

## ***3 axis***

***100 KHz to 3 GHz Radio Frequency Radiation Meters  
Electromagnetic Field strength measurement***

# **RF ELECTROMAGNETIC FIELD METER**

**Model : PCE-EM 30**



Your purchase of this RF EMF METER marks a step forward for you into the field of precision measurement. Although this METER is a complex and delicate instrument, its durable structure will allow many years of use if proper operating techniques are developed. Please read the following instructions carefully and always keep this manual within easy reach.

# **OPERATION MANUAL**

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# 1. FEATURES

- \* 3 Axis probe.
- \* Radio frequency electromagnetic field tester.
- \* Wide measuring frequency ranges, 100 KHz to 3 GHz.
- \* PCE-EM 30 is used for broadband devices of monitoring the wide range radio frequency electromagnetic field value.
- \* For precision measurement consideration, the meter is included two probes :  
EP-04L ( Low frequency Probe, 100 KHz to 100 MHz )  
EP-03H ( High frequency Probe, 100 MHz to 3 GHz )
- \* Unit : V/m, W/m<sup>2</sup>, mW/cm<sup>2</sup>.
- \* Alarm setting function can warn the user if the measuring antenna is too near the strong radiation sources, the buzzer will sound to remind the user.
- \* Peak hold function to latch peak value.
- \* Data hold function to lock the current reading.
- \* RS232 computer interface.
- \* Real time data logger, build in clock ( hour-MIN-sec., year-month-date ).
- \* Auto or manual data record, 16,000 Data logger no.
- \* Wide sampling time adjustment range from one second to 8 hours 59 minutes 59 seconds.
- \* Heavy duty hard carry case.
- \* Large size LCD with contrast adjustment, which can fit best viewing angle.
- \* Microcomputer circuit provides special function & offers high accuracy.
- \* Powered by 006P DC 9V battery or DC 9V adapter.

## 2. APPLICATIONS

This meter is specially developed for measuring or monitoring electromagnetic field, for example: cell-phone station, hospital equipment, radar , micro-wave oven, radiation work, TV antenna , Radio station , welding equipment , baking- equipment, television , computer , factory, laboratory , and other environment...etc.

## 3. SAFETY INSTRUCTIONS

### ***Danger***

- \* For worker's safety, be aware that persons with electromagnetic implant ( e.g. cardiac-pacemaker ) are subject to especial danger in some case.
- \* Particular to observe the local safety regulations of the operator of the equipment.
- \* Before using the device, it need to know that how to setting " alarm-limit " value ( refer to page 12 ).

### ***Attention***

- \* Claims by some scientists that long term exposure to electromagnetic field may be the cause of childhood leukemia & other forms of cancer.
- \* Complete answers to any of these and related questions are not currently available. At the present time the most common practice is to avoid excess exposure over long period of time.

- \* Complete answers to any of these and related " Prudent Avoidance " as stated by the Environmental Protection Agency(EPA) USA is recommended.
- \* According to ICNIRP of reference levels to time-varying electromagnetic fields, The E-field strength levels are:

### **General public**

<b>Frequency range</b>	<b>e-field strength (V/m)</b>
3 to 150 kHz	87
0.15 to 1 MHz	87
1 to 10 MHz	$87/f^{1/2}$
10 to 400 MHz	28
400 to 2000 MHz	$1.375 \times f^{1/2}$
2 to 300 GHz	61

### **Occupational**

<b>Frequency range</b>	<b>e-field strength (V/m)</b>
65 to 1000 kHz	610
1 to 10 MHz	$610/f$
10 to 400 MHz	61
400 to 2000 MHz	$3 \times f^{1/2}$
2 to 300 GHz	137

