Bench type, RS232/USB computer interface

pH, ORP, CD, TDS, DO, SALT METER

Model : WA-2015

Your purchase of this pH, ORP, CD, TDS, DO, SALT METER with SD CARD DATALOGGER 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.

QUALITY ASSURED FIRM ISO 9001 SGS

UKAS QUALITY MANAGEMENT 005

OPERATION MANUAL

TABLE OF CONTENTS

1. FEATURES

* Professional bench type meter with large size LCD display with green color back light.
* One meter for multi purpose operation : pH/ORP, CD/TDS (Total dissolved solids), Dissolved Oxygen.
* pH : 0 to 14.00 pH, ORP : ± 1999 mV.
* Conductivity : 200 uS/2 mS/20 mS/200 mS.
* Dissolved oxygen : 0 to 20.0 mg/L.
* Real time data logger (record year, month, date, hour, minute, second), 16,000 data logger.
* Auto data record, 16,000 Data logger no.
* Wide sampling time adjustment range from one second to 8 hours 59 minutes 59 seconds.
* Auto data logger, manual data logger.
* RS232 computer interface.
* Max., Min., Data hold.
* Can default auto power off or manual power off.
* Optional pH, ORP, CD/TDS, Dissolved Oxygen and ATC probe.
* DC 1.5V (UM-3, AA) x 8 PCs or DC 9V adapter in.
* pH meter function can select pH or ORP.
* pH measurement can select ATC or manual temperature adjustment.
* pH measurement can make the auto calibration for pH 7, pH 4 and pH 10 or other value.
* Conductivity measurement can select uS/mS or TDS
* Conductivity measurement can select Temp. Coefficient of measurement solution.
* ATC for the conductivity measurement.

* Dissolved oxygen meter use the polar graphic type oxygen probe with temperature sensor, high precision measurement for Dissolved Oxygen (DO) and temperature measurement.
* Heavy duty dissolved oxygen probe, probe head can connect with BOD bottle.
* DO use the automatic Temp. compensation.
* DO meter build in " % SALT " & " Mountain Height " compensation value adjustment.
* Super large LCD display with LCD backlight ON/OFF.
* Separate probe, easy for operation of different measurement environment.
* 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 : 82 mm x 61 mm. ** with green color backlight.*
Measurement	pH/ORP Conductivity/TDS(Total Dissolved Solids) Dissolved Oxygen
Sampling Time of Data Logger	*Auto data logger :* 1 sec to 8 hour 59 min. 59 sec.
	Manual data logger : Set sampling time to 0 second.
Data Hold	Freeze the display reading.
Memory Recall	Maximum & Minimum value.
Power off	Auto shut off saves battery life or manual off by push Button. *@ Can default auto power or manual power off.* *@ When default auto power function, power will off automatically after 10 MIN, if no Button be pressed.*
Sampling Time of display	Approx. 1 second.
Data Output	RS 232 PC serial interface.
Operating Temperature	0 to 50 ℃. - Main instrument.
Operating Humidity	Less than 80% R.H.
Power Supply	DC 1.5 V battery (UM3) x 8 PCs, (Heavy duty type).
	DC 9V adapter input. *@ AC/DC power adapter is optional.*

Power Consumption	Operation (LCD backlight ON) : Approx. DC 32 mA
	Operation (LCD backlight OFF) : Approx. DC 8 mA
	Power OFF (only internal clock running) : Approx. DC 1.8 uA.
Weight ** meter*	1049 g/2.3 LB.
Dimension *@ Meter*	225 X 125 X 64 mm (8.86 X 4.92 X 2.52 inch)
Accessories Included	Instruction manual.....1 PC
Optional Accessories	* pH electrode..... PE-03, PE-11, PE-01, PE06HD PE-04HD, PE-05T, PE-03K7 PE-02, PE-08, PE-21 * ATC (Automatic Temperature Probe).....TP-07 * pH 7 buffer solution.....pH-07 * pH 4 buffer solution.....pH-04 * pH electrode hoder.....EH-20
	* ORP electrode.....ORP-14
	* Conductivity probe.....CDPB-03 * 1.413 mS Conductivity Standard Solution.....CD-14
	* Oxygen probe.....OXPB-11 * Spare Probe head with diaphragm set ..... OXHD-04 * Probe-filling Electrolyte.....OXEL-03
	* Carrying case.....CA-3K
	* AC to DC 9V adapter. * RS232 cable, UPCB-02. * USB cable, USB-01 * Data Acquisition software, SW-U801-WIN. * Data Logger software, SW-DL2005.

2-2 Electrical Specifications (23± 5 ℃)

A. pH / mV

pH Electrode	Optional, Any pH electrode with BNC connector.	
Measurement	pH	0 to 14 pH
	mV	-1999 mV to 1999 mV
Input Impedance	10^12 ohm	
Temperature Compensation for pH measurement	Manual	0 to 100 ℃, be adjusted by push button on front panel.
	Automatic (ATC)	With the optional temperature probe (TP-07) 0 to 65 ℃.
pH Calibration	pH7, pH4, and pH10, 3 points calibration ensure the best linearity and accuracy.	
Optional probe and accessories	* pH electrode.....PE-03, PE-11, PE-01, PE06HD PE-04HD, PE-05T, PE-03K7 * ATC (automatic temperature probe).....TP-07 * pH 7 buffer solution..... pH-07 * pH 4 buffer solution..... pH-04 * ORP electrode.....ORP-14	

2-2 Electrical Specifications (23 ± 5 ℃)

Measurement	Range	Resolution	Accuracy
pH	0 to 14 pH	0.01 pH	± (0.02 pH + 2 d)
mV	0 to 1999 mV	1 mV	± (0.5% + 2 d)
** pH accuracy is based on calibrated meter only.*			

