TDS (Total dissolved solids),Salt,Hardniss,Resister

CONDUCTIVITY METER

Model : CD-4309

Your purchase of this CONDUCTIVITY METER marks a step forward for you into the field of precision measurement. Although this meter 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

TABLE OF CONTENTS

1. FEATURES

* One meter for multi purpose operation : Conductivity, TDS (Total dissolved solids), Salt , Hardness , Resistance measurement.
* Conductivity : 20 uS/ 200 uS/2 mS/20 mS/200 mS.
* Salt : 0 to 12 % salt (% weight).
* Hardness : 0 to 100,000 ppm .
* Resistance : 5 ohm to 99.99 M ohm .
* Conductivity measurement can select Temp. Coefficient of measurement solution.
* ATC for the conductivity measurement.
* Separate probe, easy for operation of different measurement environment.
* LCD with green light backlight, easy reading.
* It can default auto power off or manual power off.
* Data hold, record max. and min. reading.
* Microcomputer circuit, high accuracy.
* Power by UM3/AA (1.5 V) x 6 batteries or DC 9V adapter.
* RS232/USB PC COMPUTER interface.
* Wide applications: water conditioning, aquariums,beverage, fish hatcheries, food processing, photography,laboratory, paper industry, plating industry, quality control, school & college, water conditioning.

2. SPECIFICATIONS

2-1 General Specifications

Circuit	Custom one-chip of microprocessor LSI circuit.
Display	LCD size : 52 mm x 38 mm LCD with green backlight (ON/OFF).
Measurement Function	* Conductivity (uS, mS) * TDS (Total Dissolved Solids, PPM) * Salt (% Weight) * Temperature (℃,℉)
Temperature Compensation	Automatic from 0 to 60 ℃ (32 - 140 ℉), with temperature compensation factor variable between 0 to 5.0% per C.
Conductivity Probe	Pt glass electrode for long life. Hight performance for the low conductivity (pure water) measurement.
Advanced setting	* Set clock time (Year/Month/Date,Hour/Minute/ Second) * Auto power OFF management * Set beep Sound ON/OFF * Set temperature unit to ℃ or ℉ * Set CD temperature compensation factor * Set probe CELL K Value
Data Hold	Freeze the display reading.
Memory Recall	Maximum & Minimum value.

Sampling Time of Display	Approx. 1 second.	
Data Output	RS 232/USB PC computer interface. ** Connect the optional RS232 cable UPCB-02 will get the RS232 plug.* ** Connect the optional USB cable USB-01 will get the USB plug.*	
Operating Temperature	Meter	0 to 50 ℃.
	Probe	0 to 60 ℃.
Operating Humidity	Less than 85% R.H.	
Power Supply	* Alkaline or heavy duty DC 1.5 V battery (UM3, AA) x 6 PCs, or equivalent.	
	* DC 9V adapter input. (AC/DC power adapter is optional).	
Power Current	Normal operation (w/o SD card save data and LCD Backlight is OFF) : *Approx. DC 6 mA.*	
	** If LCD backlight on, the power consumption will increase approx. 12 mA.*	
Weight	489 g/1.08 LB.	
Dimension	Meter	177 x 68 x 45 mm (7.0 x 2.7x 1.9 inch)
	Probe	Round, 22 mm Dia. x 120 mm length.
Accessories Included	* Instruction manual..... 1 PC * Conductivity/TDS/Salt pt glass probe, CDPB-04..... 1 PC * Hard carrying case (CA-06)..... 1 PC	

Optional Accessories	* 1.413 mS Conductivity Standard Solution.....CD-14 AC to DC 9V adapter. USB cable, USB-01. RS232 cable, UPCB-02. Data Acquisition software,SW-U801-WIN.

