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MADE IN CHINA

Protek
• 506 • 505 • 504


# DIGITAL MULTI METER

**Auto Ranging 4000 Count**

HUNG CHANG

This multimeter is warranted against all defects of material or workmanship which may develop for any reason whatsoever, except abuse, within a period of one year from the date of purchase by the original buyer of user.

Any multimeter found defective during the warranty period and returned to the factory will be repaired, adjusted of replaced at no charge to the original purchaser. This warranty does not cover expendable items such as battery or fuse. If the defect has been caused by misuse or abnormal operating conditions, the repair will be billed to the user.

## CONTENTS

# INTRODUCTION

This meter is a super-high performance Digital Multi Meter with many useful functions and features which are indispensible for electrical and electronic measurement.

All the functions are designed to be very convenient to use. You can quickly get used to working with this meter and the great many functions integrated inside.

This meter series consists of 3 models, which are functionally classified as below.

| Function | Model No. | | | Remark |
|---|---|---|---|---|
| | 504 | 505 | 506 | |
| RS232C | | | ○ | Interface with personal computer |
| TRUE-RMS | | ○ | ○ | |
| BACK LIGHT | | ○ | ○ | Built-in LED's illuminate display in poor lighting conditions |

* OPTION 1) Rubber Holster
2) Temperature Probe ("K" type)
3) Temperature Adaptor



# FEATURES

3 ¾ digit 4,000 count auto ranging and 4 digit 10,000 count frequency counter with full annunciators and analog bargraph.

| No | Features | 504 | 505 | 506 |
|---|---|---|---|---|
| 1 | RS232C Interface with personal computer | – | – | ○ |
| 2 | True RMS measurement | – | ○ | ○ |
| 3 | Back light display | – | ○ | ○ |
| 4 | Dual display, for ℃/℉, Hz/ACV, etc. | ○ | ○ | ○ |
| 5 | 10 memory locations | ○ | ○ | ○ |
| 6 | Timer function for alarm clock or stop watch | ○ | ○ | ○ |
| 7 | decibel measurement | ○ | ○ | ○ |
| 8 | Capacitance & Inductance measurement | ○ | ○ | ○ |
| 9 | Temperature (℃/℉) using "K" type thermocouple | ○ | ○ | |
| 10 | Room Temp. (℃/℉) without any temp probe | ○ | ○ | ○ |
| 11 | Signal out function for logic signal injection or audio circuit checking | ○ | ○ | |
| 12 | Logic level check function (High, Low, - - - -) | ○ | ○ | |
| 13 | Frequency measurement up to 10MHz | ○ | ○ | ○ |
| 14 | 400 μA range measurement with 0.1μA resolution | ○ | ○ | |
| 15 | Warning beeper protects against wrong input to 20A fused input socket. | ○ | ○ | ○ |
| 16 | Overload protection for all functions | ○ | ○ | ○ |
| 17 | MAX/MIN/AVG mode | ○ | ○ | ○ |
| 18 | Relative mode | ○ | ○ | ○ |
| 19 | Auto power off & keep on mode | ○ | ○ | ○ |
| 20 | Data hold & run mode | ○ | ○ | ○ |
| 21 | Low battery indication | ○ | ○ | ○ |
| 22 | Continuity & diode test | ○ | ○ | ○ |

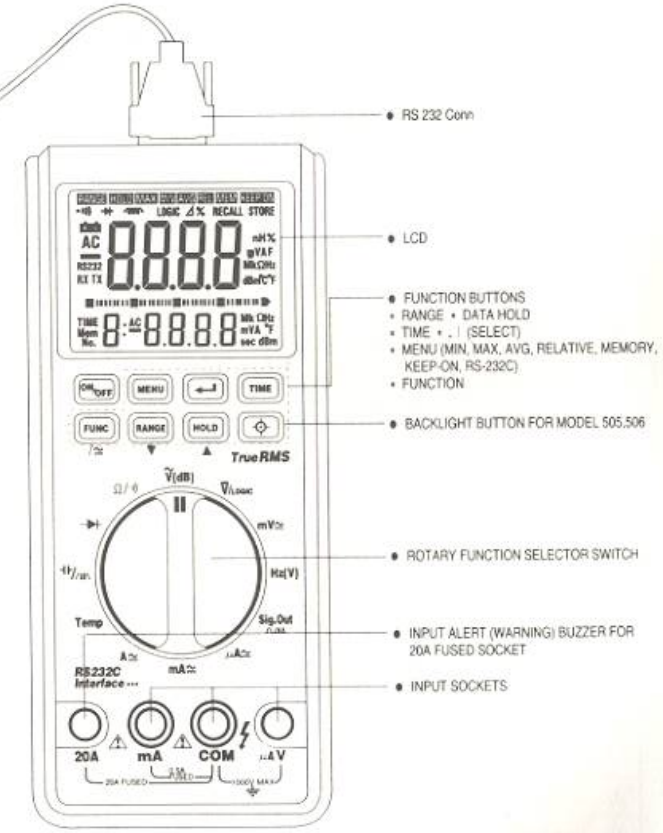



Fig.1



| No | Function | Main | Secondary | N/A Function Mode |
|---|---|---|---|---|
| 1 | ACV(dB) | ACV | dBm | |
| 2 | Hz (ACV) | Hz | ACV | |
| 3 | Temp. | ℃ | ℉ | |
| 4 | Continuity | Open, Shrt | Ω | |
| 5 | Diode | Open, Shrt,Good | DCV | |
| 6 | Logic | Hi, Lo, - - - - | DCV | |
| 7 | Time | Measuring | Time | Hz, C, L |
| 8 | Memory | Measuring | Memory Location | Logic, Signal Out, ⊣▶⊢ , 🔊 |
| 9 | Hold | Hold | Current Measuring value | Signal out, |
| 10 | MAX | MAX | Measuring | Logic, Signal Out, ⊣▶⊢ , 🔊 |
| 11 | MIN | MIN | Measuring | Logic, Signal Out, ⊣▶⊢ , 🔊 |
| 12 | AVG | AVG | Measuring | Logic, Signal Out, ⊣▶⊢ , 🔊 |
| 13 | REL | REL | Measuring | Logic, Signal Out, ⊣▶⊢ , 🔊 |

## 3 SPECIAL ANNUNCIATORS

| Symbol | Description |
|---|---|
| 🔊 | Continuity test |
| ⊣▶⊢ | Diode check |
| 🔋 | Low battery indicator |
| REL Δ | Relative value (Measured-Reference) |
| REL % | Relative percent (REL Δ /Ref. ×100) |
| MEM | Memory mode |
| RECALL | Recall the stored data from memory |
| STORE | Storage of the measured data into memory |
| Keep on | Continuous use without auto power off |
| RS232C | Serial data interface with computer |
| RX | Serial data receiving |
| TX | Serial data transmitting |
| ⏚ | Inductance test |
| dBm | Decibel measurement unit (1mW, 600Ω) |