B. Conductivity

Conductivity probe	Optional, Carbon rod electrode for long life.
Function	* Conductivity (uS, mS) * TDS (Total Dissolved Solids, PPM) * Temperature (℃,℉)
Temperature Compensation	Automatic from 0 to 60 ℃ (32 - 140 ℉), with temperature compensation factor variable between 0 to 5.0% per C.
Probe Operating Temperature	0 to 60 ℃.
Probe Dimension	Round, 22 mm Dia. x 120 mm length.
Optional probe and accessories	* Conductivity probe..... CDPB-03 * 1.413 mS Conductivity Standard Solution.....CD-14

1. Conductivity (uS, mS)

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

** 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℃*

2. TDS (Total Dissolved Solids)

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

3. Temperature

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

C. Dissolved oxygen

Oxygen Probe	Optional, The polarograpHic type oxygen probe with	
Measurement & Range	Dissolved Oxygen	0 to 20.0 mg/L (liter).
	Oxygen in Air	0 to 100.0 %.
	Temperature	0 to 50 ℃.
Resolution	Dissolved Oxygen	0.1 mg/L.
	Oxygen in Air	0.1 % O2 .
	Temperature	0.1 ℃.

Accuracy (23± 5 ℃)	Dissolved Oxygen	± 0.4 mg/L.
	Oxygen in Air	± 0.7% O2.
	Temperature	± 0.8 ℃/1.5 ℉.
Probe Compensation & Adj.	Temperature	0 to 50 ℃, Automatic
	Salt	0 to 50 % Salt
	Height (M. T.)	0 to 8900 meter
Probe Weight	335 g/0.74 LB (batteries & probe included)	
Probe Size	190 mm x 28 mm Dia. (7.5" x 1.1" Dia.)	
Optional Accessories	* Oxygen probe.....OXPB-11 * Spare Probe head with diaphragm set .....OXHD-04 * Probe-filling Electrolyte.....OXEL-03	

3. FRONT PANEL DESCRIPTION

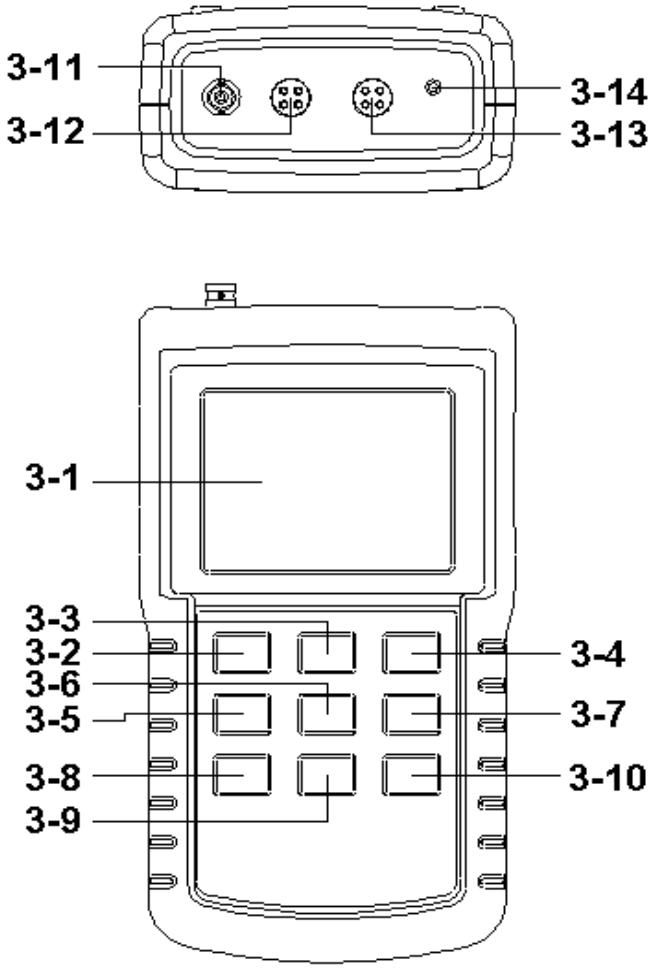


Fig. 1-1

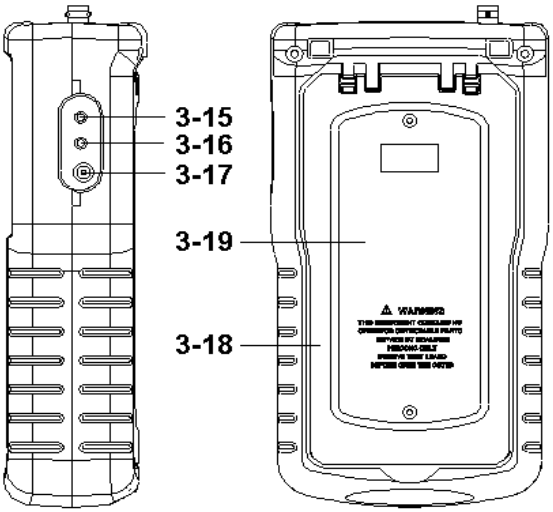


Fig. 1-2

3-1 Display
3-2 Power Button (LCD Backlight Button)
3-3 HOLD Button (ESC Button)
3-4 REC Button (Enter Button)
3-5 Mode Button (Zero Button)
3-6 Function Button (Range Button)
3-7 Send Button (Clock Button)
3-8 SET Button (Logger Button)
3-9 ▲ Up Button
3-10 ▼ Down Button
3-11 PH Socket (BNC Socket)
3-12 CD Socket
3-13 DO Socket
3-14 Temp. Socket (pH ATC Socket)
3-15 RS232 socket
3-16 Reset button
3-17 DC 9V power adapter socket
3-18 Stand
3-19 Battery Cover/Battery compartment

4. MODE SELECTION (pH/CD/DO selection)

1) Turn on the meter by pressing the " Power Button " (3-2, Fig. 1) momentarily.

