

**TENMA®**

**Quad Display  
True RMS  
PC Interface DMM**

**OPERATION MANUAL**

**TENMA**<sup>®</sup>  
TEST EQUIPMENT  
405 Pioneer Blvd.  
Springboro, Ohio 43086

# C O N T E N T S

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## 1. Warning! Please read Carefully

These operating instructions should be read carefully. Any damage caused by failure to follow these instructions will not be covered by guarantee. We accept no responsibility for any subsequent damage which may arise.

## 2. Proper use

- Measurement of DC voltages up to 1000 V DC.
- Measurement of AC voltages up to 700 V AC.
- TRUE RMS measurement AC voltages up to 700 V AC rms.
- Measurement of DC or AC up to 20 A.
- TRUE RMS measurement AC current up to 20 A.
- Measurement of capacitors up to 400  $\mu\text{F}$ .
- Frequency measurement up to 4 MHz.
- Measurement of resistance up to 400 M $\Omega$ .
- Measurement of temperature using Probe + Thermocouple set.
- Continuity test, diode test, hfe test
- Logic test
- Signal generator output, 1 Hz to 5 KHz, TTL level

Use other than those described above will result in damage to this product also involves risk of hazards such as short-circuit, fire, electric etc. The entire product must not be modified or converted. It is imperative the safety instructions!

It is forbidden to take measurements in damp or wet conditions.

### 3. Introduction, Presentation

The meter has an AUTO RANGE feature which always sets the correct appropriate measuring range for the various measurements. The "AUTO" function can be switched off so that ranges can also be set manually. The "RECORD" function can be used to store and then retrieve up to 10 measured signals. This memory is non-volatile and its contents are not lost when the meter is in AUTOPOWER OFF but are lost when the Main power switch is OFF.

If the meter is not used for longer than approximately 30 minutes, the AUTO POWER OFF function switches it off and can revive to push any function keys. The 50 series is suitable for universal use in DIY, in professional sectors or in schools etc.

### 4. Safety Instructions

• The Concept DMW 51,52,53 has been CE tested and meets the requirements of EC EMC Guideline 89/336 /EEC and Low Voltage Guideline 73/23/EEC.

• It has been manufactured in accordance with VDE 0141 Part 1 (EN 61010-1) (Protective measures for electronic measuring equipment) and left our factory in a perfectly safe condition. To keep the meter in this condition and to ensure its safe operation, the user must observe the safety instructions and warning contained in these operating instructions.

• Measurements of current are only permitted in circuits that have 20 A fuse protection and in which no voltage in excess of 250 V AC or 250 VDC occur (250 V fuse).

• The measuring appliance must not be used in installations of Overvoltage Category III according to IEC 664. The appliance and measuring leads are not protected against explosion caused arcing (IEC 1010-2-031, Sub-clause 13.101).

• Measuring appliances must be kept away from children!

• On commercial premises, the accident prevention regulations of the Association of Industrial Professional Association with respect to electrical systems and operating equipment must be observed.

• In schools, training centres and DIY workshops, the operation of measuring appliances and equipment must be supervised by responsible, trained personnel.

• Opening covers or removing parts can lead to live parts being exposed, unless this can be performed manually. Connection points can also be live. Before being balanced, serviced or repaired or, having any parts or componentry replaced, if the appliance must be opened, it must first be isolated from any source of voltage or voltage circuits. If, subsequently, it is absolutely necessary to balance, service or repair the open appliance while live, this must be carried out by a qualified technician familiar with the risks involved and the relevant regulations (VDE-0100, VDE-0683, VDE-0701).

• Capacitors inside the appliance may still be charged even after the appliance has been isolated from all sources of voltage and voltage circuits.

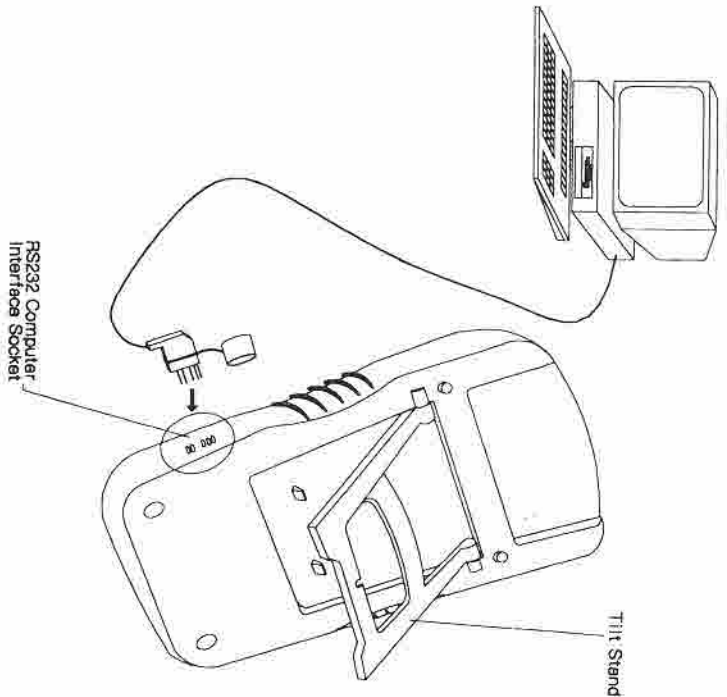
• Exercise particular care when dealing with voltage in excess of 25 V alternating current (AC) or 35 V direct current (DC). Even at voltages as low as these, it is still possible to suffer a life-threatening electric shock if contact is made with conducting parts.

First switch the source of voltage off, connect the measuring appliance to the terminals of the voltage source to be measured, set the required voltage measuring range on the measuring appliance and then switch the source of voltage on. After completing the measurement, switch the source of voltage off and remove the measurement leads from the terminals of the source of voltage.

• Before each voltage measurement, ensure that the correct measurement function is active (resistance measurement, diode test etc.).