## 4. SPECIFICATIONS

### 4-1 General Specifications

Circuit	Custom one-chip of microprocessor LSI circuit.	
Display	LCD size : 58 mm x 34 mm.	
Measurement Unit	V/m, mW/cm <sup>2</sup> , W/m <sup>2</sup> .	
Accuracy	< 2 dB.	
Probe structure	3 Axis.	
Probe Type Selection	EP-03H : 100 MHz to 3 GHz. EP-04L : 100 kHz to 100 MHz.	
Probe Input Impedance	50 OHM	
Frequency Selection Points	EP-03H: 900 MHz, 1 GHz, 1.8 GHz, 2.4 GHz, 2.45 GHz, 3 GHz. EP-04L: 100kHz, 200kHz, 500kHz, 1MHz, 10MHz, 13.56MHz, 100MHz.	
Sensor Structure	Semiconductor	
Sampling Time of Data Logger	Manual	Press the data logger button once will save data one time. <i>* Set the sampling time to 0 second</i>
	Auto	1 sec to 8 hour 59 min. 59 sec.
Data Hold	Freeze the display reading.	
REC Function	Record Maximum & Minimum value.	
Power off	Auto shut off saves battery life or manual off by push button. <i>* Can default auto power off or manual power off.</i> <i>* When default auto power off , power will off automatically after 10 min. if no button be pressed.</i>	

Peak Hold	To latch the peak measurement value.
Alarm Setting	Buzzer will sound when display over the setting value.
Sampling Time	Approx. 1 second.
Low Battery Indicator	When display show Low battery Indicator, it should change the batteries.
Data Output	RS 232 PC serial interface.
Operating Temperature	0 to 50 °C.
Operating Humidity	Less than 80 %RH.
Power Supply	DC 9 V battery ( 006P ) * <i>Heavy duty or Alkaline type.</i>
	DC 9V adapter input.
Power Current	Approx. DC 5.95 mA
Weight	523 g/ 1.16 LB.
Dimension	<i>Main instrument :</i> 200.0 x 76.2 x 36.8 mm <i>Probe :</i> 70 mm ( diameter) x 290 mm ( length)
Accessories Included	Instruction manual..... 1 PC EP-03H Probe..... 1 PC EP-04L Probe..... 1 PC Memory card for EP-03H..... 1 PC Memory card for EP-04L..... 1 PC Hard carrying case..... 1 PC DC 9V power adapter..... 1 PC
Optional Accessories	RS232 cable, UPCB-02. USB cable, USB-01. Data Acquisition software, SW-U801-WIN.



#### **4-2 Electrical Specifications ( 23 ± 5 °C )**

<b>Strength Range</b>	<b>Resolution</b>	<b>Effective Value</b>
0 to 200.00 V/m	0.01 V/m	> 1 V/m
0 to 99.999 W/m <sup>2</sup>	0.001 W/m <sup>2</sup>	> 0.03 W/m <sup>2</sup>
0 to 9.9999 mW/cm <sup>2</sup>	0.0001 mW/cm <sup>2</sup>	> 0.0003 mW/cm <sup>2</sup>

<b>Frequency Range</b>	<b>Accuracy</b>	<b>Test Point</b>	<b>Probe NO"</b>
100 KHz to 100 MHz	< 2 dB	30 V/m	EP-04L
50 MHz to 2.5 GHz	< 2 dB	60 V/m	EP-03H

**Remark:**

- \* Measurement under other frequency range ( below 400 KHz and over 2.5 GHz ), the reading value just for reference only.*
- \* For precision measurement consideration, it should select the " Frequency Team point " near the frequency value of measuring object.*