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

2) The meter can select 3 kind Mode as :

   a. pH, mV (ORP) measurement
   b. Dissolved Oxygen measurement
   c. Conductivity, TDS measurement

   Pressing the " Mode Button " (3-5, Fig. 1) once, the Display will show the following text in sequence :

PH	**pH, mV (ORP) measurement**
do	**Dissolved Oxygen measurement**
Cd	**Conductivity, TDS measurement**

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

5. pH/mV MEASURING and CALIBRATION PROCEDURE

The meter default function are following :

* The display unit is set to pH.
* The temperature unit is set to ℃.
* Manual ATC (without connect the ATC probe)
* Auto power off.
* The sampling time of data logger function is 2 seconds.

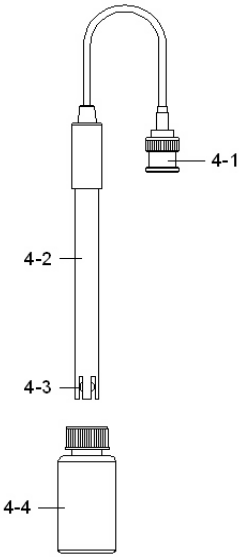


Fig. 2

If the meter is first time to connect the pH electrode, it should make the calibration before operation, the calibration procedures refer chapter 5-4, page 14.

5-1 pH measurement (manual Temp compensation)

1) Prepare the pH Electrode (optional), install the " Probe Plug " (4-1, Fig. 2) into the " pH Socket/BNC Socket " (3-11, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-2, Fig. 1) once.
   Select the measurement mode to " pH, mV (ORP) measurement ". refer chapter 4, page 11.
   The Display will show " pH " and " Temp. " indicator.
3) **Adjust the manual Temp. value same as the solution's temperature exactly, the procedures refer chapter 9-7, page 38.**
4) Hold the " Electrode Handle " (4-2, Fig. 2) by hand and let the " Sensing head " (4-3, Fig. 2) immersed wholly into the measured solution and little shake the probe.
5) The up main display will show the pH value, the left bottom display will show the setting manual Temp. value.

5-2 pH measurement (ATC , automatic Temperature)

1) All the procedures are same as
   5-1 pH measurement (manual ATC)
   but should prepare one temperature probe (optional, TP-07), insert the TP-07's plug into the " Temp. Socket " (3-14, Fig. 1), immerse the sensing head of temperature probe (TP-07) into the measurement solution.
2) The up main display will show the pH value, the left bottom display will show the sensing Temp. value of the measured solution.

When not use the Electrode, it should immerse the " Electrode sensing head " (4-3, Fig. 2) into the " Protection bottle " (4-4, Fig. 2)

5-3 mV Measurement

The instrument build in mV (millivolt) measurement function, which enable you to make ion-selective, ORP (oxidation-reduction potential), and other precise mV measurements.

1) Prepare the ORP Electrode (optional, ORP-14), install the " Probe Plug " of ORP electrode into the " pH Socket/BNC Socket " (3-11, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-2, Fig. 1) once.
   Select the measurement mode to " pH, mV (ORP) measurement ". refer chapter 4, page 11 .
   Pressing the " Function Button " (3-6, Fig. 1) once until the Display show " mV " indicator.
3) The up main display will show the mV value.

5-4 pH calibration

Calibration Consideration

The most ideal pH ELECTRODE generates 0 mV at pH 7.00 (177.4 mV at pH 4) and meter has been always calibrated with signals which simulate the most ideal pH ELECTRODE (based on 25 ℃ ambient environment). However not every pH ELECTRODE is as accurate as the most ideal one, so calibration procedures are necessary to be done before the first time measurement.
In addition to the first time measurement, users are also recommended to execute the calibration procedures to ensure the high accuracy measurement.

Required Equipment for Calibration

1) pH ELECTRODE (optional).
2) pH buffer solutions (optional).

Calibration Procedure

1) Prepare the pH Electrode (optional), install the " Probe Plug " (4-1, Fig. 2) into the " pH Socket/BNC Socket " (3-11, Fig. 1).
2) Power on the meter, set the mode to the pH measurement, the right bottom display will show " pH ".
3) Adjust the " Temperature Compensation Value " to make it same as the temperature value of the pH buffer solution.

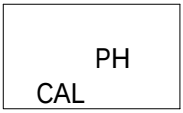
   *** Manual temperature compensation value adjustment procedure, refer to 9-7, page 38.**

   *** Automatic temperature compensation, refer to 5-2, page 13.**

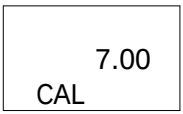
4) Hold the " Electrode Handle " (4-2, Fig. 2) by hand and let the " Sensing head " (4-3, Fig. 2) immersed wholly into the measured solution and little shake the probe.
   Display will show the pH value.

   *** If use the ATC probe, should immerse the ATC probe into the solution together.**

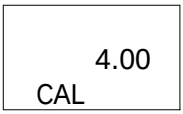
5) Use the two fingers to press the " REC Button " (3-4, Fig 1) and " HOLD Button " (3-3, Fig. 1) at the same time. Until Display will show the following screen then release the both fingers.