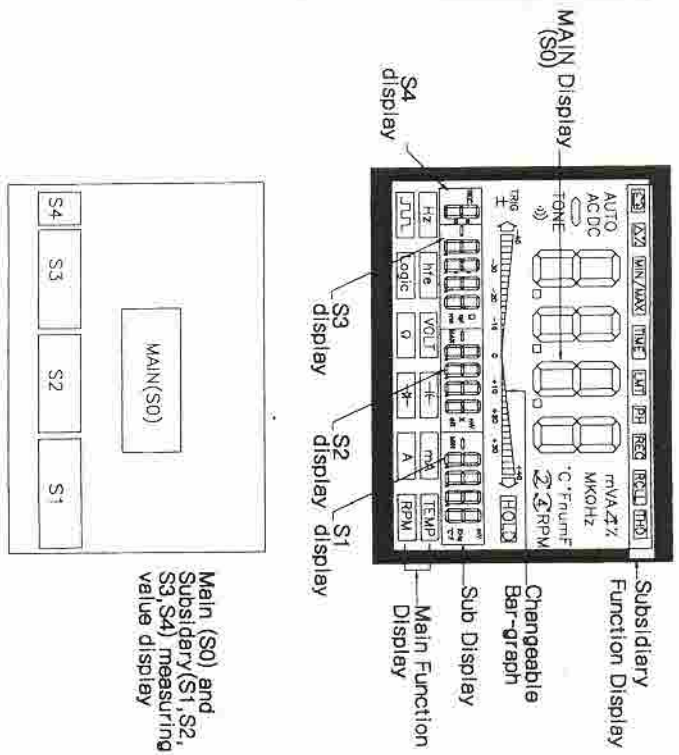






BACK VIEW

5.2 Basic Display






Main (S0) and Subsidiary(S1, S2, S3, S4) measuring value display

### Measuring Display directory

FUNCTION	MAIN (S0)	S1	S2	S3
ACV	AC VOLT	Hz		
ACA	AC AMPERE	Hz		
DCV	DC VOLT			
DCA	DC AMPERE			
$\Omega$	$\Omega$			
BUZZER	BUZZER			
DIODE	DIODE			
hfe	hfe			
CAPACITOR	CAPACITANCE			
Hz	Hz	V		ms
TEMP	*C/*F	*F/*C		
FUNCTION GENERATOR	Hz			
LOGIC	LOGIC (HI, LO)	Hz	V	TTL/5V CMOS /5V CMOS
$\Delta$ %	0	Initial value	%(S1 and S0)	
MIN-MAX-AVG	AVG	MIN	MAX	measuring value
COMPARE	PASS	MIN	MAX	
TIME				hour-minute-second (set up to 24 hours)
RECORD		0~9	0~9	0~9

-10-

### 5.3 Display symbols

- V : VOLTS
- A : Ampera
- DC : Direct current ( — )
- AC : Alternating current ( ~ )
- Hz : Hertz
- $\Omega$  : ohms
-  : Signal Generator (TTL level)
- Logic : Logic
-  : Diode
- hfe : Transistor (TR)
- AUTO : auto ranging
- \*C : Temp °C
- \*F : Temp °F
- TONE : Tone sweep
- TRIG ± : Frequency Trigger
-  : Buzzer, Continuity
- ms : millisecond
- HI : high (Logic function)
- LO : Low (Logic function)
- PASS : PASS the limits (limit function)
- : Between high level and low level (Logic Function)
- O.L : Overload

-11-

: Low Battery Indication.

: relative on AC V, DC V  
 : relative on mA/μA A  
 difference displayed. (1st and 2nd measurement difference)

: minimum/maximum

: Time stamping

: Limit (high-low limits) compare feature

: Peak Hold.

: Recording

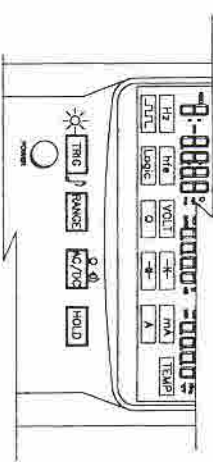
: Call the data in recording

: Data Hold

Units of Measure.	
M: Mega	(M=1,000,000)
K: Killo	(K=1,000)
m: milli	(m=10 <sup>-3</sup> )
μ: micro	(μ=10 <sup>-6</sup> )
n: nano	(n=10 <sup>-9</sup> )

#### 5.4 Power ON/OFF Switch and Buttons

The Buttons to select subsidiary function, feature while measuring Main functions. POWER switch is to main POWER ON or OFF.



: Main POWER ON/OFF switch  
 Press to POWER ON, Press to POWER OFF.

: In Frequency(Hz) range, press button to select active "Hi(+)" or active "Lo(-)" Trigger.

: TONE SWEEP features. Press button to select activate TONE SWEEPING. Works on all Volt(V), milliampere(mA), ampere(A) range. Sound can be changeable depend on amount of Input (measuring value). User can recognize the measuring value becomes bigger or smaller just by hearing the TONE Sweeping. This feature allow user eye free from watching on LCD Display and useful when work at limited space.

TONE SWEEP output frequency.

DISPLAY	FREQUENCY
10	10 Hz
50	50 Hz
100	100 Hz
399	399 Hz
.	.
.	.



LCD backlight ON and OFF button.  
 Press Button longer than 2 seconds to  
 light ON / OFF.

**RANGE** : Allows the units of measurement to be switched:  
 • Works only ACV, DCV,  $\Omega$ , CAPACITANCE.  
 • Press Button to change Manual/AUTO range.  
 If press the button longer than 2 seconds, range change  
 from Manual to AUTO.

**NOTE** : When in AUTO, pay very close attention to the UNITS OF  
 MEASUREMENT (example...mV, V, ohms, Kohms, Mohms).  
 The meter will switch scales automatically in this mode to  
 select the range best suited to the measurement being  
 made at the test leads.

: Press button check circuit continuity check Buzzer  
 will sound.

**AC/DC** : Press button to change AC or DC.  
 works on Volt(V) milliamper(mA) Ampere(A) ranges.

**HOLD** : This button is used to "FREEZE" the reading on the  
 screen. This is handy when measurements are being  
 taken in cramped spaces. If the user presses this Button  
 while the leads are connected to the circuit being tested,  
 the reading being taken at the time of the button being  
 pressed will be saved to the screen.

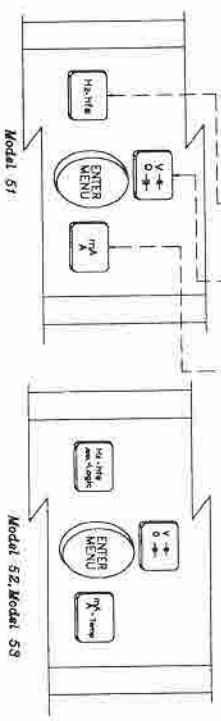
**HOLD**  
 Symbol will be shown on screen. If the hold button  
 is pressed second time, the reading will be lost  
 and the meter will return to the normal display mode.

## 6. Functional Description

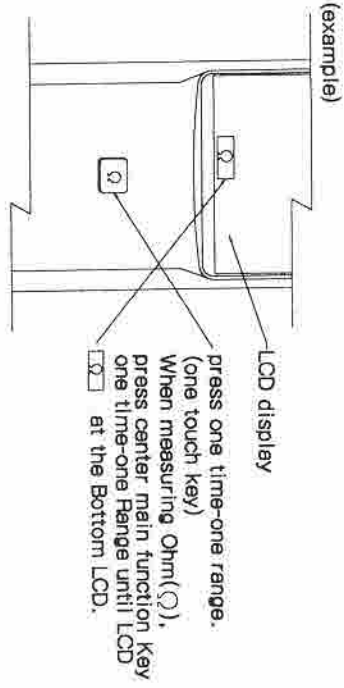
### 6.1 MAIN FUNCTION

**INITIAL DISPLAY** : Whenever main POWER Switch is pressed to ON,  
 Initial display on LCD display is "AC V" Initial  
 Display will be disappeared if press any Main  
 Function Key to other desired measuring range.

**MAIN FUNCTION** : There are three square shape Main function keys  
 SELECTION Left, Center, Right side of meter face.



Press the Function Key until desired measuring  
 Range shows on bottom of LCD display area.  
 (Letter or symbol in white, back ground in black)



### Warning!

Please read the manual carefully.


Never exceed the maximum permitted input values! Exercise particular care when voltages in excess of 25 V AC rms/DC: it is possible to suffer a life-threatening electric shock if contact is made with conducting parts.

The measuring leads must be removed from the object which is to be measured before any change of measuring function.