2-2 Electrical Specifications (23±5℃)

Conductivity (uS, mS)

Range	Measurement	Resolution	Accuracy
20 uS	0 to 20.00 uS	0.01 uS	
200 uS	0 to 200.0 uS	0.1 uS	
2 mS	0.2 to 2.000 mS	0.001 mS	±(2% F.S.+1d)
20 mS	2 to 20.00 mS	0.01 mS	* F.S. -
200 mS	20 to 200.0 mS	0.1 mS	full scale

** Temperature Compensation :*
Automatic from 0 to 60 ℃ (32 - 140 ℉), with temperature compensation factor variable between 0 to 5.0% per C.
** The accuracy is specified under measurement value ≦ 100 mS.*
** mS - milli Simens * @ 23±5℃*

TDS (Total Dissolved Solids)

Range	Measurement	Resolution	Accuracy
20 PPM	0 to 13.20 PPM	0.01 PPM	
200 PPM	0 to 132 PPM	0.1 PPM	
2,000 PPM	132 to 1,320 PPM	1 PPM	±(2% F.S.+1d)
20,000 PPM	1,320 to 13,200 PPM	10 PPM	* F.S. -
200,000 PPM	13,200 to 132,000 PPM	100 PPM	full scale

** Temperature Compensation :*
Automatic from 0 to 60 ℃ (32 - 140 ℉), with temperature compensation factor variable between 0 to 5.0% per ℃.
** The accuracy is specified under measurement value ≦ 66,000 PPM.*
** PPM - parts per million * @ 23±5℃*

Temperature

Function	Measuring Range	Resolution	Accuracy
℃	0 ℃ to 60 ℃	0.1 ℃	±0.8 ℃
℉	32 ℉ to 140 ℉	0.1 ℉	±1.5 ℉
* @ 23±5℃			

Salt

Measurement Range	0 to 12 % salt (% weight).
Resolution	0.01 % salt.
Accuracy	± 0.5 % salt value

Hardness

Range	Measurement	Resolution	Accuracy
10 PPM	0 to 10.00 PPM	0.01 PPM	
100 PPM	0 to 100 PPM	0.1 PPM	
1,000 PPM	100 to 1,000 PPM	1 PPM	±(2% F.S.+1d)
10,000 PPM	1,000 to 10,000 PPM	10 PPM	* F.S. -
100,000 PPM	10,000 to 100,000 PPM	100 PPM	full scale

Resistance

Range	Measurement	Resolution	Accuracy
automatic Range	5 ohm to 99.99 M ohm	1 ohm 0.01 M ohm	±(2% F.S.+1d) * F.S. -full scale

