All-in-One Handheld Instrument

Operator Manual

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WARNING*: USE EXTREME CAUTION IN THE USE OF THIS DEVICE. Improper use of this device can result in injury or death.*
Follow all safeguards suggested in this manual. In additiion to the normal safety precautions used in working with electrical circuits.
DO NOT service this device, if you are not qualified to do so.

SAFETY INSTRUCTIONS

This meter has been designed to be safe in use, but the operator must use caution in its operation. The rules listed below should be carefully followed for safe operation.

- **NEVER use AC Adapter while Alkaline Battery is installed inside meter.**
- **NEVER apply voltage or current to the meter that exceeds the specified maximum for the function selected.**

Input Limits	
Function	**maximum Input, Time**
V DC	1000V DC within 10 seconds
V AC	700V AC within 10 seconds
OHMS	250V DC/AC within 10 seconds
DC/AC	400mA DC/AC
20A DC/AC	20A DC/AC within 30 second per measurement. each measurement interval time minimum 15 minutes

- **USE EXTREME CAUTION when working with high voltages.**
- **DO NOT measure voltage if the voltage on the "COM" input jack exceeds 500V above earth ground.**
- **NEVER connect the meter leads across a voltage source while the function switch is in the current, resistance or diode mode. Doing so can damage the meter.**
- **ALWAYS discharge capacitors in power supplies and disconnect the power when marking resistance or diode tests.**
- **ALWAYS turn off the power and disconnect the test leads before opening the back to replace the fuse or batteries.**
- **NEVER operate the meter unless the back cover is in place and fastened securely.**

SAFETY SYMBOLS

The symbol adjacent to another symbol, terminal or

operating device indicates that the operator must **refer to an explanation in the operating instructions to avoid personal injury or damage to the meter.**

WARNING

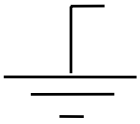
This WARNING symbol indicates a potentially

hazardous situation, which if not avoided, could result **in death or serious injury.**

CAUTION

This CAUTION symbol indicates a potentially hazardous **situation, which if not avoided, may result in minor or moderate injury, or damage to the product or other property.**

MAX
500V



This symbol advices the user that the terminal so marked **must not be connected to a circuit point at which the**

voltage, with respect to earth ground, exceeds 500VAC

or VDC.

This symbol adjacent to one or more terminals identifies

them as being associated with ranges that may, in normal **use, be subjected to particularly hazardous voltages. for maximum safety, the meter and its test leads should not be handled when these terminals are energized.**

DISPLAY SYMBOLS

A	**Ampere**
AC	**alternating current**
AUTO	**autoranging**
AVG	**average**
CALL	**recall stored data**
CLEAR	**remove stored data**
dB	**decibel**
DC	**direct current**
F	**farads(capacitance)**
LIMIT	**compare**
GLITCH	**glitch waveform**
Hz	**hertz(frequency)**
MANU	**manual**
RESET	**reset**
MAX	**maximum**
MIN	**minimum**
ms	**milliseconds**
	degrees centigrade
	degrees fahrenheit
PAUSE	**pause in min/max peakhold, single glitch mode**
P-H	**peak hold**
RANGE	**manual range**
REL	**relative**

RUN	**restart in peak hold, min/max mode**
SAVE	**saves present signal in memory**
SINGLE	**single waveform**
SLEEP	**auto shut-off**
TEST	**self test**
TIME	**manually change time base**
TRIG	**frequency trigger**
V	**volts**
Ω	**ohms(resistance)**
%Rh	**relative humidity**
	buzzer, continuity
	diode
	cursor (left or right)
	cursor(up or down)
	low battery
	over range on V & A
	AC adaptor is connected
Δt	**signal pulse width**
Δ1/t	**frequency**
ΔV	**signal amplitude**
	time to auto power off
	trigger slop

RPM 1	**2 stroke - DIS Engine**
RPM 2	**4 stroke Engine**
Ms	**millisecond**

%	**% DUTY CYCLE**
	Dwell Degree

SOFT KEYS AND SUB-MENUS

Soft keys are located directly below the LCD display and perform multiple operation as indicated on the LCD and determined by the function selected by the rotary switch.
Some functions will produce a sub-menu on the display for further selection
Operation of the menus and sub-menus is described in the appropriate operation paragraph.

: Keys to select various Software Program.

: Toggle between the multimeter test mode and the oscilloscope graphics mode.