When measuring, use only the measuring leads supplied or the optional adapters. Before making a connection, ensure that you have checked the condition of the plug-in connector and/or test probes for damage to the insulation. The measuring leads, but not the adapters, are rated for voltages up to 1000 V. The meter is designed for voltages up to 1000 V DC or 700 V AC. Be especially careful when working with voltages in excess of 25 V AC and 35 V DC.

### 6.1-1. Measuring AC voltages

To measure AC voltages up to 700 V AC proceed as follows:

- Press main function key. (center)  Initial set up is automatically AC V
- Connect the measuring leads as shown, the non-solid measuring lead corresponds to the red measuring lead.
- The bar graph, a type of analogue indication that has a high measurement rate, is active on the center of the screen. The bar graph acts as a trend indication.
- Connect the test probes to the object which is to be measured.

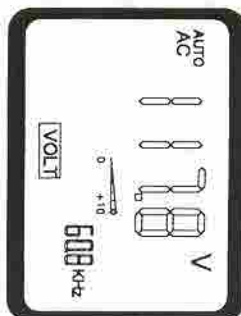
### NOTE

High Voltage



WARNING! : Beep, beep, beep (intermittent sound)

When AC Volt measuring value is displayed on main display area(s) Frequency(Hz) value in main AC Volt is simultaneously displayed at Subdisplay (st) area.



(LCD)

### NOTE

RMS(True RMS) Measurement : This meter allows the direct direct measurement of the Total Effective Voltage or True RMS value of a signal.

This is useful when measuring nonsinusoidal waveforms or waveforms containing harmonics such as the output of power control circuits and switching power supplies as well as input signals with both AC and DC voltage present.

### NOTE

Available Sub-Functions :      



To ENTER sub-functions while measuring main-function

: Press  Key.

See details of 6-2. sub-function page

### 6.1-2.Measuring DC voltages

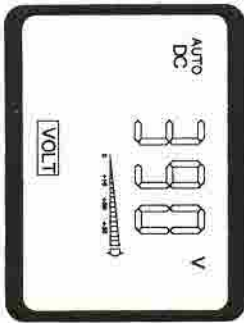
To measure DC voltages up to 1000 V DC proceed as follows:

- Press main function Key.(center)  AC Volt is displayed on LCD.
- Select the  button to enter DC Volt measuring range.
- Connect the measuring leads as shown, the non-solid measuring lead corresponds to the red measuring lead.
- The bar graph, a type of analogue indication that has a high measurement rate, is active on the center of the screen. The bar graph acts as a trend indication.
- Connect the test probes to the object which is to be measured.



**WARNING!** HighVoltage **WARNING!** : Beep, beep, beep (intermittent sound)

DC Volt measuring value is displayed on main display area( $SO$ .)



**NOTE**

Available Sub-Functions :      





To ENTER sub-functions : Press  Key.

while measuring main-function

See details of 6-2.sub-function page

**NOTE**




As soon as a  appears in front of the measured value during a DC voltage measurement, the measured voltage is negative (or the measuring leads are connected the wrong way round).

### 6.1-3.Measuring resistance ( $\Omega$ ) and continuity testing( ).

**WARNING!**

Remember that it is crucial that no parts of circuits, components and other objects to be measured are live.

To measure resistances up to 40 M $\Omega$  and perform (acoustic) continuity less than to 20 $\Omega$ , proceed as follows:

- Press main function Key (center):  select range until OHM(  $\Omega$  ) symbol is displayed on LCD.
- Connect the measuring leads as shown, the non-solid measuring lead corresponds to the red measuring lead.
- The bar-graph, a type of analogue indication that has a high measurement rate, is active on the center of the screen. The bar graph acts as a trend indication.
- Connect the test probes to the object which is to be measured. To proceed circuit continuity testing(  ), press  button.(Beep sound)

**Notes**

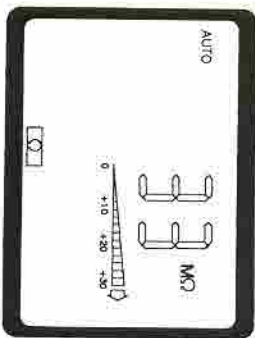
When measuring resistors mounted on circuits which contain silicon transistors/diods, the voltage for the 400 $\Omega$  range is sufficient to turn on the semiconductors. This may falsify measured values.

The resistance of the measuring leads is normally negligibly small (approx. 0.1 to 0.2 $\Omega$  ). Nevertheless, even this low value may result in inaccuracy in the 400 $\Omega$  measuring range. When taking a resistance measurement, ensure that the test points which the test probes touch are free of dirt, oil, soldering varnish and the like. Under certain circumstances this may falsify the measured value.



Do not take measurements on charged capacitors because of possible discharge which could destroy your meter.

**Notes**  
Resistance ( $\Omega$ ) measuring value is displayed on main Display area. (50')



**Notes**  
Available Sub-Functions:  $\Delta$  %  $\text{MIN/MAX}$  TIME REC RCLT

LMT  
PH

To ENTER sub-functions: Press  $\text{ENTER}$  Key.  
While measuring main-function

See details of 6-2. sub-function page

#### 6.1-4. Measuring diodes and capacitances: "M", "F"

##### Warning!

Discharge each capacitor connecting it to the appliance.

When capacitors are short-circuited, strong discharges of energy may occur. Particular care must be taken in spaces in which dust, flammable gases, vapours or liquids are or may be present => risk of explosion!

Never touch the connections of capacitors with voltages exceeding 35 V DC or 25 V AC, danger-risk of fatal injury.

Never carry out any measurement on a capacitor integrated in a circuit or a circuit component.

To test diodes and semiconductor circuits or capacitors up to 40  $\mu\text{F}$ , proceed as follows:


- Main function key (center)  $\text{+}$  select range until  $\text{+}$  (capacitance) or  $\text{-}$  (diode) is displayed on LCD.
- Connect the measuring leads as shown, the non-solid measuring lead corresponds to the red measuring lead.
- Capacitance test** During a capacitance measurement but not during a diode test, the bar graph, a type of analogue indication with a high measurement rate, is active on the center of the screen. The bar graph acts as a trend indication.  
**Diode testing** Connect the test probes to the de-energised semi-conductor device (diode or transistor). Note that the red measuring lead must be connected to the anode and the black measuring line must be connected to the cathode. The forward connecting direction is then measured. If a PN junction is intact, a value from 0.45 to 0.75 V DC appears for silicon diode paths and a value from 0.2 to 0.4 V DC.
- Connect the test probes to the object which is to be measured.

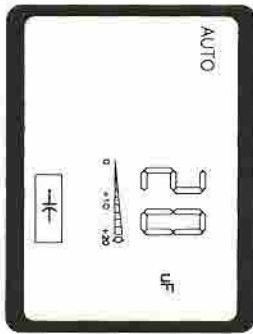


appears for germanium diode paths. If the word "OVER" (overflow) appears instead of a voltage value, there is a break in the diode path or the measuring leads are connected the wrong way round. If a voltage of more than 1 V is measured in the case of transistors, they may be transistors that have integral resistors

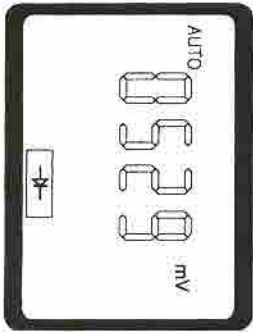
A conducting-state voltage of approximately 1.4 to 2.2 V DC is measured for LEDs. In the case of a low-current LED, the measurement current is sufficient to illuminate the LED.