3. FRONT PANEL DESCRIPTION

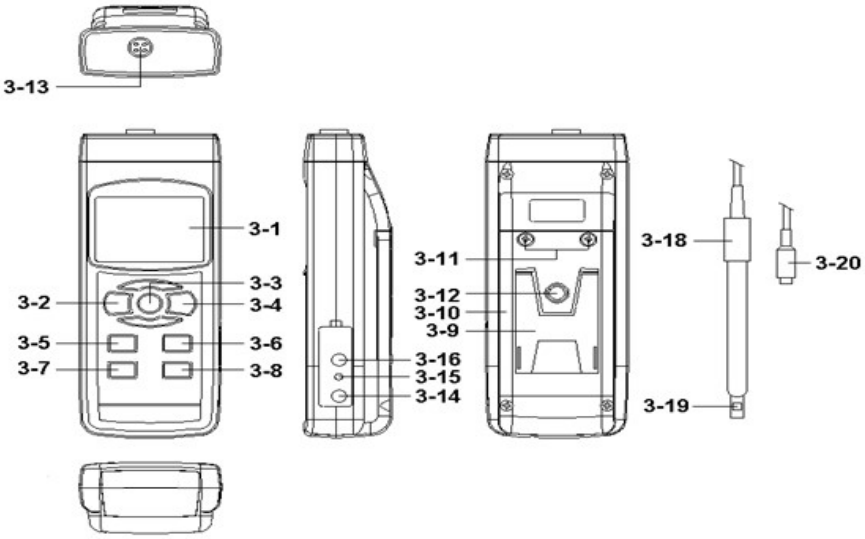


Fig.1

3-1 Display
3-2 Power Button (Backlight Button)
3-3 Hold Button
3-4 REC Button
3-5 Range Button (▲ Button)
3-6 Function Button (▼ Button)
3-7 Time Button (SET Button)
3-8 Enter Button
3-9 Stand
3-10 Battery Compartment/Cover
3-11 Battery Cover Screw
3-12 Tripod Fix Nut
3-13 Probe Socket
3-14 DC 9V Power Adapter Input Socket
3-15 Reset Button
3-16 RS-232 Output Terminal
3-18 Probe Handle
3-19 Sensing head
3-20 Probe Plug

4. FUNCTION SELECTION

1) Power ON the meter by pressing and holding the " Power Button " (3-2, Fig. 1)for at least 1.5 seconds .

   * *Pressing the " Power Button " (3-2, Fig. 1) continuously and > 1.5 seconds again will turn off the meter.*

2) The meter can select 5 kind Mode as :

   a. Conductivity measurement
   b. TDS measurement
   c. Salt measurement
   d. Hardness measurement
   e. Resistance measurement

   pressing and holding the " FUNCTION Button " (3-6, Fig. 1) continuously , Display will show the following text in sequence :

CD	**Conductivity measurement**
TDS	**TDS measurement**
SALT	**Salt measurement**
HD	**Hardness measurement**
R	**Resistance measurement**

Until the Display show the desired mode the meter will execute this FUNCTION with default.

5. CONDUCTIVITY/TDS MEASURING and CALIBRATION PROCEDURE

The meter default function are following :

* The display unit is set to conductivity (uS, mS).
* The temperature unit is set to ℃.
* Temp. compensation factor is set to 2.0% per C.
* Auto range.
* Auto power off disable.

Fig. 2

5-1 Conductivity measurement

1) Prepare the Conductivity Probe (CDPB-04, standard accessory, included), install the " Probe Plug " (3-20, Fig. 1) into the " Probe Socket " (3-13, Fig. 1).
2) Power on the meter by pressing and holding " Power Button " (3-2, Fig. 1) for at least 1.5 seconds .
   Select the Meter's measurement FUNCTION to " CD " (Conductivity measurement), refer to chapter 4, page 7 .
3) Hold the " Probe Handle " (3-18, Fig. 1) by hand and let the " Sensing head " (3-19, Fig. 1) immersed wholly into the measured solution. Shake the probe to let the probe's internal air bubble drift out from the sensing head.
   Display will show the conductivity mS (uS) values. at the same time the left bottom display will show the Temp. value of the measured solution.

Manual range operation

The meter is default to be used for the auto range mode. by pressing and holding the " Range Button " (3-5, Fig. 1) continuously in sequence will change the range from 20uS , 200 uS, 2 mS , 20 mS, 200 mS and auto range.

Change the Temp. unit to ℉

If intend to change the Temp. unit from ℃ to ℉, please refer to chapter 8-4 page 18.

Change the Temp. Coefficient Factor

The default Temp. compensation factor value of the measurement solution is to 2.0% per ℃. If intend to change it, please refer to chapter 8-5, page 18 .

Zero adjustment

If the probe not immerse the measurement solution and display not show zero value, pressing the " HOLD Button " (3-3, Fig. 1) continuously at least 10 seconds will let display show zero. The zero function only valid for the 20 uS range and the not zero value is < 2.0 uS.

5-2 TDS (PPM) measurement

The measuring procedures are same as above *5-1 Conductivity (uS, mS) measurement,* except to change the display unit from uS, mS to PPM. The detail procedures please refer chapter 4, page 7 .