## 5. FRONT PANEL DESCRIPTION

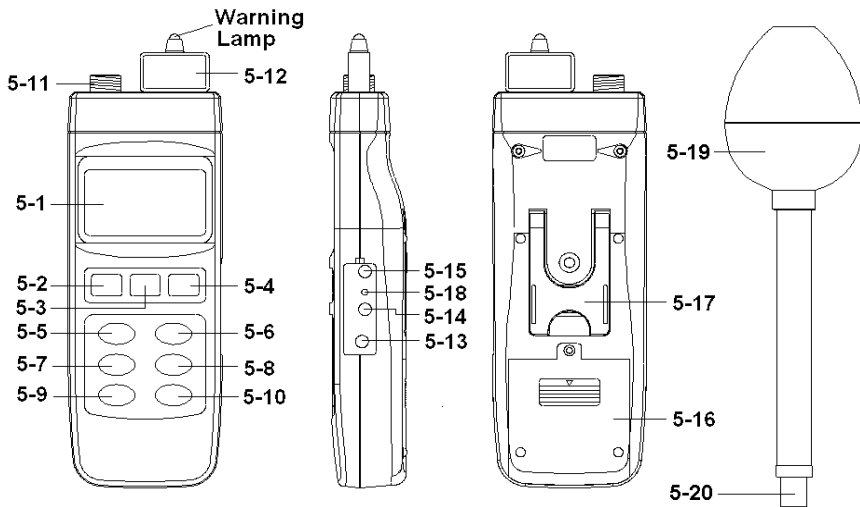


Fig. 1

- |                              |                              |
|------------------------------|------------------------------|
| 5-1 Display                  | 5-11 Probe Input Socket      |
| 5-2 Power Button             | 5-12 Probe Memory Card       |
| 5-3 Hold / Esc Button        | 5-13 DC Adapter Input Socket |
| 5-4 REC / Enter Button       | 5-14 RS-232 Output Terminal  |
| 5-5 Freq. Team Select Button | 5-15 LCD contrast adj.       |
| 5-6 Unit Button              | 5-16 Battery Cover           |
| 5-7 Peak Hold Button         | 5-17 Stand                   |
| 5-8 Alarm Set / Start Button | 5-18 Reset Button            |
| 5-9 Time / Send Button       | 5-19 Probe Sensing Head      |
| 5-10 Logger / Set Button     | 5-20 Probe Plug              |

## 6. MEASUREMENT CONSIDERATION

1) According to the measuring object's frequency to select the right probe :

EP-03H probe : 100 MHz to 3 GHz.

EP-04L probe : 100 kHz to 100 MHz.

2) After select convenient the probe, then plug in the exclusive " Probe Memory Card " ( 5-12, Fig. 1 ) into the front end socket of meter.

**Remark :**

*\* Probe memory card is saved the Probe's character into the internal memory circuit.*

*\* EP-03H and EP-04L has its own exclusive " Probe Memory card ", do not plug the wrong card, otherwise the accuracy will exist the deviation.*

\* Make sure to use the " Frequency Team Button " ( 5-5, Fig. 1 ) to select the convenient frequency value of measuring object.

However if you don't know the exact information, the meter will default to 1 GHz ( EP-03H probe ) or 1 MHz ( EP-04L probe ) after power on.

3) The meter is build in the 3 axis ( X, Y, Z ) EMF sensors, the circuit measure each X, Y, Z sensor's EMF value, then the CPU will calculate the total EMF value according the following formula :

$$\sqrt{X^2 + Y^2 + Z^2}$$


X : The EMF value that sensing from the X direction.

Y : The EMF value that sensing from the Y direction.

Z : The EMF value that sensing from the Z direction.

## 7. MEASURING PROCEDURE

### 7 -1 Buttons instructions

<b>Buttons</b>	<b>Function</b>
Power Button	Press this key to power on or off.
Hold Button	Press this key to freeze the reading value.
ESC Button	When operate " SET " or " Data logger " functions, press this key to escape..
REC Button	Press this key to record maximum or minimum value.
Enter Button	When operate " SET " or " Data logger " functions, press this key to enter value.
Freq. Team Button	Press this key to select the convenient object's frequency value.
Unit Button	Press this key to select V/m, W/m <sup>2</sup> , mW/cm <sup>2</sup> of strength units.
Peak Hold Button	Press this key to latch peak value during the measurement.
Alarm Set /Start Button	Press this key to setting alarm high/low limit or start alarm function.
Send Button	After operate " Data Logger " function, press this key to send data out.
Logger Set Button	Under " REC " function, press this key to execute data logger.
	Press this key to indicate date and time.