The non-conducting direction of a diode path must be measured by connecting the red measuring lead to the cathode and the black measuring lead to the anode. If a voltage value is indicated, the diode is faulty.

**NOTE**  
Capacitance (  ): Farad measuring value is displayed on main Display area. (50)



**NOTE**  
Diode (  ) value is displayed on main Display area. (50)



**NOTE**  
Available Sub-Functions :  %  TIME  




 

To ENTER sub-functions : Press  Key.  
While measuring main-function

See detail of 6-2-sub-function page

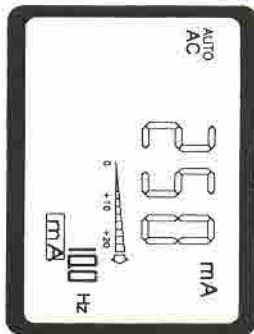
6.1-5 Measuring mA/A DC and AC (  )

To measure low direct current or alternating current up to 400 mA AC or mA DC, proceed as follows:

- Press main function key (right)  select mA range until  is displayed on LCD.  button to select DC or AC.
- Connect the measuring leads as shown, the non-sold measuring lead corresponds to the red measuring lead. Connect the measuring leads in series with the object to be measured.
- During the measurement the bar graph, a type of analogue indication with a high measurement rate, is active at the left-hand edge of the screen. The bar graph acts as a trend indication.
- Connect the test probes to the object which is to be measured.

**NOTE**  
mA/A AC measurement value is RMS (True RMS) value.

**NOTE**  
mA/A AC measuring value is displayed on main or DC Display area(*sd*) and Frequency (Hz) on Sub-display area(*sr*) simultaneously.



**NOTE**  
Available Sub-Functions :   $\Delta$  %  MIN/MAX  TIME  REC  RCUT

LMT  
 PH

To ENTER sub-functions : Press  Key.  
While measuring main-function See detail of 6-2. sub-function page

**Warning!**

As soon as "a-" appears in front of the measured value during a DC voltage measurement, the measured voltage is negative (or the measuring leads are connected the wrong way round).

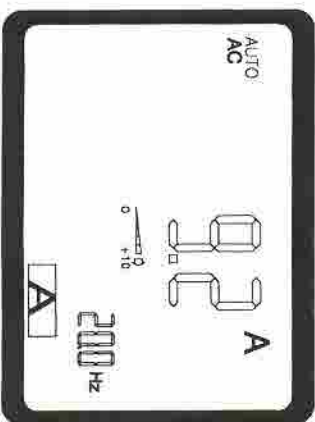
Never measure any current in circuits in which voltages in excess of 250 V DC or V AC rms can occur because this poses risk of fatal injury. Under no circumstances measure currents greater than 400 mA or, in the case of uA measurement, 400 uA. Only measure currents less than 400 mA in circuits that have 500 mA quick-acting fuse protection.

6.1-6 Measuring 20 A DC and AC (2A)

To measure low DC or AC up 20 A AC or A DC, proceed as follows:

- Press main function key (right)  until  A is displayed on LCD.  button to select DC or AC.
- Connect the measuring leads as shown, the non-solid measuring lead corresponds to the red measuring lead. Connect the measuring leads in series with the object to be measured.
- The bar graph, a type of analogue indication that has a high measurement rate, is active on the left-hand center the screen. The bar graph acts as a trend indication.
- Connect the test probes to the object which is to be measured.

**Notes**  
A AC measuring value is displayed on main or A DC Display area(*sd*) and Frequency (Hz) on Sub-display area(*sr*) simultaneously.



**Notes**

Available Sub-Functions :  $\Delta$  % MINMAX TIME REC FCLL

LMT  
PH

To ENTER sub-functions : Press **ENTER MENU** Key.  
While measuring main-function

See detail of 6-2. Sub-function page

**Warning!**

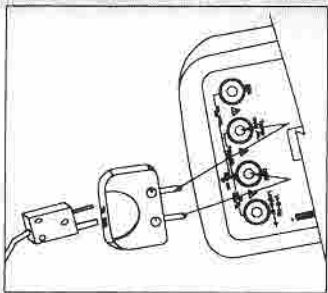
As soon as a "—" appears in front of the measured value during a DC voltage measurement, the measured voltage is negative (or the measuring leads are connected the wrong way round). Never measure any current in circuits in which voltages in excess of 250 V DC or V AC rms can occur because this poses risk of fatal injury. Under no circumstances measure currents greater than 20 A. Only measure currents in circuits that have 16 A fuse protection and where no power in excess of 4000 VA can occur.

Measurements of currents equal to 20 A may only be performed for up to 30 s and only at 15-minute intervals (to allow time for shunt resistor to cool down).

6.1-7 Measuring Temperature (°C, °F)

To measure temperature, proceed as follows:  
(Temperature measurements require the purchase of temperature probe see optional accessories in 9.2 in the manual)

a) Press main function key (right) **Temp** select Temp range until **TEMP** is displayed on LCD. °C is displayed on main display area (sr), °F is displayed on sub-display area (St1).



b) Insert the k-type the temp probe (connected with k-type thermocouple wires) into input hole at bottom of the meter. Insert terminal of temp probe to input hole (where temp is shown) and input terminal of temp probe to input hole (COM).

- c) The bar graph, a type of analogue indication that has a high measurement rate, is active on the center of the screen. The bar graph acts as a trend indication.
- d) Touch the temperature probe head to the desired measuring area. Keep the probe touching the part until the reading stabilize (about 30 seconds).

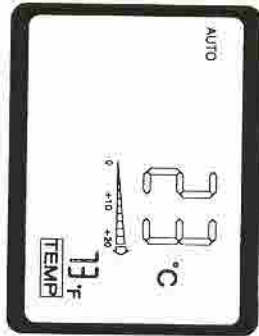
**NOTE**

LCD Display number when disconnecting Temp probes shows present room temperature.



**Notes**

Temperature measuring value is displayed as degree C (°C) on main. Display area (sr), degree F (°F) sub-display area (sr).



**Notes**

Available Sub-Functions :  $\Delta$  % MINMAX TIME REC FOLL

LMT  
PH

To ENTER sub-functions : Press ENTER MENU Key.

See detail of 6-2.sub-function page

**Warning!**

Do not measure temperatures of metal parts with a voltage power on them.

**6.1-8 Measuring Frequency(Hz)**

**Warning!**

Do not attempt to measure frequency of voltage above 250 V. measurement of voltage above 250 can result in damage to the meter and fatal injury or death of the user.

To measure Frequency, proceed as follows:

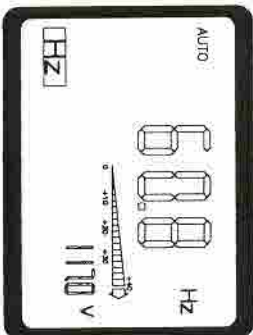
a) Press main function key (left)  $\text{Hz}$  select Temp range until  $\text{Hz}$  is displayed on LCD.

b) Connect the measuring leads as shown, the non-sold measuring lead corresponds to the red measuring lead. Connect the measuring leads in series with the object to be measured.