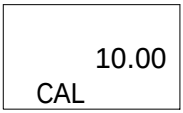
6) Press the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) once in sequence to select the following screen.

a 

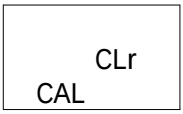
For pH 7.00 calibration

b 

For pH 4.00 calibration

c 

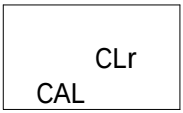
For pH 10.00 calibration

d 

Clear the existing calibration data

7) **After the above a, b, c, d is selected, press the " Enter Button " (3-4, Fig. 1) to execute the calibration procedures.**

When select the



and press the " Enter Button " will clear the existing calibration data.

7) **Fine adjustment of calibration value**

During the calibration when the main Display (7.00, 4.00 or 10.00) is flashed, it can use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) to make the fine adjust of the calibration value, for example the exact calibration value is 4.01, 4.02, 3.98.... 7.01, 7.02. 6.98....10.01, 10.02, 9.98
After the fine calibration value is adjusted, release the ▲ Button (▼ Button), the main Display will be flashed few second then execute the calibration according the new calibration value.

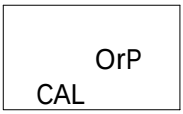
7) The complete procedures should execute the two calibration points :

pH7 calibration, pH4 calibration
pH7 calibration, pH10 calibration

* The calibration procedures should execute start from pH7 calibration then follow pH4 (or pH10) calibration.
* Rinse the electrode with distilled water again when make each point calibration (pH7, pH4 or pH10).
* Repeat above two points procedures two times at least.

5-5 ORP calibration

1) Prepare the ORP electrode (optional, ORP-14), connect the ORP electrode to the meter.
2) Power on the meter, set the mode and the function to " mV ", refer chapter 5-3, page 14.
3) Immerse the sensing head of ORP electrode into the ORP standard buffer solution, the up display will show the ORP value in mV.
4) Use the two fingers to press the " REC Button " (3-4, Fig 1) and " HOLD Button " (3-3, Fig. 1) at the same time. The display will show the following screen as example, then release the both fingers.



5) Use " ▲ Button " (3-9, Fig. 1), " ▼ Button " (3-10, Fig. 1) to adjust the up display value exact same as the standard ORP buffer solution value. Press the " Enter Button " will save the calibration the data and finish the calibration procedures.
   * **The ORP calibration procedures are available only the ORP buffer solution value is > 100 mV.**
   * **If the ORP calibration procedures is less than 100 mV the calibration is not allow.**

6. 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.
* The sampling time of data logger function is 2 seconds.

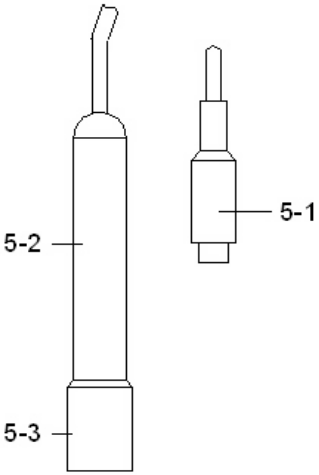


Fig. 3

If the meter is first time to connect the conductivity probe, it should execute the calibration procedures before operation, the calibration procedures refer chapter 6-3, page 22.

6-1 uS, mS measurement

1) Prepare the Conductivity Probe (optional, CDPB-03), install the " Probe Plug " (5-1, Fig. 3) into the " CD Socket " (3-12, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-2, Fig. 1) once.
   Select the measurement mode to " Conductivity, TDS measurement ". refer chapter 4, page 11.
   The Display will show " uS " and " Temp. " indicator.
3) Hold the " Probe Handle " (5-2, Fig. 3) by hand and let the " Sensing head " (5-3, Fig. 3) immersed wholly into the measured solution. Shake the probe to let the probe's internal air bubble drift out from the sensing head.
4) 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.
If intend to let the meter be used under the manual range mode, the procedures are following :

* Press the " Range Button " once a while, it can change the range, the range name (Auto, 200 uS, 2 mS, 20 mS, 200 mS) will show under the measurement value.

* If the display shows " ----- ", it indicates an overload condition, select the next higher range.
* If the display shows " ----- ", it indicates an out-of-range, select the next lower range.
* If intend to change the operation mode from Manual range back to Auto Range, press the " Range Button " (3-6, Fig. 1) once in sequence until the Display show the text " Auto ", release the " Range Button ", the meter is ready for the Auto range mode again.

Change the Temp. unit to ℉

If intend to change the Temp. unit from ℃ to ℉, please refer page 37, chapter 9-6 (Temp. Unit Default Setting)

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 page 39, chapter 9-11 (Temp. Compensation Factor Setting).

Zero adjustment

If the probe not immerse the measurement solution and display not show zero value, pressing the " Zero Button " (3-5, Fig. 1) > 10 seconds continuously will let display show zero. The zero function only valid when the no zero value less than 1.0 uS.

6-2 TDS (PPM) measurement

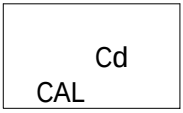
The measuring procedures are same as above
5-1 Conductivity (uS, mS) measurement,
except to change the display unit from uS, mS to PPM.
The procedures are :

* *Press the " Function Button " (3-6, Fig. 1) > 2 seconds continuously until the Display show the text " tdS ", then release the " Function Button " will enter the the TDS measurement function.*
* *Under the TDS measurement, press the " Function Button " (3-6, Fig. 1) > 2 seconds continuously until the Display show the text " Cd ", then release the " Function Button " will enter the Conductivity measurement function again.*

6-3 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 " (5-1, Fig. 3) into the " CD Socket " (3-12, Fig. 1).
3) Power on the meter, set the mode to the conductivity measurement (uS, mS).
4) Hold the " Probe Handle " (5-2, Fig. 3) by hand and let the " Sensing head " (5-3, Fig. 3) 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 " REC Button " (3-4, Fig 1) and " HOLD Button " (3-3, Fig. 1) at the same time. the display will show the following screen as example, release the both fingers.