## 7 -2 Symbols & units of display

<b><i>Symbol &amp; Unit</i></b>	<b><i>Function</i></b>
V/m	Electric field strength
W/m <sup>2</sup>	Power density
mW/cm <sup>2</sup>	Power density
100kHz..... .....3GHz	Frequency team indicates.
PEAK HOLD	Appears on the " PEAK HOLD " function. It will latch the peak value.
REC	Appears on the " REC " function, it will record maximum and minimum value.
HOLD	Appears on the " HOLD " function, it will freeze the present reading.
Alarm setting low limit	Appear on the " Alarm setting Low limit " function.
Alarm setting High limit	Appears on the "Alarm setting High limit" function.
Alarm setting hysteresis	Appears on the "Alarm setting hysteresis " function.
Sample time	Appears on the " Sample time" function, It indicate sample time that already be set.
Flash unit on the display	Appears on the " START " function, it indicate the ALARM FUNCTION has starting.

### **7-3 Unit Selection**

After inserting the " Probe card " ( 5-12, Fig. 1 ) and connecting probe's plug into the " Probe Input Socket " ( 5-11, Fig. 1 ), use " Unit Button " ( 5-6, Fig. 1 ) to select the " V/m, W/m<sup>2</sup>, mW/cm<sup>2</sup> ".

### **7-4 Frequency Teams Selection**

1) Use the " Freq. Team Button " ( 5-5, Fig. 1 ) to select the approx. measuring object frequency value.

EP-03H probe, frequency select points :

900 MHz, 1 GHz, 1.8 GHz,  
2.4 GHz, 2.45 GHz, 3 GHz.

EP-04L probe, frequency select points :

100 KHz, 200 KHz, 500 KHz, 1 MHz,  
10 MHz, 13.56 MHz, 100 MHz.

2) Make sure to use the " Frequency Team Button " ( 5-5, Fig. 1 ) to select the convenient frequency value of measuring object. However if you don't know the exact information, the meter will default to 1 GHz ( EP-03H probe ) or 1 MHz ( EP-04L probe ) after power on.

### **7-5 To see the individual axis' measuring EMF value**

Typical the meter is to present the total EMF value of XYZ direction ( refer to page 8 ), however if intend to see the individual EMF value of X, Y, Z direction, the procedures are :

1) Power off the meter, use two fingers to press the " Alarm Button " ( 5-8, Fig. 1 ) and the " Logger Button " ( 5-10, Fig. 1 ) together continuously, then power on the meter by press the " Power Button " ( 5-2, Fig. 1 ).

After power on, release all the fingers.

2)\* Press the " Unit Button " ( 5-6, Fig. 1 ) continuously and > 2 seconds, the bottom display will show X\_axis , then release the button, the upper display will show the EMF value of X direction.

- \* Press the " Unit Button " ( 5-6, Fig. 1 ) continuously and > 2 seconds, the bottom display will show X\_axis , then release the button, the upper display will show the EMF value of X direction.
- \* Press the " Unit Button " ( 5-6, Fig. 1 ) continuously and > 2 seconds, the bottom display will show X\_axis , then release the button, the upper display will show the EMF value of X direction.
- \* Press the " Unit Button " ( 5-6, Fig. 1 ) continuously and > 2 seconds, the bottom display will show " V/m " , then release the button, the upper display will show the total EMF value of XYZ direction ( refer page 8 ).

#### ***7-6 Alarm limit setting and Alarm start***

- 1) Press the "Alarm Button " ( 5-8, Fig. 1 ) once to start the alarm function, while the " units " symbol will flash on the display.
- 2) Press the " Alarm Button " ( 5-8, Fig. 1 ) once again to stop the alarm function.
- 3) Press the " Alarm Button " ( 5-8, Fig. 1 ) continuously and over 2 seconds, the "Alarm low limit value " will indicate on the lower display, use the " ▼, ▲ Buttons " to adjust the desiring low limit value.
- 4) Press the " Enter Button " ( 5-4, Fig. 1 ) will save the low limit value and going to adjust the " High limit value, procedures will similar as above.
- 5) After finish the " High limit value " adjustment, press the " Enter Button " ( 5-4, Fig. 1 ) will save the high limit value and going to adjust the alarm Hysteresis value, procedures will similar as above. Upon finish the alarm " Hysteresis value " adjustment, press the " Enter Button " ( 5-4, Fig. 1 ) will save the data.
- 6) Press the " ESC Button " ( 5-3, Fig. 1 ) to finish alarm setting procedures.