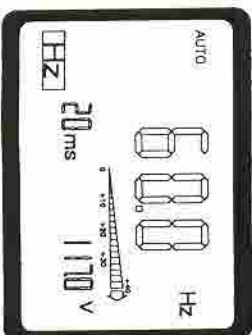
c) During the measurement the bar graph, a type of analogue indication with a high measurement rate, is active at the left-hand edge of the screen. The bar graph acts as a trend indication.

**Notes**

Frequency (Hz) measuring value is displayed on main Display area (sr) and related voltage on Sub-display area (sr) simultaneously.



Millisecond (ms) is displayed on subdisplay area (sr).  
- (0.02 msec ~ 99.9 msec)

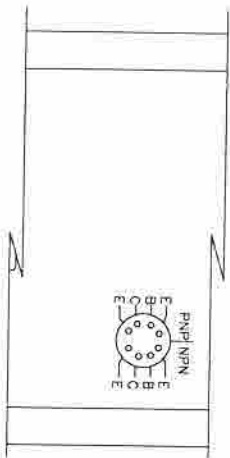




### 6.1-9. Measuring Transistor (hfe)

To measure transistor, proceed as follow.

- Press main function key (left) **hfe** until **hfe** is displayed on LCD.
- Insert the Transistor into the Transistor socket. To measure (TR<sub>hfe</sub>) on the meter. correctly install the PNP or NPN type transistor.



#### Notes

Available Sub-Functions : **Δ %** **MIN/MAX** **TIME** **REC** **RCALL**

**LMT**

**PH**

To ENTER sub-functions : Press **ENTER MENU** Key.

While measuring main-function

See detail of 6-2. sub-function page

### 6.1-10. Measuring Logic

To measure logic, proceed as follow:

- Press main function key(left) **Logic** until **Logic** is displayed on LCD.
- Connect the black test lead the "COM" input and red test lead to the "LOGIC" input.
- Connect the test probes to the object which is to be measured.

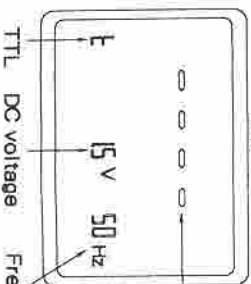
#### NOTE

•LOGIC TEST. (select by **FUNC** button key)

	S3 DISPLAY	LOW LEVEL	HIGH LEVEL	REMARK
TTL		0.8 V	2.0 V	Analog level 
CMOS (3V)		1.0 V	2.0 V	Digital level 
CMOS (5V)		1.7 V	3.3 V	Digital level 

#### NOTE

LCD



means within Low-High level

higher than high level

lower than lower level

6.1-11. Use as TTL signal generator. (Sig-out  $\overline{\text{TTL}}$ )

The meter contains a type of function generator which delivers a variable frequency from 1 Hz to 5 KHz at a fixed voltage (amplitude) of 5 V through middle input socket. (Manually adjustable Frequency from 1 Hz to 5 KHz)

- a) Press main function key (left)  $\overline{\text{TTL}}$
- b) Press the  $\leftarrow \rightarrow$  key to adjust the frequency level.
- c) Connect the measuring leads as shown, the non-soild measuring lead corresponds to the red measuring lead.

**NOTE**  
Sig out Frequency is displayed as Hz on main display area. (  $so$  )

**NOTE**  
Sig out Frequency is displayed as Hz on main display area. (  $so$  )



**NOTE**  
Available Sub-Functions :  $\overline{\text{TIME}}$

To ENTER sub-functions : Press  $\overline{\text{ENTER MENU}}$  Key.  
While measuring main-function

See detail of 6-2.sub-function

6.2 Subsidiary Function (Sub-function)

The various sub-function can be used to modify/set all the parameters.

Press  $\overline{\text{ENTER MENU}}$  key. all Sub-Function on top of LCD  $\overline{\Delta}$   $\overline{\%}$   $\overline{\text{MIN/MAX}}$   $\overline{\text{TIME}}$   
 $\overline{\text{LMT}}$   $\overline{\text{PH}}$   $\overline{\text{REC}}$   $\overline{\text{RCLL}}$  are displayed at once.

Anyone of these Sub-functions is blinking. Move left or right direction to desired function with  $\leftarrow \rightarrow$  cursor. The selected function will be blinking and press  $\overline{\text{ENTER MENU}}$  key to enter the function.

Other display will be disappeared. (if  $\overline{\text{ENTER MENU}}$  key is not pressed within 5 second after select the desired function, all sub-functions are disappeared and return to the original mode right before setting  $\overline{\text{ENTER MENU}}$  key- no subfunction mode)

6.2-1. Relative ( $\Delta\%$ ) measurements.

The relative measurement feature allows you to make measurements relative to a reference value you have set. For exact resistance measurements of low values you can set the test lead value as your reference and then the reading in the display will be the exact value of the part under test with the test lead resistance factored out. Likewise, a reference voltage, current, etc. can be set in and measurements made in comparison. The reference value must be entered by actual measurement of the reference value.

The Relative mode will work in the Volt(AC/DC), Capacitance, Ohm, mA(AC/DC), A(AC/DC), Temp measurement ranges.

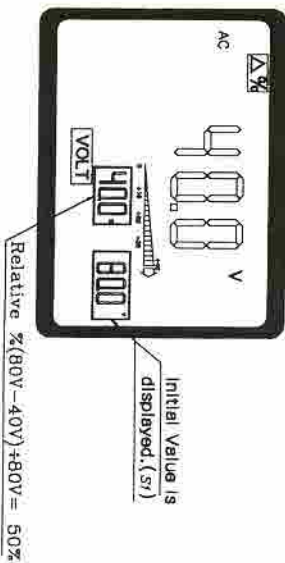
The Relative mode will not work in Auto Ranging. Actuation of the Relative mode automatically switches the meter to the manual mode. The meter must be preset to the manual range you wish to use before activating the Reference mode, the meter will switch out of the Reference mode.

- To enter the Relative function,

Press  → select by   until  $\Delta\%$  on top area of LCD

→ Press

- LCD display (ex AC V range)  $\Delta\%$  (Relative)



6.2-2 MIN/MAX/AVE measurement

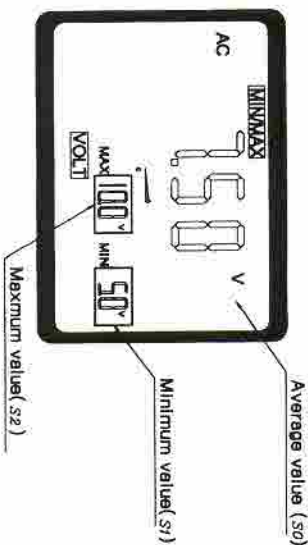
If you want to capture the highest(=MAX) and lowest(=MIN) measured value that occurs for a constantly changing measured value, use this function. The momentary measured value, maximum value, average value and minimum value are then displayed, as a glance and simultaneously, over the entire of the LCD screen.

- To enter the MIN/MAX/AVE function.

Press  → select    on top area of LCD

→ Press

- LCD display (ex AC V range)

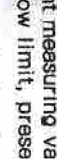




6.2-3 TIME stamping.