1. Selection method

| No | Function | Ranges | Selection method | Press key |
|---|---|---|---|---|
| 1 | ACV(dBm) | 4 | Auto & manual | Range |
| 2 | DCV | 4 | Auto & manual | Range |
| 3 | mV(AC/DC) | 1 | Fixed | |
| 4 | Hz (ACV) | 4 | Auto | |
| 5 | Resistance | 6 | Auto & manual | Range |
| 6 | μA (AC/DC) | 1 | Fixed | |
| 7 | mA(AC/DC) | 1 | Fixed | |
| 8 | 20A(AC/DC) | 1 | Fixed | |
| 9 | Continuity | 1 | Fixed | |
| 10 | Logic | 1 | Fixed | |
| 11 | Diode | 1 | Fixed | |
| 12 | Capacitance | 1 | Fixed | |
| 13 | Inductance | 1 | Fixed | |
| 14 | Temp | 1 | Fixed | |
| 15 | Signal out | 3 | Manual | Func |

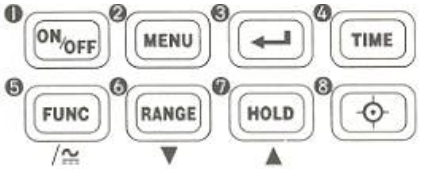
2. Over range indication
"OL" appears on the display.

**Note**

On some special functions such as MAX, MIN, AVG, REL etc. "3999" is displayed instead of "OL".



Button key configuration




❶ : Power on/off switch

When not used for very long time, it would be better to turn this switch off than to depend on the auto power off function, which can make battery drained if the meter remains on for longer than about 2 months

❷ : Menu key

Pressing this key once to go into the menu mode. Pressing key for more than 1 sec releases meter from menu mode.
Once this key is pressed, all the menu annunciators turn on, and only one annunciator at the cursor position blinks rapidly, while the previously selected menu annunciator blinks slowly.

MAX MIN AVG REL MEM KEEP ON RS232

Push menu key to move the cursor and select one of the functions shown in the above figure.

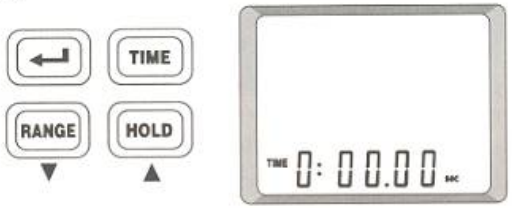
❸ : Enter key

Press enter key to bring up on the screen the function selected by the menu key. The selected function will appear on the screen and all other indicators will disappear. If however the "Keep on" or "RS232" indicator had been selected previously, they will remain on the screen.
To exit (MIN, MAX, AVG) function, press menu key once, then

❹ Time key

This is used for setting the time function.

When this key is pushed, 0 hours 00 minute 00 second is shown on the secondary display area on the LCD. (See Fig. Below)




Another push of time key discards the time function and the previous normal mode is restored.

The keys for up "(▲)" or down "(▼)" are used for starting the time count up or down.

During time count up or down, if 0:00.00 or 9:59.59 is reached. The buzzer will sound indicating the end of time count.

Pressing the time key will shut off the buzzer.

This time function also has a preset function.

After the first push of time key, if the return key is pressed, the leftmost digit will blink.

Pushing the up or down key will increase or decrease the value of the blinking digit.

After the digit you want is displayed, pushing the return key fixes the blinking digit and causes the next digit to start blinking. In that way, time can be preset and counting up or down can be done from the preset time.



This key is used for selecting the alternate function.

(When position of the rotary switch remains unchanged.)

| No | Rotary switch | #1 | #2 | #3 |
|---|---|---|---|---|
| 1 | V/Logic | DCV | Logic | |
| 2 | mV | DCmV | ACmv | |
| 3 | Sig. out | 2048H | 4096Hz | 8192Hz |
| 4 | μA | DCμV | ACμV | |
| 5 | mA | DCmA | ACmA | |
| 6 | 20A | DC20A | AC20A | |
| 7 | Ω/·)) | Ω | ·)) | |
| 8 | ⊣⊢/⎍ | ⊣⊢ | ⎍ | |

Note

1) # 1 : No key pushed (default status)
   # 2 : The first push of the function key selects alternate measurement function.
   # 3 : The second push of the function key selects second alternate function only in case of "Sig out".
2) The function key is operated toggles to another alternate function each time it is pushed.

❻ Range key

This key is used for changing from auto ranging mode to manual range mode.

When in Time mode or Memory mode, this key is used for selecting functions which are described in detail in the previous item 4 (section 3-5) time key and(3-6.)

There are two types of range operations.
One is automatic range selection (which is the default condition at power on).
The other is manual range(which is selected when the range key is pressed).
With the first push of this key, manual range mode is set up and fixed to the next range mode. Each push there-after selects the next higher range.
Range is advanced step by step each time the key is pressed.
If the range key is pressed down for more than 1 sec, the manual range mode is released and restored to auto range mode.

3

❼ Hold key

This key has 2 functions.
One is Hold, and the other is up (▲) function.
The up (▲) function is used for time and memory application and is described in detail in item(section 3-5).
The Hold function is used for "freezing" the data measured at the time the key is pressed.
With the key pressed, Hold annunciator turns on and the secondary restores the current measuring data. See, Fig. Below. Another push of the hold key restores the previous testing mode.


Main display with the data frozen.

Sub display with the data running.



❽ Back light key

This key is used for lighting the di
The first push turns on the back li
The second push turns the back
This back light has an auto s
automatically extinguish the back
light turns on.
Use of this auto-off feature saves
About 20mA current is required t
It would be better to turn the ligh

## 6 MENU FUNCTIONS

1) MAX/MIN/AVG MAX MIN AVG

These functions are used for obt
or Average value of the measured


Once MAX is selected, the maxin
display, while the secondary disp
Likewise for Min and AVG.
MAX, MIN and AVG functions ha

Before you set meter to MIN, MAX or AVG modes, Manually select the desired range. When the Maximum or Minimum value is reached on a selected range(i.e. 3.999 or-3.999), that value will be displayed instead of O.L

The AVG mode calculates true average for all the measured data aquired during the period in AVG. But AVG Mode has a time limit as shown at the note on page 17

2) REL **REL**

Relative mode allows the operator to measure values with respect to a reference value other than zero.

Relative (REL Δ) = Measured − Reference


1st indicator
2nd indicator : Δ or %
Main display : relative
Secondary display : reference


When REL % is selected instead of REL Δ (above example).

The relative value is expressed as a percent of the reference value.

REL % = 100 × Relative / Reference



1. Press menu key to display menu. Move the cursor to REL using menu key.
2. Push return key, Indicators of Δ and % will appeared, Δ will blink, but % will not.
3. Each push of menu key makes the cursor move and the related indicator blink. So Δ or % can be selected as needed.
4. Push the return key, and the relative mode will be set up and the relative measurement will be made.

※ This REL mode is only available for numerical value measurement.
It is not available for logic, continuity and signal out.

3) MEM **MEM**

Up to 10 measurements can be stored in memory and recalled at anytime, by using the menu, return, up(▲) and down (▼) keys.


To enter memory mode, push menu key to select memory function. Push menu key to select store or recall.