### **7-7 Data hold**

During the measurement, press the " Hold Button " ( 5-3, Fig. 1 ) once will hold the measured value & the LCD will indicate a " HOLD " symbol.

Press the " Hold Button " once again will release the data hold function.

### **7-8 Data Record ( Max., Min. reading )**

- \* The data record function records the maximum and minimum readings. Press the " REC Button " ( 5-4, Fig. 1 ) once to start the Data Record function and it will be a " REC " symbol on the display.
- \* When the " REC " symbol on the display :
  - a) Press the " REC Button " ( 5-4, Fig. 1 ) once, the " REC MAX " symbol along with the maximum value will appear on the display.  
Press the " REC Button " ( 5-4, Fig. 1 ) once again, the " REC MIN " symbol along with the minimum value.  
If intend to delete the maximum ( Minimum ) value, just press the " Hold Button " ( 5-3, Fig. 1 ) once, then the display will show the " REC " symbol only & execute the memory function continuously.
  - b) To exit the memory record function, just press the " REC Button " ( 5-4, Fig. 1 ) 2 seconds continuously at least. The display will revert to the current reading.

### **7-9 Peak Hold**

Press the " Peak Hold Button " ( 5-7, Fig. 1 ) once to latch peak value on the display , press once again to defect.

### **7-10 Data Logger**

The data logger function can save 16,000 measuring data with the clock time ( Real time data logger), build in clock ( hour-min.-sec., year-month-date ).



### **7-10-1 How to recording data**

- a) If press the Logger Button " ( 5-10, Fig. 1 ) once will show the sampling time value on the bottom left display then disappeared.
- b) Press the " REC Button " ( 5-4, Fig. 1 ) once to start the Data Record function and it will be a " REC " symbol on the display.
- c) **Auto Data Logger ( Sampling time set from 1 second to 8 hours 59 minutes 59 seconds )**  
Press the " Logger Button " ( 5-10, Fig. 1 ) once to start the Auto Data Logger function, at the same the bottom right display will show the indicator " Recording.... ", now the Data Logger function is executed. The upper display will show " DATA " indicator along with " REC " marker.
- d) **Manual Data Logger ( Sampling time set to 0 second )**  
Press the " Logger Button " ( 5-10, Fig. 1 ) once will save the data one time into the memory, at the same time the bottom right display will show the indicator " Recording.... " a while. Now the Data logger function is executed. The upper display will show " DATA " indicator along with " REC " marker.

e) **Memory full**

Under execute the data logger, if the bottom right display show the " Full ", it indicate the memory data already over 16,000 no. and the memory is full.

f) **Stop the Data Logger**

During the Data Logger function is executed, press the " Logger Button " ( 5-10 Fig. 1 ) once will stop to execute the data logger function, the " DATA " indicator will be disappeared.

If press the " Logger Button " ( 5-10, Fig. 1 ) once again will continue the Data Logger function.

*Remark :*

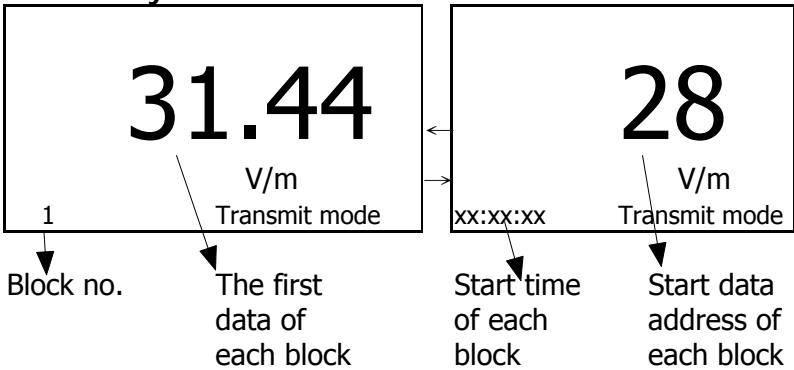
- 1) If intend to change the data logger sampling time, please refer to chapter 8-4., page 21.*
- 2) If intend to know the space of balance data numbers into the memory IC, please refer to chapter 8-1, page 19.*
- 3) If intend to clear the saving data from the memory please refer to chapter 8-2, page 20.*

**7-10-2 How to send data**

If intend to send the data out from the meter, it should cancel the " Hold function " and the " Record function " first. The display will not show the " HOLD " and the " REC " marker.