- Track the measuring time in hour\*minute\*second (set up to 24 hours)

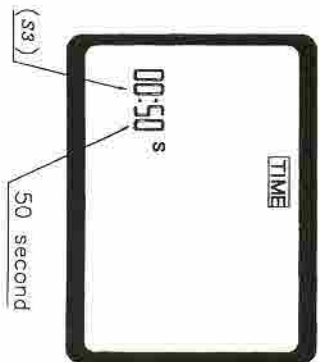
- To enter the TIME function, please proceed until **TIME** blinking press



(zero setting of previous time setting start from "0")

(STOP, START time watch function)

- LCD display

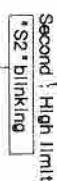
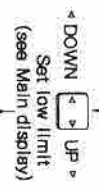
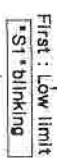


6.2-4 Limit (LMT) (compare) measurement.

- Displayed on LCD as "LMT". (limit)

- Operator can adjust high limit and low limit. Generally useful to select Resistance Capacitance. When Resistance Capacitance being tested is between High-Low Limits. LCD displayed "PASS". If lower than limit(S2) LCD shows "LO", if higher than "HI". All cases display present measuring value on display area. Operator can see High limit-low limit, present value as well as "PASS" word same time.

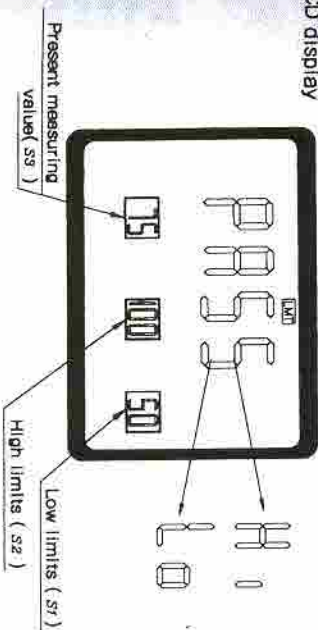
- To set High, Low limits, proceed as follow.



NOTE

One touch press change one unit. If press the key longer time, number changes X10 X100 units rapidly. High limit starts from low Limit setting value of First: Low limit.

- LCD display

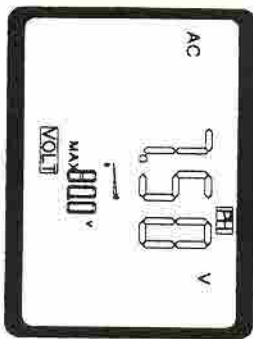
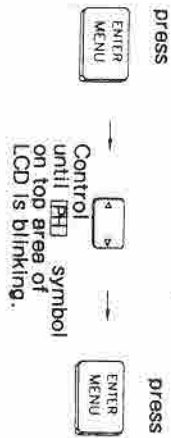




6.2-5. Peak Hold measurement

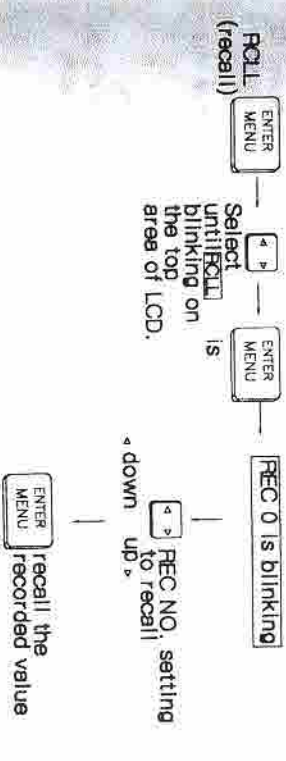
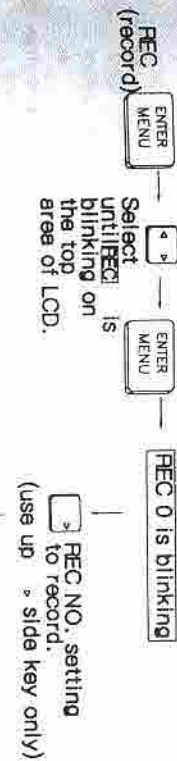
Capture the peak value. Peak value hold within 1 msec.

To enter the peak hold measurement, proceed as follow.



6.2-6. Record function ( REC ), Recall ( RCLL ) function up to 10 different measurement can be stored in the record function.

To enter the record and recall function:



**NOTE**

Previous record (REC No.) will be removed automatically when new record is set on same REC No. All records will be removed if main power switch is off, But if Auto power is off (power switch is not off) the records keep alive.

### 6.3:HOW TO USE /RS 232 PC INTERFACE

#### NOTE

Data transfer takes place unidirectionally, i.e. only in one direction: from the measuring instrument to the PC and not vice versa.

The following steps are required for communication between an (IBM compatible) PC and the measuring instrument:

1. Connect the optionally-available Interface cable on the one hand with the 5-pin asymmetrical socket on the measuring instrument and on the other hand to the PC.
2. Having established the connection, switch on the measuring instrument by means of the "POWER" switch.
3. Press the "HOLD" button (approx. 3 seconds) until the circle symbol with a "2" appears on the right beneath the main display.
4. Now switch the PC("computer") on.
5. Use of Windows software (optionally available):

#### NOTE

The following steps presupposes basic knowledge of MS Windows. In case of difficulty, study the Windows manual concerning the use of WINDOWS.

Windows 95 and VGA monitor are required for the operation of this software.

- a) Start the computer and activate Windows.
- b) Load the diskette info the appropriate 3.5" drive ('a' or 'b')
- c) With the mouse, click the "START" button and then click "Run" As a result of this, the Run dialog box with command line opens.
- d) Enter the following at the flashing cursor:  
When the diskette is in drive "a" : type a:\setup and press [Enter] or click "OK"  
When the diskette is in drive "b" : type b:\setup and press [Enter] or click "OK"
- e) Follow the on-screen directions to complete the installation.
- f) To start the program, with the left mouse button double-click the program "Multimeter" and then follow the on-screen instructions. Take note also of the "README" file on the diskette for remarks concerning operating.

6. Note the following if other software is to be used:

The data format is 14 bytes long. The sequence is as follows:

BYTE 1 2 3 4 5 6 7 8 9 A B C D E

Example 1 DC - 3.999 V OR

Example 2 DC - 399.9 m V OR

Program example in BASIC simply to read the multimeter:

```
10 OPEN "COM1:4800, N, 7, 2, RS, CS, DS, CD" AS #2
20 IN$=INPUT$(14, #2)
30 PRINT IN$
40 CLOSE #2
50 END
```

Data transfer parameters (communication parameters):

```
Transfer rate : 4800 baud (=bps=bits per second)
Character code : 7-bit ASCII
Parity : none
stop bits : 2
```