6) Use " ▲ Button " (3-9, Fig. 1), " ▼ Button " (3-10, Fig. 1) to adjust the up display value exact same as the standard conductivity value. Press the " Enter Button " 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.***

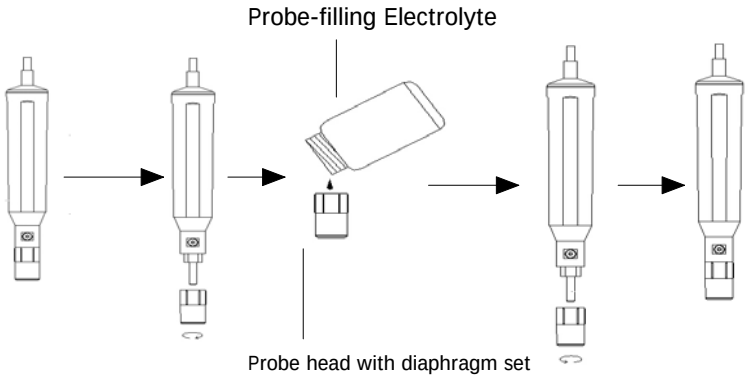
7. DO (Dissolved Oxygen) MEASURING and CALIBRATION PROCEDURE

1) Prepare the Oxygen Probe (optional, OXPB-11)

ATTENTION :

Fill the Probe's Electrolyte at first.

Intend to keep the DO probe under the best condition, it should fill the Probe's Electrolyte at first.



The procedures that to fill the Probe's Electrolyte, refer the chapter 7-3 " Probe maintenance ", page 29 .

The meter default function are following :

* The display unit is set to mg/L.
* The temperature unit is set to ℃.
* Auto power off.
* The sampling time of data logger function is 2 seconds.

7-1 Dissolved Oxygen measurement

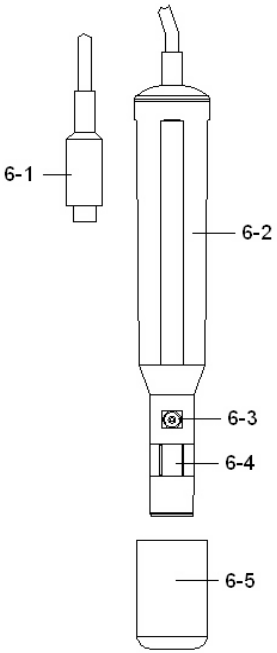


Fig. 4

1) Prepare the Oxygen Probe (optional, DOPB-11), install the " Probe Plug " (6-1, Fig. 4) into the " DO Socket " (3-13, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-2, Fig. 1) once.
Select the measurement mode to " Dissolved Oxygen measurement ". refer chapter 4, page 11.
The Display will show " mg/L " and " Temp. " indicator.

Calibration at first !

Press the " Function Button " (3-6, Fig. 1) once, the Display will show the " % O2 " indicator. Wait approx. 2 minute until the reading value reach stable, if the reading value not within 20.7 to 21.1 (20.9 ± 0.2), then should be processed the calibration procedures first. The calibration procedures, please refer chapter 7-2, page 28.

After execute the calibration procedures, the display should show the value near 20.9 (20.8 to 21.0).

3) Press the " Function Button " (3-6, Fig. 7) once, the right low display will show the " mg/L " unit, the meter is ready for the Dissolved Oxygen measurement.
4) a. Immersed the probe to a depth at least 10 cm of the measured liquid in order for the probe to be influenced by the temperature & automatic temperature compensation to take place.

b. As for the thermal equilibrium to occur between the probe & the measurement sample must be allowed to pass, which usually amounts to a few minutes if the Temp. difference between the two is only several Celsius degrees.

5) a. In order to measure the dissolved oxygen content in any given liquid, it is sufficient to immerse the tip of the probe in the solution, making sure that velocity of the liquid coming into contact with the probe is at least 0.2 - 0.3 m/s or to shake the probe.

b. During laboratory measurements, the use of a magnetic agitator to ensure a certain velocity in the fluid is recommended. In this way, errors due to the diffusion of the oxygen present in the air in the solution are reduced to a minimum.

6) Display will show the Dissolved Oxygen values (mg/L) at the same time the left bottom display will show the Temp. value of the measured solution.

7) Rinsed the probe accurately with normal tap water after each series of measurement.

Oxygen in the air

When the display unit show " %O2 ", it show the air Oxygen value approximately.

Change the Temp. unit to ℉

If intend to change the Temp. unit from ℃ to ℉, please refer page 37, chapter 9-6 (Temp. Unit Default Setting)

"% Salt" compensation value adjustment

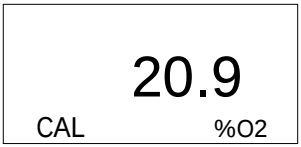
If intend to change the % Salt compensation value, refer page 38, chapter 9-8 (% Salt Compensation value Setting).

"Height" compensation value adjustment

If intend to change the Height compensation value, refer page 39, chapter 9-9, 9-10 (Height Compensation value Setting).

7-2 Calibration

1) Install the " Probe Plug " (6-1, Fig. 4) into the " DO Socket " (3-13, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-2, Fig. 1) once.
   Select the measurement mode to " Dissolved Oxygen measurement ", the Display will show " mg/L " indicator.
   Pressing the " Function Button " (3-6, Fig. 1) once until the right bottom display show " %O2 ".
3) **Wait for approx. 5 minutes at least until the display reading values become stable & no fluctuation.**
4) Use the two fingers to press the " REC Button " (3-4, Fig 1) and HOLD Button " (3-3, Fig. 1) at the same time, the display will show the following screen as example, release the both fingers.