Press the " SEND Button " ( 5-9, Fig. 1 ) at least 2 seconds until the bottom right display show " Transmit mode ", then release the button.

LCD display will show the following screen alternately.

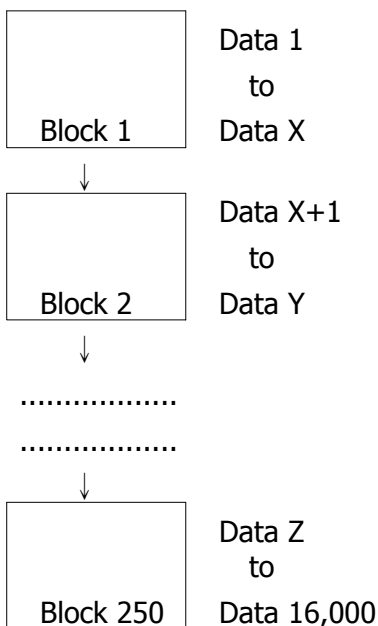


Use ▲ Up Button, ▼ Down Button to select the different data memory block no. ( 1 to 250 ).

*If intend to clear the saving data from the memory please refer to chapter 8-2, page 20.*

**The meter can save 16,000 data max. , those data will saved into 250 memory block max.**

\* The data that save into one routine Data Logger procedures ( Press " REC " button , following press the " Logger " button to save the data, the display will show the " REC " and " DATA " . After save the data, press the " Logger " button, following press the " REC " button will exit the Data Logger function. The " REC " and " DATA " indicator of LCD will be disappeared ).



- \* Until the desired Memory Block no. be selected. Press the " Send Button " ( 5-9, Fig. 1 ) once, the data in the Memory Block will send out. During the data send out, the bottom right display will show the " Sending Data " indicator. When data already send out completely, the bottom right display will show the " Transmit mode " indicator again.
- \* Press the " ESC Button " ( 5-3, Fig. 1 ) will exit the data sending function and return to the normal display.


**Remarks :**

- \* **Optional USB data cable + adaptor + software SOFT-LUT-USB required for data transfer to PC.**
- \* **When sending the data, each time just can send one Memory Block data out. for example block 1 data, block 2 data... or block 250 data.**

### **7-10-3 How to show sample time**

Press the " Logger Button " ( 5-10, Fig. 1) once then display will appear sample time.

### **7-10-4 How to show date and time**

Press the "  button " ( 5-9, Fig. 1 ) once to indicate date and time.

## 8. INTERIOR SETTING MODE

Press the " SET button " ( 5-10, Fig. 1 ) continuously and over two seconds, the display will show :

XXXXX Memory space

Press " SET button " once again

Clear memory  
XX ESC:N Enter:Y

Press " SET button " once again

Date/Time set  
XX:XX:XX ^,v Enter ( > )

Press " SET button " once again

Sample Time  
XX:XX:XX ^,v Enter ( > )

Press " SET button " once again

Autopower OFF  
XXXXX 1:ON, 0:OFF

Press " SET button " once again

ECS > Finish

Press " ESC " to finish.  
or Press " SET button " again to quit.

### ***8-1 Check Memory Space***

To check the balance data numbers that exist into the memory ( allow memorize data no. ).



- \* XXXXX is the balance data numbers, for example  
XXXXX=15417.

### ***8-2 Clear Memory***

- \* To delete the existing save data numbers from the memory.
- \* Press ENTER Button once, then press ENTER Button to confirm.
- \* Press the ESC Button once to quit and return to the main measurement manual.