: Save and recall measurement data or graphical display.

: press the key for 4 seconds until the print symbol appears. Print data or graphical display.

: Display the basic meter warning, Input Jack locations and test procedures

: Toggle between AUTORANGE and MANUAL RANGE.

: Toggle between AC and DC measurements in , and A functions.

: press the help key for 3seconds until the RS232 symbol appears. RS232 interface is on.

: logic analyzer function.

: operation of the scope function.
ΔV, Δt%, Δt, Δ1/t value display.

: power reset key to re-activate power if the auto-shutoff is in effect after max 30minutes of inactivity.

: "freezes" the reading on the display. press again to resume normal operation. The HOLD symbol will be blinking on the display when hold is selected.

NOTE ***: SOFTKEY REACTION TIME***
for proper reaction of Soft keys, please note Soft Key Reaction Time.
Soft keys react ONLY AFTER 250 msec(millisecond)for all except Oscilloscope Mode (500msec).

AUTO RANGE/MANUAL RANGE SELECTION

The meter will turn on in the auto ranging mode. For most application this is the easiest and most accurate method of measurement.
For measurements that require the range to be held:

- Press the key. The display will change from "AUTO" to "RANGE" with the full scale value displayed.
- Each time the key pressed, the next available range will be set.
- To return the range, hold the key for 4 seconds.

DATA HOLD

The meter will freeze the reading in the display when the key pressed. HOLD will be blinking at top area of display when HOLD is activated.
Press again to resume normal operation.

AUTO POWER OFF

The meter will automatically shut off after 30 minutes if a push button is not pressed or the rotary switch is not moved.
The meter will start "beeping" just before shut off.
The symbol (moon) at left-top corner area on the display indicates the time left to shut off (Full Moon in Black means 30 minutes lef. half moon in black means 15 minutes left. The black area will decrease as shutoff is approached.)

HELP Key

Display basic meter Warning, Input Jack locations, Test Procudures.
press Key to enter the feature and select page with (Down Page) and (up page)

SAVE

1. Press the key to enter this feature.
2. The display will list 15 memory locations and indicates what type of data
is stored in each location. Locations with no data will be left blank.
3. Press keys to scroll the arrow cursor ( ) up/down through the 15 memory locations.
4. At the selected memory location, press to to save the last text or graphical display.
5. Press to RECALL the saved data.
6. At the selected memory location, press to clear the saved data.
7. Press key to exit the feature.

PRINT

1. Connect the thermal print cable to the top of the meter..
2. power on thermal print.
3. Press the key for 4 seconds.

NOTE*: Printing is available only through the recommended Thermal Printer*

RS232 Communications

INSTALLATION

1. Start Window 95,98 and ME.
2. Insert the Software Program diskette into drive A :
3. Select "START" and then "RUN" from the Windows menu bar.
4. Type " A: SETUP in the OPEN box and select "OK"
5. Follow the installation instructions on the screen.

OPERATION

1. Connect the RS232 cable bwteen the meter's and the PC's serial ports.
2. Select " Allinone" icon in the START/PROGRAM menu.
3. In the "Allinone" opening screen select "Setup / Comm port".
4. Select the proper COM port and click " OK"
5. Select "RUN/START"
6. Turn RS232 Comm system on Meter : press RS232 key for longer than 4 seconds until RS232 letter will be blinking on the LCD display of the Meter.
Turn the Rotary Switch of meter to the measurement function desired.
The PC display will indicate the measured value on the large display and also in a list format with the associated time of measurement.

7. Select "Setup / Sampling Time" to set the sampling (data record) time for each measurement. (250ms,500ms,1s,2s,5s,10s)

8. Select "Setup / dB " to select the dB reference level.
9. In the "STOP" mode, select " View /Bar, Line or Text" to plot the data in graphical format.
10. Select "File/Save" to save the recorded data.

11. Select "File/Open" to open the existing file.
12. Select "File/Print" to print the file.
13. To EXIT from RS232 function, press RS232 key for 4 seconds until RS232 does not display on LCD display on the Meter.