5-3 Calibration

conductivity Calibration

1) Prepare the standard conductivity solution (optional)
   For example :
   2 mS range calibration solution :
   1.413 mS Conductivity Standard Solution, CD-14
   200 uS range calibration solution :
   80 uS Conductivity Standard Solution
   20 mS range calibration solution :
   12.88 mS Conductivity Standard Solution
   or other Conductivity Standard Solution
2) Install the " Probe Plug " (3-20, Fig. 1) into the " CD Socket " (3-13, Fig. 1).

3) Power on the meter by pressing " Power Button " (3-2, Fig. 1) once.
4) Hold the " Probe Handle " (3-18, Fig. 1) by hand and let the " Sensing head " (3-19, Fig. 1) immersed wholly into the measured solution. Shake the probe to let the probe's internal air bubble drift out from the sensing head.
Display will show the conductivity mS (uS) values.
5) Use the two fingers to press the " ▲ Button " (3-5, Fig. 1) " , and " ▼ Button " (3-6, Fig. 1) at the same time. the display will show the following screen as example(Fig. a), release the both fingers , then Press the " Enter Button " (3-8, Fig. 1) , the display will show the following screen as example (Fig. b).

Fig. a

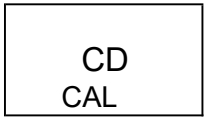
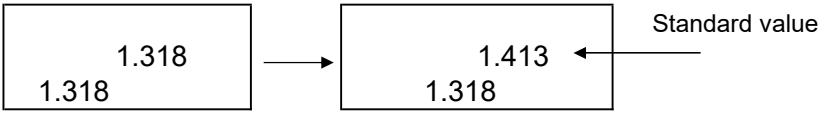


Fig. b

6) Press the " Enter Button " (3-8, Fig. 1), the measuring value will present on both upper and lower Display. Use "▲ Button " (3-5, Fig. 1), " ▼ Button " (3-6, Fig. 1) to adjust the up display value exact same as the standard conductivity value. Press the " Enter Button " (3-8. Fig. 1)will save the calibration data and finish the calibration procedures.



**** If only intend to make the one point calibration, just execute the 2 mS range (1.413 mS Cal.) is enough.***

**** Multi-points calibration procedures should execute the 2 mS range (1.413 mS Cal.) calibration at first, then make other ranges (20 uS range, 20 mS range or 200 mS range) calibration procedures following if necessary.***

Temprature Calibration

1) Install the " Probe Plug " (3-20, Fig. 1) into the " CD Socket " (3-13, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-2, Fig. 1) once.
3) Hold the " Probe Handle " (3-18, Fig. 1) by hand and let the " Sensing head " (3-19, Fig. 1) immersed wholly into the measured solution. Shake the probe to let the probe's internal air bubble drift out from the sensing head.
   Display will show the conductivity mS (uS) and Temprature values.

5) Use the two fingers to press the " ▲ Button " (3-5, Fig. 1) " , and " ▼ Button " (3-6, Fig. 1) at the same time. the display will show the following screen as example(Fig. a), release the both fingers , then Press the " Enter Button " (3-8, Fig. 1) , the display will show the following screen as example (Fig. b). and press the " ▲ Button " (3-5, Fig. 1) once . the display will show the following screen as example (Fig. c).

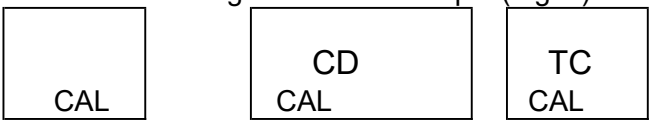
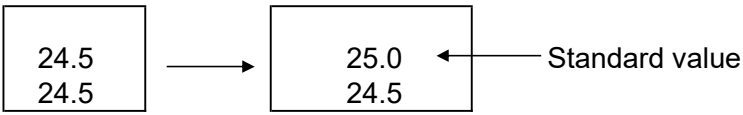


Fig. a Fig. b Fig. C

6) Press the " Enter Button " (3-8, Fig. 1), the measuring value will present on both upper and lower Display. Use "▲ Button " (3-5, Fig. 1), " ▼ Button " (3-6, Fig. 1) to adjust the up display value exact same as the standard Temprature value. Press the " Enter Button " (3-8. Fig. 1)will save the calibration data and finish the calibration procedures.