### ***8-3 Date/Time Setting***

- \* Use ▲ Up Button, ▼ Down Button and Enter ( → ) Button to select the expect Date ( year-month-date ) and the time ( HOUR-MIN.-SEC.).
- \* After finish the Date/Time adjustment, Press the " Enter Button " , then press the " ESC Button " will quit and save the clock data into the memory.

#### ***8-4 Sample Time Setting***

- \* Use ▲ Up Button, ▼ Down Button and Enter ( →) Button to select the expect Sample Time ( HOUR-MIN. -SEC.).
- \* After finish the Sample Time adjustment, Press the " Enter Button " once , then press the " ESC Button " will quit and save the clock data into the memory.

#### ***8-5 Auto Power Off Default Setting***

- \* Use ▲ Up Button, ▼ Down Button to select " 1 " or " 0 ".

1 = Auto power off 0 = Manual power off
--

- \* Press the " Enter Button " once , then press the " ESC Button " to quit.

#### ***8-6 Escape from the SETTING function***

Press the " ESC Button " once a while will quit and return to the normal measurement display.

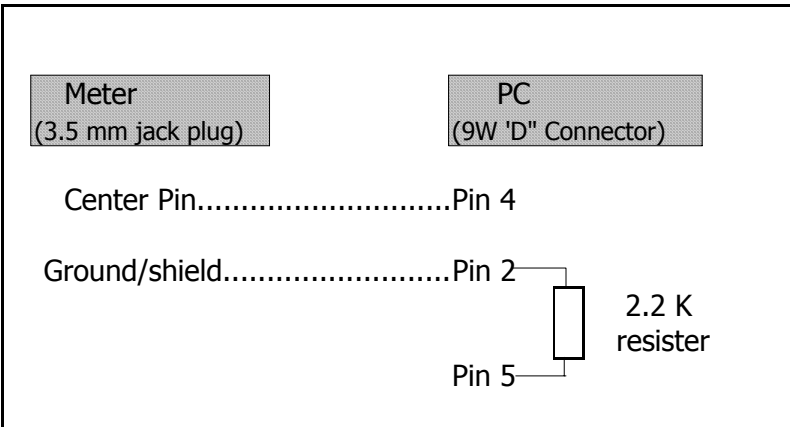


## 9. RS232 PC SERIAL INTERFACE

The instrument has RS232 PC serial interface via a 3.5 mm terminal ( 5-14, Fig. 1 ).

The data output is a 16 digit stream which can be utilized for user's specific application.

A RS232 lead with the following connection will be required to link the instrument with the PC serial port.



The 16 digits data stream will be displayed in the following format :

D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0


**Each digit indicates the following status :**

D0	End Word = 0D
D1 & D8	Display reading, D1 = LSD, D8 = MSD For example : If the display reading is 1234, then D8 to D1 is : 00001234
D9	Decimal Point(DP), position from right to the left 0 = No DP, 1= 1 DP, 2 = 2 DP, 3 = 3 DP
D10	Polarity 0 = Positive 1 = Negative
D11 & D12	Annunciator for Display W/m <sup>2</sup> =A9   mW/cm <sup>2</sup> = A8   V/m = A7
D13	When send the upper display data = 1 When send the lower display data = 2
D14	4
D15	Start Word = 02

**RS232 setting**

Baud rate	9600
Parity	No parity
Data bit no.	8 Data bits
Stop bit	1 Stop bit

## 10. BATTERY REPLACEMENT

When the left corner of LCD display show "  ", it is necessary to replace the batteries ( 006P ).

- 1) Slide the " Battery Cover " ( 5-16, Fig. 1 ) away from the instrument and remove the battery.
- 2) Replace with batteries ( 006P ) and reinstate the cover.
- 3) Make sure the battery cover is secured after changing the battery.

## 11. SYSTEM RESET

If the meter happen the troubles such as :

*CPU system is garbled ( for example, the key button can not be operated..... ).*

Then make the system RESET will fix the problem.  
The system RESET procedures will be either following method :

**During the Power On, used a pin tool to push the " System Reset " button ( 5-18, Fig. 1 ) once.**