NOTE : ***When the meter is in the Oscilloscope mode, press HOLD key to capture a waveform display to the PC screen.***

NOTE : ***Baudrate of Software can be selected "Setup". The same selected baud rate should be set in the Meter before enter RS 232 Communications. To set the Baudrate of the Meter, turn the Rotary Switch of Meter to "SET UP" and select "Baudrate" by F1 key and select the same baud rate by F2 key. (Baud rate selection : 1200,2400,4800 or 9600 bps)***

Back- Light LCD Display

1. Press the key for 4 seconds to the EL lighting.
2. Press the key for 4 seconds to exit this function.

SET UP

The setup function provides a means to set 10 measurement conditions.

printer : EPSON M-T102,
Baud rate : 1200bps, 2400bps, 4800 bps, 9600bps.
Parity bit : NONE
dBm reference : 2Ω,4Ω,8Ω,16Ω,50Ω,75Ω,93Ω,110Ω,125Ω, 135Ω,150Ω,300Ω,600Ω,900Ω,1000Ω,1200Ω.
Beeper : enable, disable.
Sleep mode (Auto Power Off) : enable, disable
Back-light (Lighting Time) : OFF, 15s, 30s, 60s, no limit.
Self-Test in MORE (F4) : Memory/System/etc test Automatic Testing and result should show "GOOD".

Auxiliary in MORE (F4) : **/ , %RH, High Current**
User's Manual in MORE (F4) : **Very detailed Information including Safety, Test Procedures, Grossary are displayed.**

Use keys for enjoying of the benefits.

SET UP procedures

1. Turn the rotary switch to the SET UP position.
2. Press : select one of the seven features.
3. Press : enable or disable the feature or to set level.
4. Press : set the user preferred selection.
5. Press : MORE function (self test, auxiliary , User' Manual)

AUX

Auxiliary Measurement Procedure

The auxiliary selection allows direct display of / , %RH, High Currents in the correct units when the meter is used with an external DC Adapter. The external DC Adapter should output 40 or 400 .

1. Insert the black adapter banana plug into the negative(COM)jack and red adapter banana plug in to the positive AUX jack.
2. Turn the rotary switch to the setup position.
3. Press (more) : to select auxiliary function.
4. Press to : to select the units that match the adaptor being used.
5. Press : EXIT to return to the upper menu.

NOTE *: AC Current Adapter is not possible to measure at this range. AC High Current Adapter can be used at other meter range ; AC mV or AC V ranges.*

MULTIMETER

AC and DC VOLTAGE (mV, V) measurements

WARNING*: Risk of electrocution. The probe tips may not be long enough to contact the live parts inside some 240V outlets for appliances because the contacts are recessed deep in the outlets. as a result, the reading may show 0 volts when the outlet actually has voltage on it. Make sure the probe tips are contacting the metal contacts inside the outlet before assuming that no voltage is present.*

CAUTION*: Do not measure AC or DC voltages if a motor on the circuit is being switched ON or OFF. large voltage surges may occur during the ON or OFF operations that can damage the meter.*

1, Insert the black test lead into the negative jack (COM) and the red test lead into the positive V jack.
2, Set the function switch to V ac/dc range. (*Initial setting of the meter is always* " ac" . *Press button to change to* " dc".)
3, Touch the test probe tips to the circuit under test.
4, Read the voltage in the display. The display will indicate the proper decimal point, value and symbols.

RESISTANCE measurements

WARNING: *To avoid electric shock while taking any resistance measurements, disconnect power to the unit under test and discharge all capacitors. remove the batteries and unplug the line cords.*

1, Insert the black test lead into the negative jack (COM) and the red test lead into the positive Ω jack.
2, Set the function switch to the Ω position.
3, Touch the test probe tips across the circuit or part under test. It is bets to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
4, Read the resistance in the display. The display will indicate the proper decimal point, value and symbols.

CONTINUITY check

WARNING*: To avoid electric shock, never measure continuity on circuits or wires that have voltage on them*

1, Insert the black test lead banana plug into the negative jack and the red test lead banana plug into the positive Ω jack.
2, Set the function switch to the Ω position.
3, Select Continuity function by key.
4, Touch the test probe tips to the circuit or wire you wish to check. If the resistance is less than 60Ω, the audible signal will sound.

DIODE test

WARNING: ***To avoid electric shock, do not test any diode that has voltage on it***

1, Insert the black test lead into the negative jack (COM) and the red test lead into the positive diode symbol jack.
2, Set the function switch to the position.
3, Press the key to enter the diode function.
The diode symbol will change to white on black.