6. SALT and Hardness and Resistance MEASURING and CALIBRATION

6-1 Salt measurement

1) Prepare the Probe (CDPB-04, same probe as the conductivity measurement, refere to Fig. 1, page 6), install the " Probe Plug " (3-20, Fig. 1) into the " Probe Socket " (3-13, Fig. 1).
2) Power on the meter by pressing and holding " Power Button " (3-2, Fig. 1) for at least 1.5 seconds .
   Select the Meter's measurement FUNCTION to " SALT", refer to Chapter 4, page 7 .
3) Hold the " Probe Handle " (3-18, Fig. 1) by hand and let the " Sensing head " (3-19, Fig. 1) immersed wholly into the measured solution. Shake the probe to let the probe's internal air bubble drift out from the sensing head.
   Display will show the Salt values (% weight).

6-2 Hardness measurement

1) Prepare the Probe (CDPB-04, same probe as the conductivity measurement, refere to Fig. 1, page 6), install the " Probe Plug " (3-20, Fig. 1) into the " Probe Socket " (3-13, Fig. 1).
2) Power on the meter by pressing and holding " Power Button " (3-2, Fig. 1) for at least 1.5 seconds .
   Select the Meter's measurement FUNCTION to " HD", refer to Chapter 4, page 7 .
3) Hold the " Probe Handle " (3-18, Fig. 1) by hand and let the " Sensing head " (3-19, Fig. 1) immersed wholly into the measured solution. Shake the probe to let the probe's internal air bubble drift out from the sensing head.
   Display will show the Hardness values (ppm).

6-3 Resistance measurement

1) Prepare the Probe (CDPB-04, same probe as the conductivity measurement, refere to Fig. 1, page 6), install the " Probe Plug " (3-20, Fig. 1) into the " Probe Socket " (3-13, Fig. 1).
2) Power on the meter by pressing and holding " Power Button " (3-2, Fig. 1) for at least 1.5 seconds . Select the Meter's measurement FUNCTION to " R ", refer to Chapter 4, page 7 .
3) Hold the " Probe Handle " (3-18, Fig. 1) by hand and let the " Sensing head " (3-19, Fig. 1) immersed wholly into the measured solution. Shake the probe to let the probe's internal air bubble drift out from the sensing head. Display will show the Resistance values (ohm , K ohm , M ohm).

Remark:

The test function is automotic range

6-4 Calibration

If the conductivity range already make the calibration completely then the Salt measurement is not necessary to make the calibration again.

7. OTHER FUNCTION

7-1 Data Hold

During the measurement, press the " Hold Button " (3-3, Fig. 1) once will hold the measured value & the LCD will display a " HOLD " symbol.
Press the " Hold Button " once again will release the data hold function.

7-2 Data Record (Max., Min. reading)

1) The data record function records the maximum and minimum readings. Press the " REC Button " (3-4, Fig. 1) once to start the Data Record function and there will be a " REC. " symbol on the display.

2) With the " REC. " symbol on the display :
   a) Press the " REC Button " (3-4, Fig. 1) once, the " REC. MAX. " symbol and the maximum value will appear on the display.

   b) Press the " REC Button " (3-4, Fig. 1) again, the " REC. MIN. " symbol and the minimum value will appear on the display.

   b) Press the " REC Button " (3-4, Fig. 1) again, the " REC. " symbol and the REC value will appear on the display.

   c) To exit the memory record function, just press the " REC " button for 2 seconds at least. The display will revert to the current reading.