5) Press the " Enter Button " (3-4, Fig. 1), the Display value will count down from 30 to 0, then return to normal measuring screen and finish the calibration procedures. The complete calibration procedures will take 30 seconds approximately.

After finish the calibration, press the " Function Button " (3-6, Fig. 1) once, to let Display unit to return " mg/L ".

Calibration Consideration :

a. As the oxygen in air is 20.9 % typically, so use the environment air oxygen value for quick & precise calibration.

b. Please process calibration procedures under wide and ventilating environment for best effect.

7-3. Probe maintenance

User first time to use the meter :

Intend to let the DO probe keep the best condition, when user receive the Oxygen Probe, it should fill the Probe's Electrolyte at first.

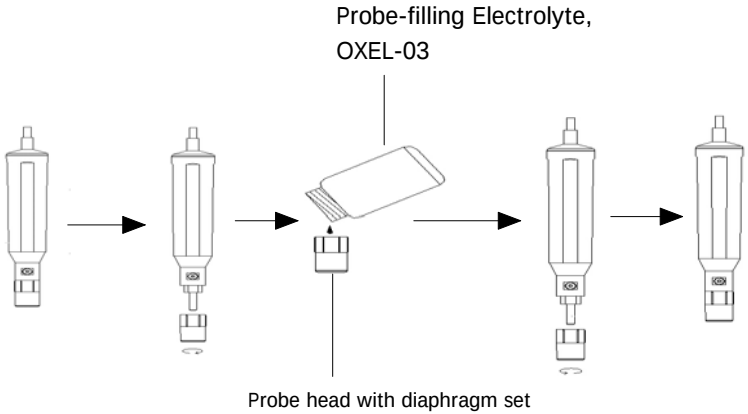
User already use the probe for a certain period :

Whenever user can not calibrate the meter properly or the meter's reading value is not stable, please check the oxygen probe to see if the electrolyte in the probe head container is run out or the diaphragm (probe head with diaphragm set) exist problem (dirty). If yes, please fill the electrolyte or change the " Probe head with diaphragm set " and make the new calibration.

The consideration of diaphragm (probe head with diaphragm set) :

The oxygen probe component is the thin Teflon diaphragm housed in the tip of the probe. The diaphragm is permeable by the oxygen molecules but not by the considerably larger molecules contained in the electrolyte. Due to this characteristic, the oxygen may diffuse throughout the electrolyte solution contained in the probe, and its concentration may be quantified by the measurement circuit.

This sensitive diaphragm is rather delicate & is easily damaged if it comes into contact with solid objects or is subjected to blows. If the diaphragm is damaged or the electrolyte is run out, it must be replaced in the following way :



1) Unscrew the " Probe head " (7-3, Fig 5).
2) Pour out the old Electrolyte from the container of the " Probe head ".
3) Fill the new Electrolyte (OXEL-03) into the container of the " Probe head " .

4) Screw the " Probe head " (7-3, Fig 5) into the probe body.

5) When not use the probe, should insert the " Probe head " into the " Probe protection cover " (6-5, Fig. 4)

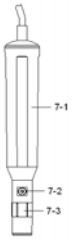


Fig. 5

7-1 Probe handle
7-2 Temp. sensing metal
7-3 Probe head

8. DATA HOLD, DATA RECORD, DATA LOGGER, LCD BACKLIGHT

8-1 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.

8-2 Data Record (MAX, MIN reading)

* 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.
* With the " REC " symbol on the display :
  a) Press the " REC Button " (3-4, Fig. 1) once, the " REC MAX " symbol along with the maximum value will appear on the display.
  If intend to delete the maximum value, just press the " Hold Button " (3-3, Fig. 1) once, then the display will show the " REC " symbol only & execute the memory function continuously.

b) Press the " REC Button " (3-4, Fig. 1) again, the " REC MIN " symbol along with the minimum value will appear on the display.
If intend to delete the minimum value, just press the " Hold Button " (3-3, Fig. 1) once, then the display will show the " REC " symbol only & execute the memory function continuously.

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

8-3 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).

The data logger procedures are as following :

a) If push the " Logger Button " (3-8, Fig. 1) once will show the sampling time value on the bottom left display then disappeared.

b) 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.

Auto Data Logger (Sampling time set from 1 second to 8 hours 59 minutes 59 seconds)

Press the " Logger Button " (3-8, Fig. 1) once to start the Auto Data Logger function, The upper display will show " DATALOGGER " indicator along with " REC " marker.

* *Pause the data logger function :*
  Press the " Logger Button " (3-8, Fig. 1) once.
* *Exit the data logger function :*
  Press the " REC Button " (3-4, Fig. 1) > 2 seconds.

Manual Data Logger (Sampling time set to 0 second)

Press the " Logger Button " (3-8, Fig. 1) once will save the data one time into the memory.
Beeper will sound and the upper display will show " DATALOGGER " indicator along with " REC " marker.

** Exit the data logger function :*
Press the " REC Button " (3-4, Fig. 1) > 2 seconds.

d) 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.

e) During execute the Auto Data Logger function, press the Logger Button " (3-8, Fig. 1) once will stop to execute " the data logger function, the " DATALOGGER " indicator will be disappeared.
If press the " Logger Button " (3-8, Fig. 1) once again will continuous the Auto Data Logger function.
Remark :
1) If intend to change the data logger sampling time, please refer chapter 9-4, page 36.
2) If intend to know the space of balance data numbers into the memory IC, please refer chapter 9-1, page 35.
3) If intend to clear the saving data from the memory please refer chapter 9-2, page 35.