4, Touch the test probe tips to the diode or semiconductor junction you wish to test. note the meter reading.
5, Reverse the probes polarity by switching probe position. Note this reading.
6, The diode or junction can be evaluated as follows:
-If one reading shows a voltage value (approximately 0.25V for germanium and 0.7V for silicon) and the other reading shows "OVER" the diode is good.
- If both reading show "OVER", the device is open.
- If both reading are very small or 0, the device is shorted.

NOTE*: The value indicated in the display during the diode check is the forward voltage.*

CURRENT(, 20A) measurements

WARNING*: To avoid electric shock do not measure AC current on any circuit with voltage exceeds 250V AC.*
CAUTION*: Do not make current measurements on the 20A scale for longer than 30 seconds, Exceeding 30 seconds may cause damage to the meter and/or the test leads and/or injure yourself.* *Keep measurement interval time every 15 minute.*

1. Insert the black lead into the negative(COM) jack and the red test lead into the positive or 20A jack.
2. Turn the rotary switch to the position.
3. The meter will turn on in the DC function.
4. Press AC/DC switch to toggle between AC and DC measurements.
5. Press to toggle between and 20A functions.
6. Connect the test probe tips in series with the circuit under test. The display will indicate the proper decimal point, value and symbol.
7. Press F1 : relative function.
Press F2 : peak hold function (history graph display : LINE or BAR).
Press F4 : min/max/avg function (history graph display : LINE or BAR).

CAPACITANCE measurements

WARNING*: To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any capacitance measurements. Remove the batteries and unplug the line cords.*

1,Insert the black test lead into the negative jack (COM)and the red test lead into the positive CAP jack.
2, Turn the rotary switch to the CAP position.
3, The meter will turn on in the capacitance autoranging mode.
4, Touch the test lead to the capacitor to be tested. The display will indicate proper decimal point, value and symbol.

RELATIVE measurements

While in the relative mode, the difference between a reference value and the actual measurement value is displayed.
The relative mode will not work in auto ranging.
Actuation of the relative mode automatically switches the meter to the manual.

1. Press soft key when the measured reference value is on the display.
2. The REL will appear will be blinking on LCD display when the relative mode is in active.
3. Press to exit relative mode.

AVG/MIN/MAX measurements

1. Press key to enter this function.
2. The display will indicate the maximum value, the average value, and the minimum value since the mode was initiated and the relative time for each value is displayed next to the value.
3. The time format is MAX : 00.00Vac 00:00:00.
4. Press to reset the time and begin recording a new series.
5. Press to run or pause the recording.
6. Press to change the history graph type(line or bar).
7. Press "exit" to return.

PEAK HOLD measurements

Capture the peak value. Peak value will be held within 1S.

1. Press key to enter the this function.
2. The LCD will display the peak value of the measured parameter, the peak max and peak min values. The meter will beep whenever a new MIN or MAX is captured.
3. Press RESTART to reset the values for a new run.
4. Press RUN/PAUSE to continue measuring or to hold the MIN/MAX values.
5. Press to change the history graph type(line or bar)
6. Press EXIT to return to the initial menu.

LIMIT (Compare)FUNCTION

The LIMIT function can be activated volt, resistance, auxiliary function.
This function allows testing or selection of components between a settable minimum and maximum limit.

1. Press the LIMIT function key to display the LIMIT.
2. Press , arrow keys to select the digit.
3. Press cursor up/down arrow key to adjust the value of the digit.
4. Press key to store the value and move to the next digit.
5. Repeat steps 2,3,4 for all minimum and maximum limits.
6. If the measured value fall between the maximum and minimum limits, the display will indicate PASS and a continuous beep will occur.
7. If the measured value exceeds the maximum limit, " HIGH " will be displayed and " LOW" will be displayed if the value is less than the minimum limit.

OSCILLOSCOPE

CAUTION ***: Do not measure AC or DC voltages if a motor on the circuit is being switched ON or OFF. Large voltage surges may occur during the ON or OFF operations that can damage the meter.***

1. Insert the test lead or scope probe and BNC socket.
2. Set the function switch to V function.
(Initial settiing of Volts is always "ac" . Toggele "ac" or "dc" with AC/DC button)

3. The scope mode is entered when the key is pressed.

4. : Time(horizontal)divisions.
Time divisions are selected automatically when in the autoranging mode.

The time division will vary to display the best wave pattern in the auto-ranging mode or can be set manually using the and arrow keys.

: VOLT(vertical)divisions.
Voltage divisions are selected automatically when in the autoranging mode.
The voltage division will vary to display the best amplitude in the autoranging mode or can be set manually using

: TRIGGER level.