7-3 LCD Backlight ON/OFF

After power ON, the " LCD Backlight " will light automatically. During the measurement, press the " Backlight Button " (3-2, Fig. 1) once will turn OFF the " LCD Backlight ".

Press the " Backlight Button " once again will turn ON the " LCD Backlight " again.

8. ADVANCED SETTING

Under do not execute the Datalogger function, press the " SET Button " (3-7, Fig. 1) continuously at least two seconds will enter the " Advanced Setting " mode. then press the " SET Button " (3-7, Fig. 1) once a while in sequence to select the eight main function, the display will show :

DATE..... Set clock time (Year/Month/Date, Hour/Minute/ Second)
POFF..... Auto power OFF management
BEEP..... Set beeper sound ON/OFF
T CF..... Select the Temp. unit to ℃ or ℉
PCNT..... Set CD temperature compensation factor
CELL..... CELL K Value setting

Remark :
During execute the " Advanced Setting " function, if press " HOLD Button " (3-3, Fig. 1) will exit the " Advanced Setting " function, the LCD will return to normal screen.

8-1 Set clock time (Year/Month/Date, Hour/Minute/ Second)

When the upper display show " DATE "

1) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button " (3-6, Fig. 1) to adjust the value (Setting start from Year value). After the desired value is set, press the " Enter Button " (3-8, Fig. 1) once will going to next value adjustment (for example, first setting value is Year then next to adjust Month, Date, Hour, Minute, Second value).

Remark :
The adjusted value will be flashed.

2) After set all the time value (Year, Month, Date, Hour, Minute, Second), press the " SET Button " (3-7, Fig. 1) once will save the time value, then the screen will jump to Sampling time " setting screen (Chapter 10-2).

Remark :
After the time value is setting, the internal clock will run precisely even Power off if the battery is under normal condition (No low battery power).

8-2 Auto power OFF management

When the lower display show " POFF "

1) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button " (3-6, Fig. 1) to select the upper value to "YES " or "NO ".

YES - Auto Power Off management will enable.
NO - Auto Power Off management will disable.

2) After select the upper text to " YES " or " NO ", press the " Enter Button " (3-8, Fig. 1) will save the setting function with default.

8-3 Set beeper sound ON/OFF

When the lower display show " BEEP "

1) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button " (3-6, Fig. 1) to select the upper value to " YES " or " NO ".

YES - Meter's beep sound will be ON with default.
NO - Meter's beep sound will be OFF with default. is power ON.

2) After select the upper text to " YES " or " NO ", press the " Enter Button " (3-8, Fig. 1) will save the setting function with default.

8-4 Select the Temp. unit to ℃ or ℉

When the lower display show " T CF "

1) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button " (3-6, Fig. 1) to select the upper Display text to " C " or " F ".

   C - Temperature unit is ℃
   F - Temperature unit is ℉

2) After Display unit is selected to " C " or " F ", press the " Enter Button " (3-8, Fig. 1) will save the setting function with default.

8-5 Set CD temperature compensation factor

When the lower display show " PCNT "

1) This function only for the Conductivity (PCNT) mode of adjusting the probe's Temp.compensation value in %/per ℃ unit. The default value is 2 %/ per ℃.
2) Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button " (3-6, Fig. 1) to select the upper value to the desired Temp. compensation value (%/per ℃), then press the " Enter Button " (3-8, Fig. 1) will save the setting value temporally.

8-6 CELL K Value setting

When the display show " CELL "

When the Display show the text " CELL ", Use the " ▲ Button " (3-5, Fig. 1) or " ▼ Button " (3-6, Fig. 1) Adjustment CELL(Probe) K Value setting, than press the " Enter Button " (3-8, Fig. 1) will save the setting.

Remark :

During execute the " Advanced Setting " function, if press " HOLD Button " (3-3, Fig. 1) will exit the " Advanced Setting " function, the LCD will return to normal screen.