1st indicator : memory
2nd indicator : recall
Main display : real time data
Secondary display : memory No. and memory contents

In the memory store mode.

The memory No. "0" has a special function, which can be used to input an arbitrary numerical value by manual operation of up,

After entering the memory store mode, if you go to memory No.zero with the up or down key, the memory No. "0" will blink. Now push the return key and the up or down key, and "–" indicator will blink. If return key is pushed, the "–" indicator is fixed and the next digit will blink.

Any numerical value you want can be set by using up or down key.

After this, if the return key is pushed, the next right digit will blink. In that way all the rest of digits can be set. Finally the memory No. "0" will blink again. Now you can go to other memory No. using the up or down key or exit to other test mode using the menu key.

Other memories except for No. "0" memory are used for storing measurement data. Whenever the return key is pushed, the memory is updated and stored with the present measurement value.

In memory recall mode, up to 10 memory location can be recalled at anytime.

This 10 memory is not erased even with the meter in the auto power off mode.

4) Keep on KEEP ON

When the meter is to be used continuously for more than 30 minutes, the auto power off function should be disabled.

The "Keep on" function disables auto power off function for continuous use of the meter until the battery is drained.

1. Push menu key
2. Move the cursor to the "Keep on" position
3. Push return key



4. Then the annunciator "Keep on" will be turned on to indicat that the meter is in the "Keep on" mode.
5. To exit the "Keep on" mode, one method is to use the mer key, another method is to turn the power off.

This "Keep on" mode operates independent of other mode and functions.

Therefore this mode remains on regardless of any moc change with button key or rotary switch.

5) RS232 **RS232**

This RS232 mode is also operated independent of oth modes and functions.

Refer to the chapter 8 for detailed description.

**Note**

<Averaging Method & Spec for AVG mode>

Average $\bar{X} = (X_1 + X_2 + \cdots X_n)/n$

Maximum Count for n = 100,000 times

| Function. | Sampling Time | Maximum Time |
|---|---|---|
| V, A, Ohm, Diode, Temp | 125 ms | 3.5 hrs |
| Frequency | 1.1 sec | 30.5 hrs |
| Capacitor | 0.35~1.1 sec | 19.4~30.5 hrs |
| Inductor | 0.9~1.5 sec | 25~41.7 hrs. |

## 7 MODES APPLICATION

| NO | Functions | MAX | MIN | AVG | REL | MEM | Keep-on | RS232 | RNG | HOLD | TIME |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ACV(dB) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 2 | DCV | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 3 | Logic | | | | | | ○ | ○ | | ○ | ○ |
| 4 | DC mV | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ |
| 5 | AC mV | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ |
| 6 | Sig Out | | | | | | | | | | ○ |
| 7 | Hz(ACV) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | |
| 8 | DC μA | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ |
| 9 | AC μA | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ |
| 10 | DC mA | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ |
| 11 | AC mA | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ |
| 12 | DC 20A | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ |
| 13 | AC 20A | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ |
| 14 | RESISTANCE | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 15 | CONTINUITY | | | | | | ○ | ○ | | ○ | ○ |
| 16 | DIODE | | | | | | ○ | ○ | | ○ | ○ |
| 17 | CAPACITANCE | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | |
| 18 | INDUCTANCE | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | |
| 19 | TEMPERATURE | ○ | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ |



# GENERAL SPECIFICATION

## 1 MEASURING METHOD

1. A/D Conversion : 4000 Count resolution dual slope integration
2. Digital count : 10000 Count resolution
3. Sampling Time : refer to sampling Spec. on page 50

## 2 DISPLAY

1. Type : LCD
2. View area : 47 × 62 ㎜
3. Segments : Total 142
   - 21 for Analog Bargraph
   - 10 for Menu Indicator
   - 14 for Annunciators
   - 25 for Measurement unit
   - 31 for Main display
   - 39 for Secondary display
   - 2 for Polarity sign (Negative)
4. LED back light (except for 504)
   - ※ Auto light off : Approximately 2 min.

## 3 ENVIRON MENTAL

| Item | Operating | Storage |
|---|---|---|
| Temperature | 0 to 50℃<br>(32 to 122℉) | -40 to 70℃<br>(-22 to 158℉) |
| Humidity | 80% RH max.<br>No wetting | 95% RH max.<br>Battery removed |

※ Temp coefficient : 0.1 × (Specified accuracy) / ℃
for 0 to 18℃ or 28 to 50℃
(32 to 64℉ or 82 to 122 ℉)

## 4 MAXIMUM INPUT & PROTECTION TYPE

| Rotary Switch | V-COM | mA-COM | 20A-COM | Protection |
|---|---|---|---|---|
| ACV (dB) | 1000V peak | | | 10MΩ 1/2W |
| DCV / Logic | | | | |
| mV AC /DC | 250V rms | | | PTC 500Ω |
| Hz (ACV) | | | | |
| Sig. Out | | | | |
| Ω / Continuity | | | | |
| Diode | | | | |
| C / L | | | | |
| Temp | | | | |
| μA | | | | |
| mA | | 0.5A 250V | | Fuse |
| 20A | | | 20A 250V | Fuse, W/B |

Note

1) W/B (Warning beep) : Incorrect insertion of the test lead plug into 20A input socket while in any other function than 20A will cause the warning beeper to sound.

2) 20A : MAX 30sec. for 10A to 20A. continuous for up to 10 A

## 5 POWER SUPPLY

1. Type : 9V Battery, NEDA 1604 or 6F22 or 006P, carbon zinc or alkaline
2. Power consumption : 30mW typ. (3.5mA typ.)
   60 hrs typ. for continuous operation with carbon zinc battery.
   120 hrs typ. with alkaline battery
3. Auto power off : After 30 ± 1min. of no key operation except for Hz, C, L
   After 25 to 50min. for Hz, C, L.
4. Low battery indication : at below 6.9 ± 0.5V

## 6 MECHANICAL

1. Dimension : 88(W) × 37(H) × 199(L)MM
2. Weight : 410g

## 7 SAFETY

Designed in compliance with UL1244 and IEC1010

## 8 ACCESSORY

1. Basic : (1) Test lead (Red & Black) ..... 1set
   (2) Alligator clip (Red & Black) ..... 1set
   (3) Battary 9V ..... 1pc
   (4) Spare fuse 0.5A, 250V ..... 1pc
   (5) Instruction manual ..... 1pc
   (6) RS232 cable (for 506 only) ..... 1pc
   (7) Diskette (for 506 only) ..... 1pc

2. Option : (1) Holster
   (2) "K" type thermo couple temperature probe
   (3) Temperature adaptor for "K" type probe

± {(1% of reading) + (Number of least significant digits)}

※ Accuracy in specified at 23℃ ± 5℃ (75℉ ± 9℉) with relative humidity up to 80% for a period of one year after calibration.

