

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

To prevent electrical 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:

- A. Never connect more than 1000Volt DC or 750Vrms AC.
- B. Never connect a source of voltage with function switch in OHM position.
- C. Never operate the DMM unless the back case is in place and fully closed.
- D. 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**

Note the condition of 9 Volt battery following the procedure described previously in the contents 4-1 if the battery needs replacing, open the battery-cell cover, remove the flat battery and replace it with a battery of the same type.

### 5-2. Fuse Replacement

If the fuse should be replaced, use only 2A fuse identical in physical size to the original or use the spare fuse in the storage compartment adjacent to the main fuse.

## 6. Specifications

### 6-1. General Characteristics

- Max Display: 19999 counts (4 1/2 Digit) with automatic polarity indication.
- Max Input Current of AC & DC: 20A (Max 15 minutes)
- 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 (HXWXL, Cm): 3.4X8.7X18.7
- Net Weight: 350g + 10g (incl. 9V Battery)
- Accessories supplied: operating Manual, a pair of test lead, spare fuse, 9V battery, carrying case (option), MT/RS-232C cable (option), programmed floppy disk (option).

### 6-2. Special Characteristics

	FUNCTION	RANGE	ACCURACY	RESOLUTION
M-4650/4630CR	DC VOLTAGE	200mV	±0.05% of rdg + 3 dgts	10µV
		2V		100µV
	AC VOLTAGE	20V	±0.5% of rdg + 10 dgts	1mV
		200V		10mV
		750V		100mV
DC CURRENT	2mA	±0.3% of rdg + 3 dgts	100nA	
	200mA		10µA	
	20A		1mA	
AC CURRENT	2mA	±0.8% of rdg + 10 dgts	100nA	
	200mA		10µA	
	20A		1mA	
RESISTANCE	200Ω	±0.2% of rdg + 10 dgts	0.01Ω	
	2KΩ		0.1Ω	
	20KΩ		1Ω	
	200KΩ		10Ω	
	2MΩ		100Ω	
	20MΩ		1KΩ	
CAPACITANCE	2000pF	±2.0% of rdg + 20dgs	0.1pF	
	20nF		1pF	
	200nF		10pF	
	2µF		100pF	
CAPACITANCE	2000pF	±3.0% of rdg + 30 dgts	1nF	
	200nF		0.1pF	
	20µF		10pF	
FREQUENCY	20KHz	±2% of rdg + 5 dgts	1Hz	
	200KHz		10Hz	

M4650CR SCHEMATIC DIAGRAM