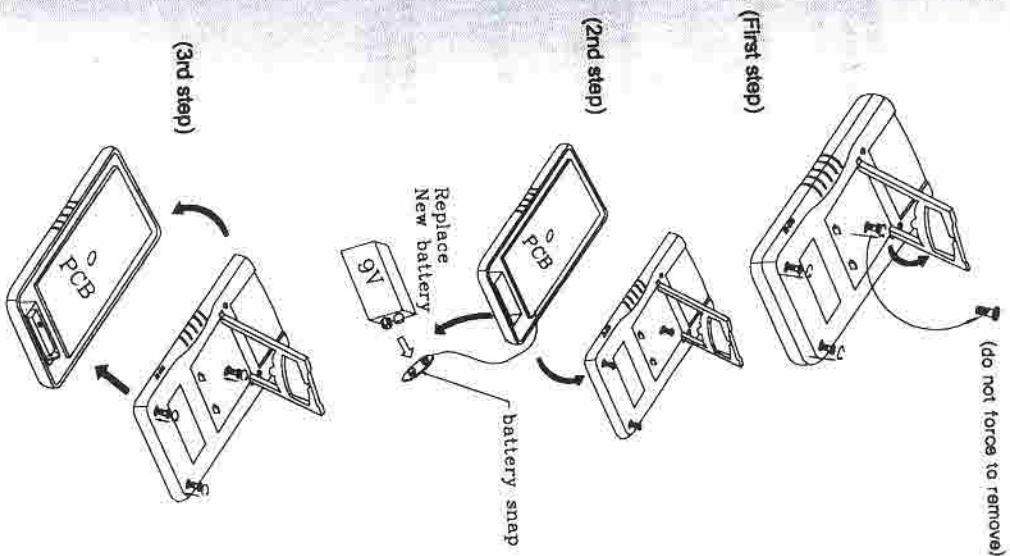
## 7.MAINTENANCE

**WARNING!** : To avoid electric shock, disconnect the test leads from any source of voltage before removing bottom case.

**WARNING!** : Do not operate your meter until the bottom case is in place and fastened securely.

### 7.1 Battery Replacement

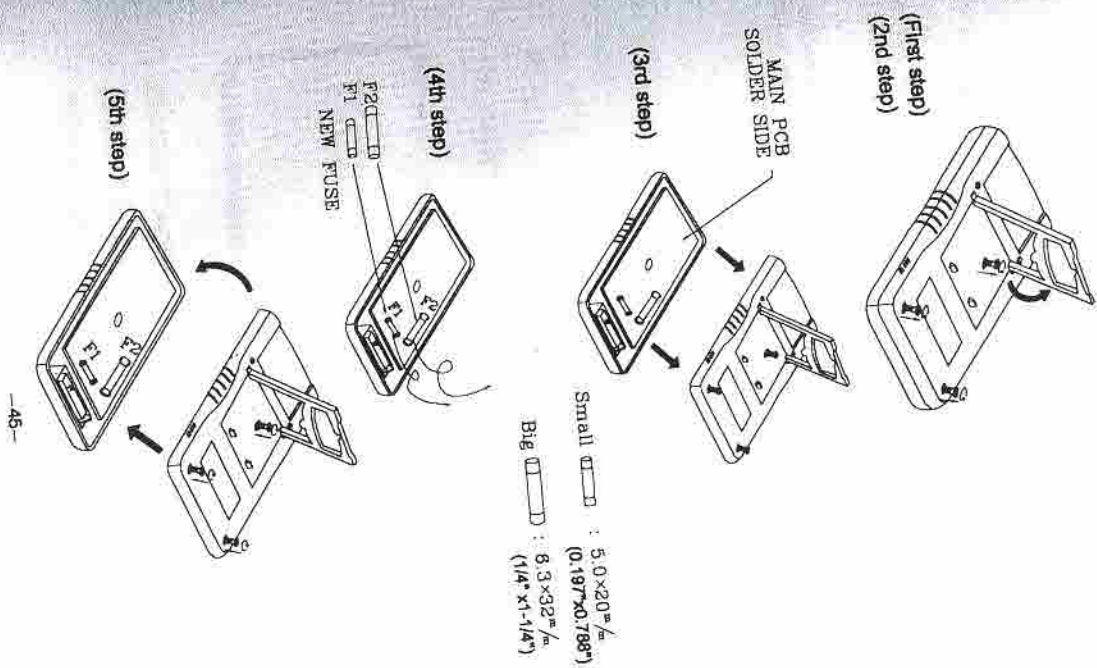
- **First step** : Find out three screw at bottom case.  
Unscrew the screw by Phillips Screw driver.  
The Screws are Captioned Screw and will be hanging on the Battery cover unless force to remove them.
- **2nd step** : Open the Bottom case. Remove used battery from battery snap.  
Replace with new battery. Place the new battery into the battery compartment.
- **3rd step** : Screw the three screws by Phillips screw driver.  
Make sure the screws securely fastened.





## 7.2 Fuse Replacement

- **First step** : Find out three screw at bottom case. Unscrew the screw by Phillips Screw driver. The Screws are Captioned Screw and will be hanging on the Bottom case unless force to remove them.
- **2nd step** : Separate Bottom Case from the Front Case. You will see the F1 Fuse at Solder side and F2 Fuse of component side of main PCB.  
Find out correct Fuses.  
SMALL SIZE Fuse : 5x20 m/m (0.197"x0.789")  
Fast acting glass Fuse, F500mA/250V  
BIG SIZE Fuse : 6.3x32 m/m (1/4"x1-1/4")  
Ceramic Fuse F 20A/ 250V
- **3rd step** : Replace with correct size Fuses. Replace with correct rating fuse.
- **4th step** : After replace with new fuses, screw the three screws by Phillips screw driver. Make sure screws securely fastened.





### 7.3 CLEANING AND DECONTAMINATIONS

The meter can be cleaned with a soft cloth to remove any water, oil grease or grime.

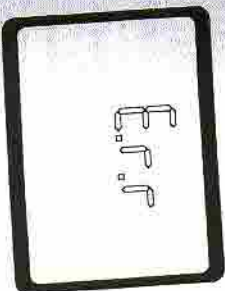
Never use liquid solvents or detergents. If the meter gets wet for any reason, dry the instrument using low pressure clean air at less than 25 PSI.

Use care and caution around the INPUT, RS 232 Socket, Capacitance Socket, Rubber Key switch around areas, LCD display cover around area where water or oil could enter into the meter while drying.

## 8. SPECIFICATIONS

### 8.1 General specifications.

- Display : 3 1/2 Digit (4000 count) with BAR-GRAPH+3 sub display. (Quad)\*1
- RANGE : AUTO
- INPUT IMPEDANCE : Greater than 10M $\Omega$ hm
- CONVERSION TIME
  - Numeric : 3-5 / sec.
  - BAR-GRAPH : 7 / sec.
- BACK LIGHT.
  - Time : 60 sec.
  - LED drive. (DC 5V Out— Current Consumption approx. 30mA)
- AUTO POWER OFF TIME : 30 min.  
(Reset if press any function key or button on front face of meter.)
- 20A WRONG POSITION DETECTOR.