8-4 LCD Bcklight 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.

9. ADVANCED ADJUSTMENT PROCEDURES

Under do not execute the Datalogger function, press the " SET Button " (3-8, Fig. 1) continuously at least two seconds will enter the " Advanced Setting " mode, press the " SET Button " (3-8, Fig. 1) once a while in sequence to select the 13 main function, the display will show :

SPACE.. Check memory space
Clr..... Clear Memory
dAtE..... Set clock time (Year/Month/Date, Hour/Minute/ Second)
SP-t..... Set sampling time (Hour/Minute/Second)
PoFF..... Auto power OFF management
t-CF..... Select the Temp. unit to ℃ or ℉
t-SEt..... *Set pH manual Temp. compensation value, pH only*
SALt..... *Set DO salt% compensation, DO only*
High-.... *Set DO height (meter) compensation, DO only*
Highf.... *Set DO height (feet) compensation, DO only*
PEr C.... *Set CD temperature compensation factor, CD only*
tdS..... *Set CD to TDS or TDS to CD, CD only*
ESC..... Escape from the advanced setting

Remark :
a. DO - Dissolved oxygen Mode
CD - Conductivity/TDS Mode
pH - pH/mV Mode

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

9-1 Check memory space

When the display show " SPACE "

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

@ The bottom value XXXXX is the balance data numbers, for example XXXXX=15417.

9-2 Clear Memory

When the display show " CLr "

1) To delete the existing save data numbers from the memory.
2) Push ENTER Button to enter " Memory clear " function. Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) to select the upper value to " yES " or " no ".

   yES - Intend to clear the Memory.
   no - Not to clear the Memory.

3) If select the upper to " yES ", press the " Enter Button " (3-4, Fig. 1) once will clear the Memory, the bottom value will show " 0 ".
   Press the ESC Button once to quite and return to the main measurement screen.

9-3 Set Date/Time (Year/Month/Date, Hour/Minute/ Second)

When the upper display show " dAtE "

1) Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) to adjust the value (Setting start from Year value). After the desired value is set, press the " Enter Button " (3-4, 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 " (3-8, Fig. 1) once will save the time value, then the screen will jump to Sampling time " setting screen (Chapter 9-4).

   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).

9-4 Set sampling time (Hour/Minute/Second)

When the upper display show " SP-t "

1) Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) to adjust the value (Setting start from Hour value). After the desired value is set, press the " Enter Button " (3-4, Fig. 1) once will going to next value adjustment (for example, first setting value is Hour then next to adjust Minute, Second value).

Remark :
The adjusted value will be flashed.

2) After set all the sampling time value (Hour, Minute, Second), press the " SET Button " (3-8, Fig. 1) once will save the sampling value with default then the screen will jump to " Auto power OFF " setting screen (Chapter 9-5).

9-5 Auto power OFF management

When the lower display show " PoFF "

1) Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, 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 " (3-4, Fig. 1) will save the setting function with default.

9-6 Select the Temp. unit to ℃ or ℉

When the lower display show " t-CF "

1) Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, 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 " (3-4, Fig. 1) will save the setting function with default.

9-7 Set pH manual Temp. compensation value

When the lower display show " t-SEt "

1) This function only for the pH measurement of adjusting the pH electrode's manual Temp.compensation value. The default value is 25 ℃ (77 ℉).
2) Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) to select the upper value to the desired Temp. compensation value (℃ or ℉), then press the " Enter Button " (3-4, Fig. 1) will save the setting value with default.

9-8 Set DO salt% compensation value

When the lower display show " SALt "

1) This function only for the DO (Dissolved oxygen) mode of adjusting the probe's salt% compensation value. The default value is 0% salt.
2) Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) to select the upper value to the desired salt% compensation value, then press the " Enter " Enter Button " (3-4, Fig. 1) will save the setting value temporally.

9-9 Set DO height (meter) compensation value

When the lower display show " High- "

1) This function only for the DO (Disolved oxygen) mode of adjusting the probe's height compensation value in meter unit. The default value is 0 meter.
2) Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) to select the upper value to the desired height compensation value (meter), then press the " Enter Button " (3-4, Fig. 1) will save the setting value temporally.

9-10 Set DO height (feet) compensation value

When the lower display show " Highf "

1) This function only for the DO (Dissolved oxygen) mode of adjusting the probe's height compensation value in feet unit. The default value is 0 FEET.
2) Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) to select the upper value to the desired height compensation value (feet), then press the " Enter Button " (3-4, Fig. 1) will save the setting value temporally.

9-11 Set CD temperature compensation factor

When the lower display show " PEr C "

1) This function only for the Conductivity (TDS) mode of adjusting the probe's Temp. compensation value in %/per ℃ unit. The default value is 2 %/ per ℃.

2) Use the " ▲ Button " (3-9, Fig. 1) or " ▼ Button " (3-10, Fig. 1) to select the upper value to the desired Temp. compensation value (%/per ℃), then press the " Enter Button " (3-4, Fig. 1) will save the setting value temporally.

9-12 ESC

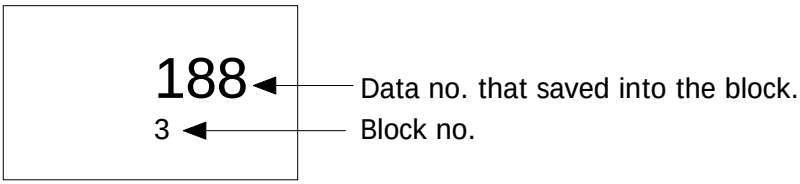
When the display show " ESC "

When the Display show the text " ESC ", then press the " Enter Button " (3-4, Fig. 1) will finish the Advanced Setting procedures and return to the normal measuring screen.