9. POWER SUPPLY from DC ADAPTER

The meter also can supply the power supply from the DC 9V Power Adapter (optional). Insert the plug of Power Adapter into " DC 9V Power Adapter Input Socket " (3-14, Fig. 1).

10. BATTERY REPLACEMENT

1) When the left corner of LCD display show " ", it is necessary to replace the battery. However, in-spec. measurement may still be made for several hours after low battery indicator appears before the instrument become inaccurate.
2) Loose the screws of the " Battery Cover Screw " (3-11, Fig. 1) and take away the " Battery Cover " from the instrument and remove the battery.
3) Replace with DC 1.5 V battery (UM3, AA, Alkaline/heavy duty) x 6 PCs, and reinstate the cover.
4) Make sure the battery cover is secured after changing batteries.

11. SYSTEM RESET

If the meter happen the troubles such as :

CPU system is hold (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 :

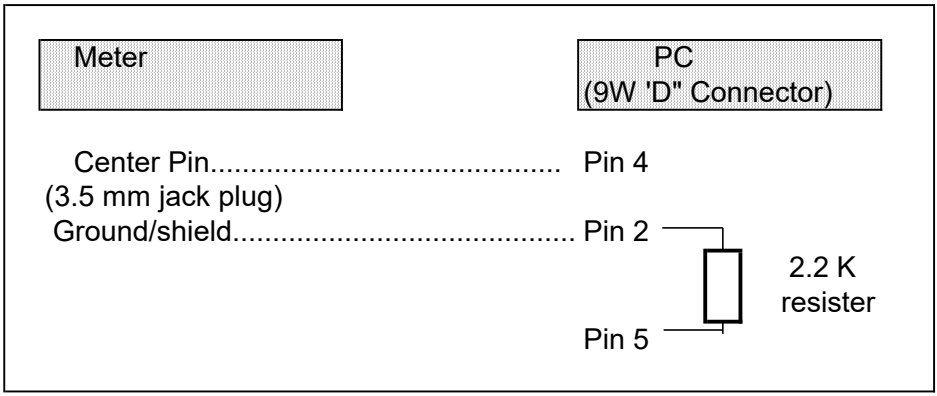
During the power on, use a pin to press the " Reset Button " (3-15, Fig. 1) once a while will reset the circuit system.

12. RS232 PC SERIAL INTERFACE

The instrument has RS232 PC serial interface via a 3.5 mm terminal (3-16, 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 :

D15	Start Word		
D14	4		
D13	When send the upper display data = 1 When send the lower display data = 2		
D12, D11	Annunciator for Display		
	uS = 13	mS = 14	PPM = 19
	% = 03	ohm =38	Kohm = 39
	Mohm = 40		
D10	Polarity 0 = Positive 1 = Negative		
D9	Decimal Point(DP), position from right to the left 0 = No DP, 1= 1 DP, 2 = 2 DP, 3 = 3 DP		
D8 to D1	Display reading, D1 = LSD, D8 = MSD For example : If the display reading is 1234, then D8 to D1 is : 00001234		
D0	End Word		

RS232 FORMAT : 9600, N, 8, 1

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

13. OPTIONAL ACCESSORIES

RS232 cable UPCB-02	* Computer interface cable. * Used to connect the meter to the computer (COM port).
USB cable USB-01	* Computer interface cable. * Used to connect the meter to the computer (USB port).

Data Acquisition software SW-U801-WIN	The SW-U801-WIN is a multi displays (1/2/4/6/8 displays) powerful application software, provides the functions of data logging system, text display, angular display, chart display, data recorder high/low limit, data query, text data recorder high/low limit, data report, chart report.. .xxx.mdb data file can be retrieved for EXCEL, ACESS.., wide intelligent applications. wide intelligent applications.

Power adapter	AC 110\ AC 110V to DC 9V. USA plu USA plug.
	AC 220\ AC 220V/230V to DC 9V. German Germany plug.

Conductivity standard solution	1.413 mS standard solution. Model : CD-14