## 1 DC VOLTAGE

| Function | Range | Resolution | Accuracy | Impedance |
|---|---|---|---|---|
| DCmV | 400mV | 0.1mV | 0.3% + 2d | > 1GΩ |
| DCV | 4V | 0.001V | 0.5% + 2d | 10MΩ |
| | 40V | 0.01V | | |
| | 400V | 0.1V | | |
| | 1000V | 1V | | |

## 2 AC VOLTAGE

| Function | Range | Resolution | Accuracy | Frequency |
|---|---|---|---|---|
| ACmV | 400mV | 0.1mV | 1% + 3d | 50Hz ~ 1KHz |
| AC V | 4V | 0.001V | 1.5% + 5d | 50Hz ~ 100Hz |
| | 40V | 0.01V | | |
| | 400V | 0.1V | | 50Hz ~ 500Hz |
| | 750V | 1V | | |

**Note**

1) ACmV INPUT IMPEDANCE : > 1GΩ SHUNTED WITH < 3nF
   AC V INPUT IMPEDANCE : 10MΩ SHUNTED WITH < 100PF
2) True RMS Crest Factor

| Waveform | Crest Factor | Additional Error |
|---|---|---|
| Square | 1 | 0.2% |
| Sine | 1.414 | 0% |
| Triangle | 1.73 | 0.3% |
| Others | 2 | 0.5% |
| | 3 | 1.7% |

3) Model 504 does not have true RMS function, but average conversion.



| Function | Range | Resolution | Accuracy | Burden Voltage |
|---|---|---|---|---|
| μA | 400μA | 0.1μA | 1.0% + 2d | 1mV /μA |
| mA | 400mA | 0.1mA | | 1mV / mA |
| 20A | 20A | 0.01A | | 10mV / A |

## 4 AC CURRENT

| Function | Range | Resolution | Accuracy | Frequency |
|---|---|---|---|---|
| μA | 400μA | 0.1μA | 1.5% + 3d (3.0% + 5d) | 50Hz ~ 100 Hz (100Hz ~ 1KHz) |
| mA | 400mA | 0.1mA | | |
| 20A | 20A | 0.01A | | |

**Note**

1) Burden voltage : Same as that for DC current
2) MAX 30 sec.for 10A to 20A. continuous for up to 10A.
   ※ Likewise for DC current.
3) μA : PTC Protected and no fuse
   ※ Likewise for DC current.
4) True RMS Crest Factor : Same as that for ACV

## 5 RESISTANCE

| Range | Resolution | Accuracy | Open circuit |
|---|---|---|---|
| 400Ω | 0.1Ω | 0.5% + 2d | 2.5V |
| 4kΩ | 0.001kΩ | | 1.2V |
| 40kΩ | 0.01kΩ | | |
| 400kΩ | 0.1kΩ | | |
| 4MΩ | 0.001MΩ | 1% + 2d | |
| 40MΩ | 0.01MΩ | | |

**Note**

1) Test leads for 4 and 40MΩ measurement should be short enough to avoid unstability due to external noise.
2) It is recommended to use a shielded cable for long distance.

| Range | Tested | Buzzer | Main Digit | Sub Digit |
|---|---|---|---|---|
| 400Ω | below 100Ω ± 0.5% | Audible Tone | Shrt | Displays Resistance Value |
| | above 100Ω ± 0.5% | No tone | OPEn | |

**Note**

1) Open Circuit Voltage : 2.5V typ.

## 7 DIODE

| Range | Tested | Main Display | Secondary Display |
|---|---|---|---|
| 4V | below 0.5V | Shrt | Displays Diode Voltage |
| | Above 1.0V | OPEn | |
| | 0.5 to 1.0V | Good | |

**Note**

1) Open Circuit Voltage : 3.3V MAX.
2)Test Current for Diode : 1mA typ.



## 8 FREQUENCY

| Range | Resolution | Accuracy | Impedance | Sensitivity |
|---|---|---|---|---|
| 10KHz | 1Hz | 0.01% ± 2d | 10MΩ// < 1nF (≒100pF) | 0.7Vrms Sine Wave For 10Hz to 10MHz |
| 100KHz | 10Hz | | | |
| 1MHz | 100Hz | | | |
| 10MHz | 1KHz | | | |

**Note**

1) ACV shown on Secondary Display is useful for simultaneous reading of Both Hz and ACV.
The specification for this ACV is described in the previous item No.2 AC Voltage.

| Range | dBm Measurable | Frequency | Accuracy |
|---|---|---|---|
| 4V | -25.74 ~ 14.25dBm(0.04 ~ 3.999V) | 30~200Hz | ±0.5dB |
| 40V | -5.74 ~ 8.24dBm(0.4 ~ 2.0V) | 20~1KHz | ±0.5dB |
| | | 1K~2KHz | ±1.0dB |
| | | 2K~5KHz | ±2dB |
| | 8.24 ~ 34.25dBm(2 ~ 39.99V) | 30~5KHz | ±0.5dB |
| | | 5K~10KHz | ±1.0dB |
| | | 10K~20KHz | ±2.0dB |
| 400V | 31.76 ~ 54.25dBm(30 ~ 399.9V) | 30~20KHz | ±0.5dB |
| 750V | 51.76 ~ 59.71dBm(300 ~ 750V) | 30~20KHz | ±0.5dB |

**Note**

1) Input Impedance : 10MΩ // < 100PF
2) 0 dBm = 0.7746V, Based on 1mW AT 600Ω Load
[dBm] = 20 LOG(V/0.7746)
3) Resolution : 0.01dBm for all ranges
4) Audio frequency area from 20Hz up to 20KHz is covered appropriately by 40V range, and so the 40V range setting with manual range key is recommended for audio measurement.

## 10 TEMPERATURE

| Function | Range | Resolution | Accuracy |
|---|---|---|---|
| ℃ | -20℃~1200℃ | 1℃ | 3%+5d from -20℃ up to 10℃<br>3%+3D up to 350℃<br>5%+3D up to 1200℃ |
| ℉ | ℉ At sub digit display on the LCD is calculated and displayed by the formular ℉ = 32 + (9/5 × ℃) | | |

**Note**

1) Temp. Sensor type : "K" type thermo-Couple
2) Room Temp. is displayed with no sensor probe connected.

| Range | Tested | Main Display | Secondary Display | Remark |
|---|---|---|---|---|
| 40V | below 0.8V | Lo | DCV Value | Based on TTL Logic Level |
| | above 2.0V | Hi | | |
| | 0.8 to 2.0V | - - - - | | |

## 12 CAPACITANCE

| Range | Resolution | Accuracy | Open Circuit |
|---|---|---|---|
| 100μF | 0.01μF | 3% + 5d | 3.2V MAX. |

## 13 INDUCTANCE

| Range | Resolution | Accuracy | Open Circuit |
|---|---|---|---|
| 100H | 0.01H | 3% + 5d UP TO 20H<br>5% + 5d UP TO 50H<br>10% + 5d UP TO 100H | 3.2V MAX. |

Note

1) Measurement Method : Measuring the inductors time Constant.
2) Inductor Q of LESS than 10 and coil resistrances of greater than 100Ω will cause inaccuracy.

## 14 SIGNAL OUT

| Function | Accuracy | Waveform | Output Level |
|---|---|---|---|
| 2048Hz<br>4096Hz<br>8192Hz | ±0.1% | Square Wave<br>50% duty | 4.0Vp - p Min.<br>(4.5Vp - p typ.)<br>at No Load |

Note

1) Source Impedance : 1.5KΩ typ.