: Slop selects rising( ) or falling( )signal.

: Trigger level adjust.

: Exit the trigger level menu.

: MORE function

: SINGLE shot.

The "single"key will trigger a single measurement when the key is pressed. and open a sub-menu which allows time expansion or compression for enhanced waveform viewing.

sub (reset) : TRIGGER a new measurement.

sub : arrow keys to change the time division.

sub : EXIT to return to the graphical display.

: GLITCH capture.

The "glitch capture" key sets the meter to trigger a measurement on any single which causes an overrange indication or is greater than one vertical division or is greater than 10% of one horizontal division.

sub (reset) : trigger a new measurements.

sub : arrow keys to change the time division.

sub : return to the graphical display.

: POSITION

Set vertical position of the signal display.

sub : arrow keys to change the vertical position.

CURSOR FUNCTION

The cursor function measures time difference or voltage difference between two points on a waveform or the frequency of a regularly repeating signal.

(ΔV) : voltage difference.
Measure the voltage difference between two points.
For examples, the volt difference cursor function can be used to measure the peak to peak voltage.

(Δt) : time difference.
Measure the time difference between two points.
For examples, the time difference cursor function can be used to measure the pulse width.

(Δ1/t) : frequency.
Measure the frequency between any two points.
For examples, the frequency cursor function can be used while observing a waveform.

SIG.OUT

Squarewave Signal Out function. 2.5Khz-78Khz output (manuallu Adjustable)

1. **Insert proper Test Lead, Cable to Negative jack(COM) and positive SIG.OUT input jack.**
2. **Set the function switch to SIG.OUT position.**
3. **Press F2 or F3 keys to approach desired Frequency in high speed (Scrolling)**
4. **Press F1 key to enter FINE adjustment.**

WARNING : ***Never attempt a Voltage measurement if a test lead is in SIG.OUT position. You might be injured or the meter might be damaged***
NOTE : ***For faster change of Frequency (Scroll of Frequency) hold key firmly for minimum 3 seconds and as needed to scroll Frequency in high speed.***

FREQUENY COUNTER

1. Insert the Test Lead / Cable to the negative (COM) jack and positive COUNTER jack
2. Turn the rotary switch to the Frequency Counter.
3. Press to enter the Frequency Counter
4. Press to see DUTY

AUTOMOTIVE RPM

1. Turn the Rotary Switch to RPM / Freq. Counter
2. Insert Inductive Pick Up to the Meter and Hook the Pick Up to the secondary Ingnition Wire of Engine
3. Press F3 or F4 key depend on Engine Type
   F3 : RPM 1 - Distributorless Electronic Type Engine (2 stroke /DIS)
   F4 : RPM 2 - Conventional 4 stroke Distributor type Engine
4. read the RPM reading.

NOTE : ***To receive accurate measurement reading from Engine noise or outside interference, keep Meter away from Spark Plug or Coil Wires. Place selection switch at rear side of Inductive Pick Up to bigger Flash symbol. If there is difficulty to receive***

stable reading, repeat testing, change the switch to smaller FLASH symbol side. Or try to measure the reserve the direction of Inductive Pick Up

AUTOMOTIVE % DUTY, DUTY CYCLE, DWELL Degree

1. Turn the Rotary Switch to RPM,Freq. Counter position

2. Press F2 key to measure % DUTY, DUTY CYCLE or DWELL degree
4. Insert Test Lead to Meter and Connect Test Lead to Signal Wire Circuit - % DUTY CYCLE and DWELL are displayed
3. Select Cylinder Numbers of the Car to be measured by key.
4. Insert Test Lead or Meter and Connect. Test Lead to Signal Wire Circuit. % DUTY CYCLE and Dwell Degree are displaying on the LCD Display dimaltaneousely ; DUAL Display

AUTOMOTIVE SCOPE

mS / Pulsewidth measurement
See manual - Oscilloscope mV/V range

LOGIC ANALYZER

WARNING ***: To avoid electric shock, never measure exceeds 40V dc.***

1, Insert the black test lead into negative (COM)jack and the red test lead into the SCOPE input jack.
2. Set the function switch to V and change to "dc" with key.
3. Press key.
4. Read the voltage and frequency, timing chart.
: restart the logic chart.
: Slope selects rising or falling signal.
: Time division.
Time divisions will vary to display the best wave pattern in the autoranging mode or can be set manually using the arrow keys.
: range.
Logic series select (TTL, 3V CMOS, 5V CMOS).