\*E r r r\* display with Continuous "BEEP" sound

- AUDIBLE TONE SWEEP : Select by "J" key.
- LOW BAT INDICATION :  7.5V  $\pm$  0.3V.
- HIGH VOLTAGE WARNING : BEEP, BEEP, BEEP (intermittent sound)  
When OVER AC 700 V, DC 1000 V

- RS 232 COMPUTER INTERFACE
- Baud Rate : 4800
- Data bit : 7
- Stop bit : 2
- Parity : none

- Safety
- Voltage or current input : 1000 V
- Surge Protection : 5 KV
- Maximum Voltage Isolation From Ground : 500 V
- IEC 1010-1, Class II Double Insulation
- Pollution Degree 2

- POWER : 9V Alkaline battery, NEDA 1604 6F22  
or 006P or 6LR61. (battery is not included)

- FUSE : F 5.0x20(0.197" X0.789")Fast acting Glass Fuse 500mA/250V  
F 6.3x32(1/4" X1-1/4")Ceramic Fuse 20A/250V

- GROSS WEIGHT : 315g (0.7LB) - Meter only
- DIMENSIONS : 880(W) X178(L) X330(D) mm  
3.5" (W) X 7" (L) X 1.3" (D) Inch

•COMPARISON TABLE

General

Display	4,000 (3 1/2 Digit) with Bar-graph.
Sub Display	4
Range	AUTO
Auto power off	Yes
PC Interface	Yes
Wrong position detector	Yes
Back light	Yes

Function

DCV(basic accuracy)	Yes(0.3%)
ACV	Yes
DC Current	Yes+40mA range
AC Current	Yes
Resistance	Yes+400KΩ range
Capacitance	Yes+400uF range
Frequency	Yes
Diode	Yes
Continuity	Yes

TACH/HI/LO RPM	Yes
Duty Cycle/Dwell	Yes

Special Features	
Relative	Yes
Storage	Yes
Min/Max/Average	Yes
Peak Hold	Yes
Data Hold	Yes
Compare	Yes
Stop watch, Timer	Yes
Audible Tone Sweep	Yes

### 8.2 Electrical Specifications.

#### 1. DC VOLTAGE (AUTO RANGE)

Range	Resolution	Accuracy	Input Impedance	Overload Protection
400 mV	0.1 mV	±(0.5% rdg+5 digits)	100 MΩ	1,000 V DC or AC Peak within 10 Seconds.
4 V	1 mV	±(0.3% rdg+5 digits)	10 MΩ	
40 V	10 mV			
400 V	100 mV			
1,000 V	1 V			

#### 2. AC VOLTAGE (TRUE RMS)

Range	Resolution	Accuracy		
		20 Hz ~ 50 Hz	50 Hz ~ 1 KHz	1 KHz ~ 10 KHz
400 mV	0.1 mV	2.0% + 10 digits	1.0% + 10 digits	2.5% + 10 digits
4 V	1 mV	2.0% + 10 digits	1.0% + 10 digits	2.5% + 10 digits
40 V	10 mV	2.0% + 10 digits	1.0% + 10 digits	2.5% + 10 digits
400 V	100 mV	2.0% + 10 digits	1.0% + 10 digits	2.5% + 10 digits
700 V	1 V	2.0% + 10 digits	2.0% + 10 digits	na

#### 3. AC CURRENT (TRUE RMS)

Range	Resolution	Accuracy				Overload Protection
		20 Hz ~ 50 Hz	50 Hz ~ 1KHz	1 KHz ~ 10 KHz	10 KHz	
40 mA	10 uA	2.0% + 10 digits	1.2% + 10 digits	4% + 10 digits		250 V /400 mA Fused
400 mA	100 uA	2.0% + 10 digits	1.2% + 10 digits	4% + 10 digits		
20 A	10 mA	2.5% + 10 digits	1.5% + 10 digits	4% + 10 digits		250 V /20 A Fused



4. DC CURRENT.

Range	Resolution	Accuracy	Overload Protection
40 mA	10 uA	±(1.2% rdg + 5 digits)	250 V / 500 mA Fused
400 mA	100 uA	±(1.5% rdg + 5 digits)	250 V / 20 A Fused
20 A	10 mA	±(1.5% rdg + 5 digits)	250 V / 20 A Fused

5. RESISTANCE (AUTO RANGE)

Range	Resolution	Accuracy	Overload Protection
400 Ω	0.1 Ω	±(0.75% rdg + 5 digits)	250 V DC or AC Peak Within 10 Seconds.
4 K Ω	1 Ω		
40 K Ω	10 Ω		
400 K Ω	100 Ω	±(3% rdg + 5 digits)	
4 M Ω	1 K Ω		
40 M Ω	10 K Ω	±(5% rdg + 20 digits)	
400 M Ω	100 K Ω		

6. CONTINUITY TEST

- BELOW 20 Ω

7. DIODE TEST:

Range	Resolution	Accuracy	Overload Protection
Diode	1 mV	±(2% rdg + 5 digits)	MAX 5.0 V

8. CAPACITANCE (AUTO RANGE)

Range	Resolution	Accuracy
4 nF	1 pF	±(3% rdg + 10 digits)
40 nF	10 pF	
400 nF	100 pF	
4 uF	1 nF	±(5% rdg + 20 digits)
40 uF	10 nF	
400 uF	100 nF	

9. TEMPERATURE:

- -20 °C ~ 1370 °C (0 °F ~ 2000 °F) : K-TYPE
- With thermocouple Wire + Temp probe set
- ±(3 °C±5d) to 150 °C, ±3%rdg over 150 °C
- ±(3 °F±5d) to 302 °F, ±3%rdg over 302 °F

10. FREQUENCY (AUTO RANGE)

Range	Resolution	Accuracy
4 KHz	1 Hz	±(0.1% rdg + 10 digits)
40 KHz	10 Hz	
400 KHz	100 Hz	
4 MHz	1 KHz	

- Voltage Sensitivity : 50mV eff ( 1 Hz to 4 MHz)
- Sub-Display(Voltage) Available Range : Min:50 mV- Max:40.00 V

12. SIGNAL GENERATOR.

- TTL Level.

- Manually Adjustable Frequency (Amplitude a fixed 5V)

1 / 10 / 100 / 993 / 1986  
2979 / 3972 / 5041 Hz

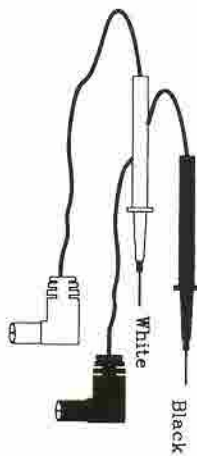
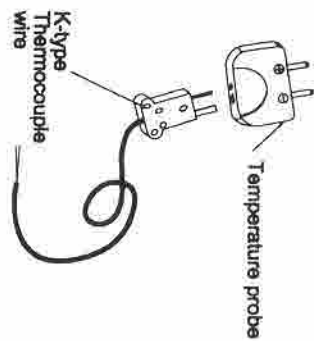
Range	Resolution	Accuracy
100 Hz	1 Hz	±(0.5% rdg + 5 digits)
1 KHz	10 Hz	
5 KHz	1 KHz	

13. STOP WATCH / TIMER.

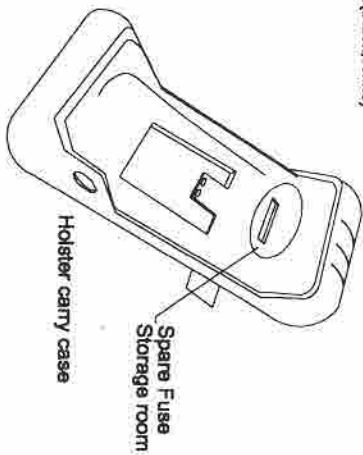
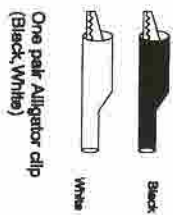
• 24 HOUR.

9. Accessories

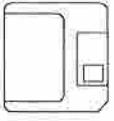
9.1 Standard Item



One pair of test lead(Black, White)



9.2 Optional Item



Software PC Diskette



RS 232 Interface  
cable