## 15 TIME COUNT

| Range | Resolution | Accuracy | Display | Alarm |
|---|---|---|---|---|
| 10 hours | 1 sec | 0.2% + 1d | Secondary Display | Buzzer Sound |

Note

1) Alarm will Sound : at 9 hours 59 min 59 sec. in Count up mode.
at 0 hours 0 min 0 sec. in Count Down mode.

# MEASUREMENT PROCEDURES

## 1 DCV

1. Select V̿/Logic with the rotary function switch.
2. Attatch the probe tips to the voltage source as shown below.
3. The LCD will display the measured value along with the Bargraph.
4. If the measured is too high, "OL" will appear.

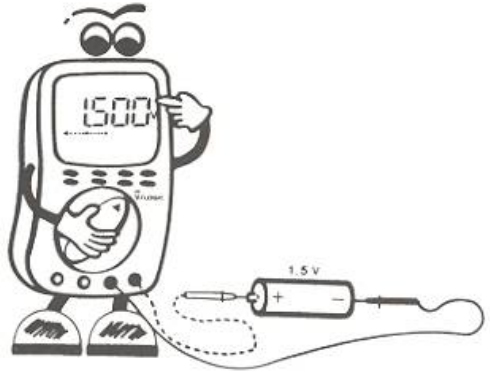



Fig.2 DC VOLTAGE TEST

## 2 ACV

1. Select Ṽ(dB) with the rotary function switch.
2. Attatch the probe tips to the voltage source.
3. The voltage will appear on the display.
4. Bargraph indicator will move to the appropriate positic Bar-graph scale.
5. If the voltage is too high, the measurement rang changed to the next higher range automatically. When is in the highest or in the manual range, too high voltag the display read "OL".
6. The secondary will show the decibel value calculate formular of dBm = 20 Log [ V/ 0.7746 ]

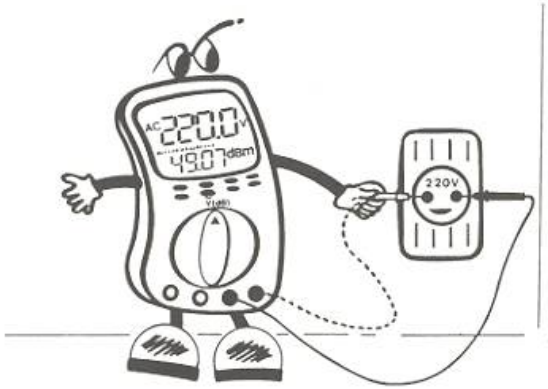



Fig.3 AC VOLTAG

1. Select μA ≅ with the rotary function switch.
2. Break the circuit point to be measured.
3. Connect the two test leads to complete the broken circuit.
4. If the measured current is too high, the display will indicate "OL". In this case, the higher current range (mA or 20A) should be selected.
5. The bargraph segments will indicate the measured value.

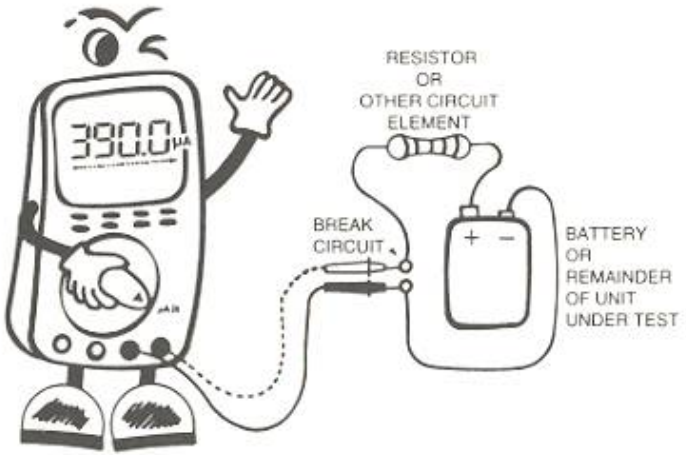



Fig.4 LOW CURRENT(μA) TEST

1. Select mA ≅ with the rotary function switch.
2. Insert the red test lead into the input socket mar
3. The measuring procedure is the same as that of


Fig5 CURR

### 5 DC 20A

1. Select 20A ⎓ with the rotary function switch.
2. Insert the red test lead into the input socket marked as "20A".
3. The measuring procedure is the same as that of DC mA or μA.

※ The 20A input socket has a special function designed for safety, which is called "Warning Beep".
When the rotary switch is set up to other than the 20A function, wrong insertion of the test lead plug into the 20A input socket will cause the warning beeper to sound.

※ Do not continue measuring high current above 10A for more than 30sec. to avoid opening fuse or overheating.

### 6 AC μA

1. Select AC μA ≅ with the rotary function switch.
   Press the function key once. This will select AC μA measuring mode.
2. The testing procedure hereafter is the same as that of DC μA.

### 7 AC mA

1. Select AC mA ≅ with the rotary function switch.
   Press the function key once. This will select AC mA measuring mode.
2. The measuring procedure is the same as for DC mA.

### 8 AC 20A

1. Select 20A ≅ with the rotary function switch.
   Press the function key once. This will select 20A AC measuring mode.
2. The measuring procedure hereafter is the same as for 20A DC.



### 9 RESISTANCE

1. Select Ω/·)) with the rotary function switch.
2. "Open" leads will display "OL" appeared on the display.
3. "Shorting" the test leads will display zero or extremely low value resistance (Test Lead Resistance).
4. Relative mode is useful to get rid of this error by subtract the test lead resistance from the measured resistance.


Fig.7 RESISTANCE TEST

## 10 CONTINUITY

1) Select Ω/·)) with the rotary function switch.
2) Press the function key one time.
3) The annunctor of "·))" appears on at the upper left of the display, the resistance value is now read in the secondary display, and the main display reads either "OPEn" or "Shrt" instead of numerical value.


Below 100Ω : Shrt together with Beep Sound
Above 100Ω : OPEn

Fig.8 CONTINUITY TEST



## 11 DIODE

1. Select ⊣◀ with the rotary function switch.
2. Annunciator " ⊣◀ " will appear
3. Main display will read;
   - OPEn : Open circurt or above 1.0v
   - Shrt : Short circuit or below 0.5v
   - Good : Good diode or 0.5 upto 1.0v
4. Secondary display will read the voltage of a measured diode.