5. function exit : Press key to exit logic function.

MAINTENANCE

WARNING : ***To avoid electric shock, disconnect the test leads from any source of voltage before removing the Battery Covers. To avoid electric shock, do not operate your meter until the Battery Covers are in place and fastened securely.***

1. KEEP THE METER DRY. If gets wet, wipe it off.
2. USE AND STORE THE METER IN NORMAL TEMPERATURES Temperature extremes can shorten the life of the electronic parts and distort or melt plastic parts.
3. HANDLE THE METER GENTLE AND CAREFULLY. Dropping it can damage the electronic parts or the case.
4. KEEP THE METER CLEAN. Wipe the case occasionally with a damp cloth. DO NOT use chemicals, cleaning solvents or

detergents.

5. DO NOT USE OLD / WEAK BATTERY.
Remove old or weak Alkaline batteries so they do not leak and damage the unit.

6. IF THE METER IS TO BE KEPT FOR A LONG PERIOD OF TIME , the batteries should be removed to prevent damage to the unit.

TILT STAND

The Tilt Stand can be placed either in the locked stand position for flat surface use or in the hinged position for hanging use.

1.For use on a flat surface, lift the Stand to approximately a 55 degree angle and push in until the Stand locks in the holding hole.

2. To hang the meter, squeeze the legs of the Stand and remove it from the meter. Turn the stand 180 degrees and replace in the holder. The Stand will now swing free over the top of the meter.

BATTERY REPLACEMENT

1, Disconnect the test leads from any circuit being measured.
2, Lift Tilt Stand and remove the two screws at each ends of two Battery Cover using Philips Screw driver.
(Screws are to be kept securely. Do not loose any of them)
3, Lift the two battery covers up to remove them.
4. Remove the Tilt Stand.
5, Replace the batteries , making sure the new batteries are located with the correct polarity and the Metal Contacts and Springs in the Battery Compartments are in proper contacts with the batteries.

6, Snap the two battery covers back into the original place and put the Tilt Stand in the place.
7. Put the two screws in the place using Screw Driver.

WARNING*: To avoid electric shock, do not operate your meter until the battery covers are in place and fastened securely.*

NOTE*: If your meter does not work properly,check the fuses and battery to make sure that they are still good and that they are properly inserted.*

CAUTION : ***Do not use non- rechargeable batteries (alkaline,carbon-zinc,etc) with meter's AC Power adapter. The AC Power adaptor maybe used whether or not the rechargeable Ni-Cd batteries are installed.***

NOTE :*When the Battery becomes exhausted or drops below operating voltage Low battery symbol will appear in the top area of LCD display with sound.*
The alkaline battery should be replaced if alkaline batteries are installed.
In case rechargeable batteries (NiCd) are installed ,The NiCD battery will be automatically recharged while connected with AC Adapter.
Rechargeable NiCd Battery is charged while using AC Adapter.
Recharging time will be shorten if the battery is charged at Rotary Switch " OFF" position.
When installed NiCd Battery is totally drain out, very rare case, Meter may not properly operate with AC Adapter. In this case, recharge the drained out NiCD battery (being installed inside meter)with AC Adapter for about 5 minutes - Meter Rotary Switch at " **OFF***" position.*

REPLACING FUSE

WARNING*: To avoid electric shock, do not operate your meter until the battery covers are in place and fastened securely.*

NOTE*: If your meter does not work properly, check the battery /Fuse to make sure that they are still good and that they are properly inserted.*

1, Disconnect the test leads from any circuit being measured.
2, Remove one screw (at the rear case -bottom side) and the two screws of two Battery Covers after lift the Tilt Stand.
- Total three(3) Screws are to be kept securely. Do not loose any of them.
3. Lift the two battety covers up to remove them.
4. Remove the Batteries installed Battery Compartments at each ends. Find one (1)screw at the bottom of each Battery Compartment and remove them.
5. Open the Bottom Case : Slightly Open the LOW SIDE of Bottom case (opposite side of LCD Display Area)

***You may see two FUSES mounted on PCB* :**
- **F1 : Small size Fuse : 250V/500mA for 400mA range**
- **F2 : Bigger Size Fuse : 250V/ 20A for 20 A range**

6. Replace proper FUSE.
7. Close the Bottom Case carefully. Make sure Top(Front) Case and Bottom Case are closeed securely in line.
8. Place the two Screws at the bottom of two Battery Compartments.