10. SEND THE DATA OUT FROM THE METER

1) If intend to send the data out from the meter, it should exit the " Hold function " and the " Record function " first. The display should be not show the " HOLD " and the " REC " marker.
2) Press the " SEND Button " (3-7, Fig. 1) at least 2 seconds until the Display show " SEnd ", then release the Button.

LCD display will show the following screen :

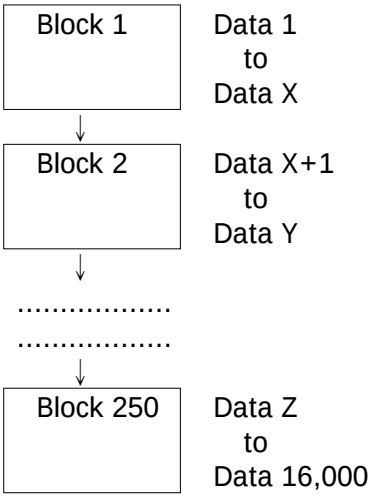


Use "▲ Up Button", " ▼ Down Button " to select the different data memory block no. (1 to 250).

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

* " One " Memory Block " means :
  Execute the Data logger function (Push " REC " Button, following push the " Logger " Button to save the data..... .) will generate the first Memory block

* Exit the Data logger function and execute the Data logger function again will generate the second Memory " Block " again.



3) Until the desired Memory Block no. be selected. Push the " Send Button " (3-7, Fig. 1) once, the data in the Memory Block will send out. During the data send out, the bottom display will show the " SEend " indicator, the upper value (Data no. that saved into the Block) will count down until zero.
4) Push the " ESC Button " (3-3, Fig. 1) will exist the data sending function and return to the normal display.

Remarks :

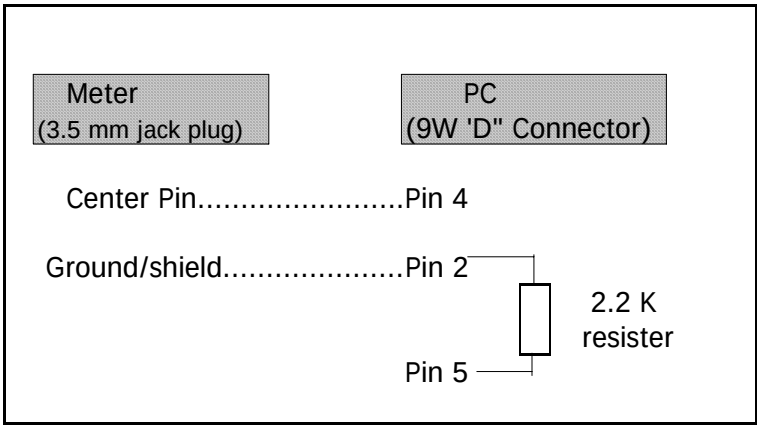
@ If intend to load the data to the computer, should connect the RS232 cable (optional, model : UPCB-02) or the USB cable (optional, model : USB-01) and apply the Data Logger software (optional, Model : SW-DL2005).

@ 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.

11. RS232 PC SERIAL INTERFACE

The instrument has RS232 PC serial interface via the RS-232 Out Terminal " (3-15, 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 = 02		
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
	pH = 05	mV = 18	
	mg/L = 07	% O2 = 06	
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 = 0D		

RS232 setting

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

12. BATTERY REPLACEMENT

1) When the left corner of LCD display show "  ", it is necessary to replace the batteries (UM3/1.5 V x 8 PCs).
2) Slide the " Battery Cover " (3-19, Fig. 1) away from the instrument and remove the batteries.
3) Replace with batteries (UM3/1.5 V x 8 PCs) and reinstate the cover.
4) Make sure the battery cover is secured after changing the battery.

13. 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 are as following.

Used a pin tool to push the " System Reset Switch " (3-16, Fig. 1) once a while then power on again will fix the problem.

14. 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 Logger software SW-DL2005	* Software the used to download the data logger (data recorder) from the meter to computer.
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 report, chart report.. .xxx.mdb data file can be retrieved for EXCEL, ACESS.., wide intelligent applications.

Power adapter	AC 110V to DC 9V USA plug
Power adapter	AC 220V/230V to DC 9V Germany plug

Carrying case	Soft carrying case Model : CA-3K

Electrode holder	Electrode holder for all pH electrodes and the ATC Temp. probe. Model : EH-20

pH optional accessories	* pH Electrode, 1 to 13 pH. Model : PE-11
	* pH Electrode, 1 to 13 pH. Model : PE-03
	* pH Electrode, 0 to 14 pH. Model : PE-01
	* Glass body heavy duty pH Electrode, 0 to 14 pH. Model : PE-02
	* Glass body plane pH Electrode, 0 to 14 pH. Model : PE-08
	* Industrial in line pH Electrode, 0 to 14 pH. Model : PE-21
	* SPEAR pH Electrode Model : pH-06HD, pH-04HD
	* pH Electrode + Temp. probe, 2 in 1 Model : PE-03K7
	* pH Electrode + Temp. probe, 2 in 1 Model : PE-05HT
	* pH 7 BUFFER SOLUTION Model : pH-07
	* pH 4 BUFFER SOLUTION Model : pH-04
	* Temperature probe (ATC probe) Model : TP-07

Conductivity optional accessories	* Conductivity probe Model : CDPB-03
	* 1.413 mS standard solution. Model : CD-14

Dissolved Oxygen optional accessories	* Oxygen probe Model : OXPB-11
	* Spare Probe head with DiapHragm set Model : OXHD-04
	* Probe-filling Electrolyte Model : OXEL-03