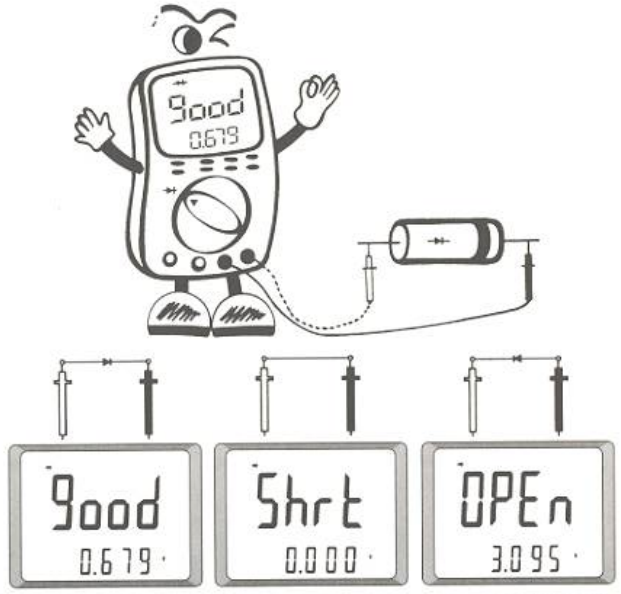



Fig.9 DIODE TEST

## 12 LOGIC

1. Select $\bar{\tilde{V}}$/Logic with the rotary function switch.
   Press "FUNC" key once.
2. Annunciator "Logic" will appear.
3. Main display will read
   - Hı : above 2.0V
   - Lo : below 0.8V
   - ---- : 0.8V to 2V
4. Secondary display will read the voltage of measured Logic circuit.

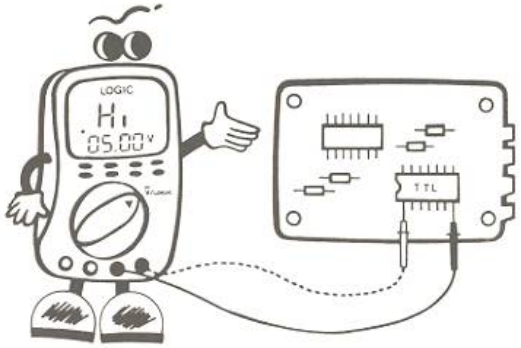




Fig.10 LOGIC TEST



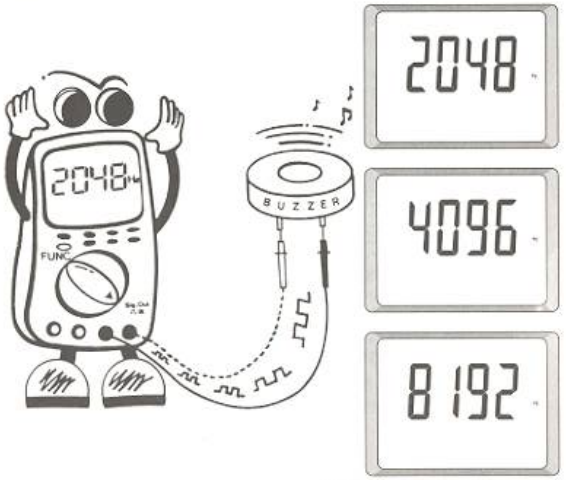
## 13 FREQUENCY

1. Select Hz($\tilde{V}$) with the rotary function switch.
2. Attach the test lead tips to signal source.
3. Main display will read the measured frequency.
4. Secondary display will read measured Voltage.


Fig.11 FREQUENCY(Hz) TEST

## 14 SIGNAL OUT

1. Select sig out ( ⎍⎍⎍ ) with rotary function switch.
2. 2.048KHz 5Vp-p pulse signal is output to test leads.
3. If the function key is pressd one time, the frequency of output signal is changed to 4.096KHz.
   Repeated pressing of the function key will cause the output frequence to sequence between 2.048KHz, 4.096KHz and 8.096KHz




2KHz, 4KHz and 8KHz signal out

Fig.12 SIGNAL OUT TEST

**Note**

In this function mode, no button key except for Time and Back Light is activated, nor does the Buzzer built in the meter make sound.



## 15 CAPACITANCE

1. Select ⊣⊢/⏦ with the rotary function switch.
2. Discharge the capacitor to be measured.
3. Attach the test lead tips to the capacitor.


Fig.13 CAPACIYANCE( ⊣⊢ )TEST

1. Select mH/mA with the rotary function switch.
2. Press the function key one time.
3. The Annunciator "mA" will appear.
4. Main display will show the inductance value of the measured inductor.

※ This function is based on Time Constant Method other than frequency response method for dedicated type of LCR meter and has some limited measurement conditions as below.

- DC Resistance of Inductor : less than 100 Ω
- Quality Factor of inductor : more than 10

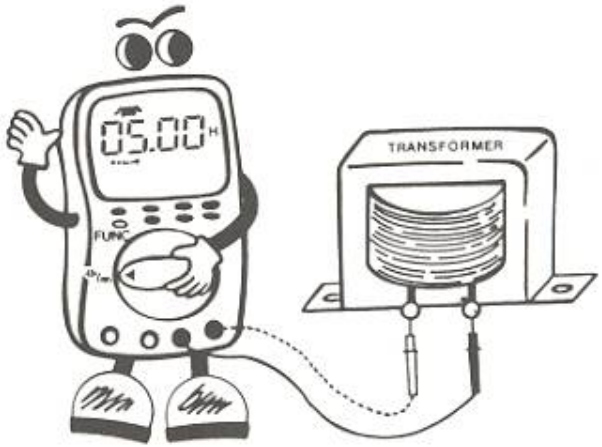



Fig.14 INDUCTANCE( mA )TEST

1. Select temp with the rotary funct
2. The main display will show centigrade with no test lead inse the secondary display will read is calculated by the formular of
3. The type "K" temp Probe is u from -20 ℃ up to 1200 ℃.

**Note**

Abrupt change in ambient Temperat a measurement error. So about 30 r settling time is necessary for the cha Temperature to be reached to the s


Fig.15

# RS-232C INTERFACE

## 1 RS-232C INTERFACE WITH A PERSONAL COMPUTER

1. Connection of PC and Meter

Connect the RS-232 cable to the built-in RS-232 connetor in the Meter and to the PC serial port.

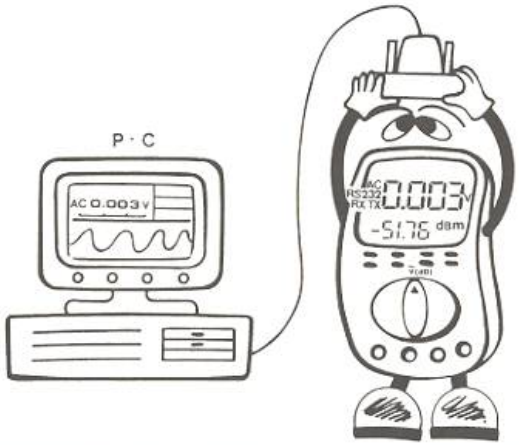



Fig.16

2. RS232 Cable Pin Connection

| DMM | Cpmputer | | |
|---|---|---|---|
| D-sub 9 Pin Male | D-sub 9 Pin Female | D-sub 25 Pin Female | Pin Name |
| 2 | 2 | 3 | RX |
| 3 | 3 | 2 | TX |
| 4 | 4 | 20 | DTR |
| 5 | 5 | 7 | GND |
| 6 | 6 | 6 | DSR |
| 7 | 7 | 4 | RTS |
| 8 | 8 | 5 | CTS |