9. Place the batteries , making sure the batteries are l located with the correct polarity and the Metal Contacts and Springs in the Battery Compartments are in proper contacts with the batteries.
10. Snap the two battery covers back into the original place and put the Tilt Stand in the place. And place the other cover into place.
11. Put the two screws to hold Battery Compartments with Tilt Stand in the place using Screw Driver.
12. Put the one Screw at the Lower Side of Bottom Case using Screw Driver.
13 . Make sure the Power is ON and LCD displays in good condition. Check the Soft Keys and Rotary Switch are properly operate.

CAUTION *: Always use a Fuse of the Proper Size and Value. Use same or better qualified Fuses.*

CAUTION : ***Do not open the top area of Bottom Case where PCB and LCD module is connected with sensitive Pin Socket. If open top area of bottom case, this may break the LCD Display connection system. Do not touch PCB and Do not try pull out of Front Case***

TROBLESHOOTING

There maybe times when your meter does not operate properly. Here are some common problems that you may have and some easy solutions to them.

1. **Always read all the Instructions in this manual before use.**
2. **Check to be sure the battery is properly installed.**
3. **Check to be sure the battery is good.**
4. **If the battery is good and meter doesn't operate, check to be sure that fuses are properly installed.**

GENERAL SPECIFICATIONS.

DISPLAY.

160 by 160 pixel graphic LCD. (View Area : 63 mm x 63 mm)
EL back-light

MEASUREMENT RATE.

Digital : 4 Times/sec.
Bar-Graph : 7 Times/sec.

AUTO POWER OFF.

- **30 Minutes.**
- **set up mode (enable / disable).**

OVER RANGE INDICATION.

OVER display with beeper sound.

POWER.

Six size AA cells (9V Alkaline) or Six size A (7.2V) NiCd Battery or 2 NiCd Battery Pack or AC Adapter with Internal Charger
Operating Time : Alkaline -- 6 hours Approx.
NiCd ---- 6 hours Approx.

· Charging time : 10 hours approx (with AC Adapter)

TEMPERATURE.

Operating Temperature : 0 to 40 .
Storage Temperature : -20 to 60 . (NiCd batteries removed)
Charging Temperature : 0 to 45 .

RS232 COMPUTER INTERFACE

·baud rate : 1200, 2400, 4800, 9600 bps.
·data bit : 8 bit.
·stop bit : 1 bit.
·parity : none

DIRECT PRINT CAPABILITY

·through Recommended Thermal printer.

PROTECTION LEVEL. (CLASS : DC 1000V AC700V)

·per IEC1010-1.

DIMENSION / WEIGHT

·107(W) × 220(L) × 55(D) .
·800g (net meter only).

STANDARD ACCESSORIES

·Alligator Clip Set
·Test Lead Set
·Operator Manual
·Holster Case
·AC/DC Power Adapter with Internal Charger

OPTIONAL ACCESSORIES.

Ni-CD battery pack.
·Scope Probe (1:1) with BNC Adapter
·RS232 interface cable with Software .
. Automotive Pick Up
·Temperature Adapter
·DC Current Adapter
·Humidity Adapter
·Thermal Printer
·Deluxe Carrying Bag with Shoulder Stripe

SIG . OUT

·Output : square wave.

·**Range** : **2.5Hz - 78kHz (Manual Adjustment)**
·**Amplitude** : **p/p 5V**
·**Duty** : **50%**

FREQUENCY COUNTER

·**Range** : **0.5 Hz- 45 MHz**
·**Display** : **4 digits**
·**DUTY** : **5Hz - 100 KHZ**
.**Amplitude** : **p/p 0.6 V**
.**Accuracy** : **0.1 % + 5d**

AUTOMOTIVE RPM

Measurement through Inductive Pick Up

. **RANGE** : **0 - 12000 RPM**
. **RPM1** : **DIS Electronic Type Engine (2 Cycle Engine)**
. **RPM2** : **Distributor type Engine (4 Cycle Engine)**

% DUTY CYCLE : **0 - 100 %**
Dwell Degree : **0- 360 deg (2/4/5/6/8/12 Cylinder engines)**
Automotive Scope
ms PULSEWIDTH : **see Oscilloscope Specifications**