## 6. QBASIC EXAMPLE PROGRAM (DM506.BAS)

```
10   CLS
20   PRINT "WELCOME !"
30   PRINT "<RS232 EXAMPLE PROGRAM BY BASIC>"
40   PRINT "DM506.BAS"
50   PRINT "1200 BAUD"
60   PRINT "NONE PARITY"
70   PRINT "7 DATA BIT"
80   PRINT "2 STOP BIT"
90   PRINT "COM2 PORT"
100  PRINT
110  PRINT "PLEASE"
120  PRINT "PRESS ANY KEY TO EXECUTE OR ESC TO STOP"
130  PRINT
140  RS$ = "COM2:1200,N,7,2,DS,CS,RS,CD"
150  OPEN RS$ FOR RANDOM AS #2
160  T$ = INPUT$(1)
170  IF T$ = CHR$(27) THEN 340
180  PRINT #2,T$
190  DIM R$(15)
200  I = 1
210  R$(I) = INPUT$(1,#2)
220  IF R$(I) = CHR$(13) THEN 250
230  I = I + 1
240  GOTO 210
250  FOR J = 1 TO I
260  PRINT R$(J);
270  NEXT J
280  PRINT
290  I$ = INKEY$
300  IF I$ = CHR$(27) THEN 340
310  FOR K = 1 TO 99
320  NEXT K
330  GOTO 180
340  CLOSE #2
350  END
```



**Note**

This is a sample program which helps users to understand the data format and the data interfacing method,and also to develop their own program.

## 7. DATA FORMAT

| No | Function | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Bytes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DC V | D | C | | 3 | | 9 | 9 | 9 | | V | ↵ | | | | | 11 |
| 2 | DC V | D | C | | - | 3 | | 9 | 9 | 9 | | V | ↵ | | | | 12 |
| 3 | DC V | D | C | | 0 | L | ↵ | | | | | | | | | | 6 |
| 4 | AC V | A | C | | 3 | . | 9 | 9 | 9 | | V | ↵ | | | | | 11 |
| 5 | AC V | A | C | | 0 | L | ↵ | | | | | | | | | | 6 |
| 6 | DC mV | D | C | | 3 | 9 | 9 | . | 9 | | m | V | ↵ | | | | 12 |
| 7 | DC mV | D | C | | - | 3 | 9 | 9 | . | 9 | | m | V | ↵ | | | 13 |
| 8 | AC mV | A | C | | 3 | 9 | 9 | | 9 | | m | V | ↵ | | | | 12 |
| 9 | DC μA | D | C | | 3 | 9 | 9 | | 9 | | μ | A | ↵ | | | | 12 |
| 10 | DC μA | D | C | | - | 3 | 9 | 9 | . | 9 | | μ | A | ↵ | | | 13 |
| 11 | DC μA | A | C | | 3 | 9 | 9 | . | 9 | | μ | A | ↵ | | | | 12 |
| 12 | DCmA | D | C | | 3 | 9 | 9 | . | 9 | | m | A | ↵ | | | | 12 |
| 13 | DCmA | D | C | | - | 3 | 9 | 9 | . | 9 | | m | A | ↵ | | | 13 |
| 14 | AC mA | A | C | | 3 | 9 | 9 | . | 9 | | m | A | ↵ | | | | 12 |
| 15 | DC 20A | D | C | | 3 | 9 | | 9 | 9 | | A | ↵ | | | | | 11 |
| 16 | DC 20A | D | C | | - | 3 | 9 | . | 9 | 9 | | A | ↵ | | | | 12 |
| 17 | AC 20A | A | C | | 3 | 9 | . | 9 | 9 | | A | ↵ | | | | | 11 |
| 18 | RESISTANCE | R | E | S | | 3 | | 9 | 9 | 9 | | M | O | H | M | ↵ | 15 |
| 19 | RESISTANCE | R | E | S | | 3 | 9 | 9 | . | 9 | | Ω | H | M | ↵ | | 14 |
| 20 | RESISTANCE | R | E | S | | O | L | ↵ | | | | | | | | | 7 |
| 21 | CONTINUITY | B | U | Z | | S | H | O | R | T | ↵ | | | | | | 10 |
| 22 | CONTINUITY | B | U | Z | | O | P | E | N | ↵↵ | | | | | | | 9 |
| 23 | DIODE | D | I | O | | O | P | E | N | ↵↵ | | | | | | | 9 |
| 24 | DIODE | D | I | O | | S | H | O | R | T | ↵ | | | | | | 10 |
| 25 | DIODE | D | I | O | | G | O | O | D | ↵ | | | | | | | 9 |
| 26 | LOGIC | L | O | G | | L | O | W | ↵↵ | | | | | | | | 8 |
| 27 | LOGIC | L | O | G | | H | I | G | H | ↵ | | | | | | | 9 |
| 28 | LOGIC | L | O | G | | U | N | D | E | T | ↵ | | | | | | 10 |
| 29 | FREQUENCY | F | R | | 9 | . | 9 | 9 | 9 | | M | H | z | | | | 13 |
| 30 | FREQUENCY | F | R | | 9 | . | 9 | 9 | 9 | | K | H | z | | | | 13 |
| 31 | CAPACITANCE | C | A | P | | 9 | 9 | | 9 | 9 | | F | | | | | 13 |
| 32 | CAPACITANCE | C | A | P | | O | L | ↵ | | | | | | | | | 7 |
| 33 | INDUCTANCE | I | N | D | | 9 | 9 | . | 9 | 9 | | H | ↵ | | | | 12 |
| 34 | INDUCTANCE | I | N | D | | O | L | ↵ | | | | | | | | | 7 |
| 35 | TEMPERATURE | T | É | M | P | | 0 | 0 | 2 | 5 | | ^ | C | ↵ | | | 13 |
| 36 | TEMPERATURE | T | E | M | P | | - | O | 0 | 2 | 5 | | ^ | C | ↵ | | 14 |

**Note**

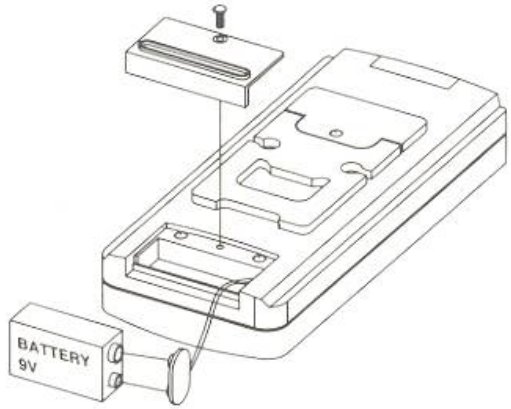
1) This is a format of the data sent out from the meter to a personal computer.
2) Each function data consists of 6 to 15 bytes as shown above.
3) Each byte has ACSII code corresponding to each charactor or number, and the last byte has a ASCII code (13) for carriage return(↵).

# MAINTENANCE

## 1 GENERAL

1. Do not use abrasives or solvents and Periodically wipe the case with a damp cloth and detergent.
2. Calibrate the meter once a year to maintain its accuracy specification.

## 2 BATTERY REPLACEMENT

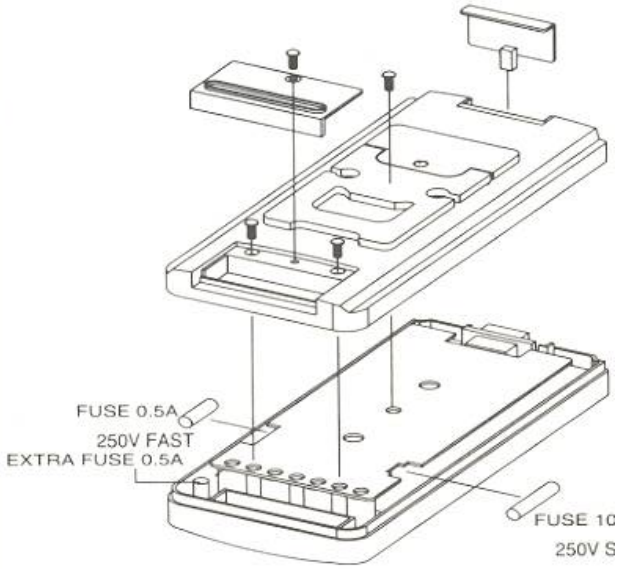



Replacing the Battery should be done according to these steps.

1. Remove the test leads from the input sockets, and turn off the power on/off switch.
2. Remove the screw from the battery cover.
3. Lift the battery cover and the discharged battery from the case.
4. Carefully disconnect the battery snap connecter.
5. Snap the battery connector to the new battery terminals.
6. Reinsert the new battery into the case and be careful so that the battery leads are not pinched between the case and cover.
7. Replace the cover and reinstall the screw with a screw driver.



## 3 FUSE REPLACEMENT




Replacing the defective fuses should be done according following procedure.

1. To avoid electrical shock, remove the test leads and any signal before opening the case.
2. Remove the battery cover screw, and remove the three from the buttom case.
3. Lift the buttom case until it gently unsnaps from the top ca

4. Remove the defective fuse by gently prying loose one end of the fuse and sliding the fuse from the fuse holder.
5. Install a new fuse of the same size and rating. Ensure that the new fuse is centered in the fuse holder.
6. Replace the buttom case, and reinstall all the screws.

**Note**

Testing the internal fuse

1) Plug a test lead into the V input socket and touch the test lead tip to the mA input socket.
2) Set the rotary switch to Ω. The display should read between 0 and 1 Ω.
   A defective fuse will display reading more than 1 Ω.
3) 20A input socket contain split contacts, ensure that the test lead tips is touched to the left half of the input socket.

## 4 CALIBRATION

1. Remove the bottom case by performing the steps from 1 through 3 in the fuse replacement procedure.
2. Proceed in the order listed below.
   These adjustments should be done only by a qualified service personnel and only with appropiate equipment (Calibrator, decade box etc.)

| No | Adjust | Symbol | Rotary SW | Source |
|---|---|---|---|---|
| 1 | VR2 | VreF | DCmV | 300mVDC |
| 2 | VR5 | DCV | DCV | 300VDC |
| 3 | VR3 | T-RMS | ACV | 300VAC 60Hz |
| 4 | VR1 | 20A | DC20A | 10ADC |
| 5 | VR4 | Temp | Temp | Thermometer |
| 6 | VR7 | C | ⊣⊢/Ω | Decade Capacitance |
| 7 | VR6 | L | ⊣⊢/Ω | Decade Inductance |



## 5 REPLACEMENT PARTS & ACCESSORIES

1. Replacement parts

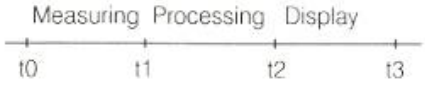
| No | P/Cord | Name | Description | Unit | Q'ty | Remark |
|---|---|---|---|---|---|---|
| 1 | D21066 | Fuse | 0.5A/250V Pi5.0 × 20mm | EA | 2 | FAST BLOW |
| 2 | D21099 | Ceramic Fuse | 10A/250V pi6.5 × 31.8mm | EA | 1 | SLOW BLOW |
| 3 | D10204 | B/L PCB | 50X66X0.8T XPC | EA | 1 | Back Light |
| 4 | D10212 | B/L PCB(A) | PCB T1.0 3LED | EA | 2 | LED Chip |
| 5 | D13094 | LCD | LS-0919A | EA | 1 | |
| 6 | Y08086 | Top Case | ABS | EA | 1 | |
| 7 | Y08080 | Bottom Case | ABS | EA | 1 | |
| 8 | T44193 | Battery Cover | ABS | EA | 1 | |
| 9 | Y05325 | Knob | ABS | EA | 1 | |
| 10 | T44191 | Tilt Stand | ABS | EA | 1 | |
| 11 | T44211 | Stand Holder | ABS | EA | 1 | |
| 12 | T44192 | Connector Cover | ABS | EA | 1 | |
| 13 | D21092 | M/Screw | FH(+) M2.6 Black | EA | 1 | |
| 14 | D21091 | M/Screw | PH(+) M3 Black | EA | 1 | |
| 15 | D21093 | M/Screw | PH(+) M3 Black | EA | 3 | |
| 16 | T44194 | Key Pad | Rubber | EA | 1 | |
| 17 | T44195 | LCD Cover | Acryl | EA | 1 | |
| 18 | T42106 | Connector | RS232 Connector | EA | 1 | D-Sub, 9P |

2. Accessories

| No | P/Cord | Name | Description | Unit | Q'ty | Remark |
|---|---|---|---|---|---|---|
| 1 | D19036 | Test Lead | | EA | 1 | |
| 2 | D19065 | RS232 Cable | 6ft, D-Sub 9/9 | EA | 1 | |
| 3 | D30035 | Diskette | 3.5" | EA | 1 | |
| 4 | A03640 | Carrying Case | | EA | 1 | |
| 5 | D29074 | Manual | Instruction Manual | EA | 1 | |
| 6 | D18155 | Holster | PVC | EA | 1 | Option |
| 7 | Y03063 | Temp. Probe | "K" type | EA | 1 | Option |
| 8 | Y08070 | Temp. Adaptor | | EA | 1 | Option |

# NOTE

## <Sampling Rate Spec>




1. Defimition

| SYM | TIME | DESCRIPTION | USE |
|---|---|---|---|
| T1 | t1 - to | A/D Converasion or Digital Count For Hz, C&L | Minimum time to capture measurement data |
| T2 | t2 - to | T1 + $\mu$-C operation time for calculation | Updating for MAX, MIN & AVG or Bargraph |
| T3 | t3 - to | Total Udate rate for easy Visual reading time for more than 0.3sec | Updating for measurement diaplay or for RS232 Serial data |

2 Sampling Time

| FUNCTION | | T1 | T2 | T3 |
|---|---|---|---|---|
| 1. A/D Conversion for V, Ω, A Diode, Temp | | 50ms | 125ms | 350ms |
| 2. Frequency Count for Hz | | 1sec | 1.1sec | 1.1sec |
| 3. Time Constant | Capacitor | 0.33 ~ 1sec | 0.35 ~ 1.1sec | 0.35 ~ 1.1sec |
| | Inductor | 0.7 ~ 1.4sec | 0.9 ~ 1.5sec | 0.9 ~ 1.5sec |