Bench type, SD card real time data recorder

pH/ORP,DO,CD,TDS,Hardness,Resistivity,Salt METER

WATER QUALITY METER

Model : BWA-2018SD

Your purchase of this WATER QUALITY METER with micro SD CARD DATA LOGGER 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 : PH/ORP, CD/TDS/ Salt/ Hardness/ Resistivity,Dissolved Oxygen,measurement
* pH : 0 to 14.00 pH, ORP : ±1999 mV.
* Conductivity : 200 uS/2 mS/20 mS/200 mS.
* Salt : 0 to 12 % salt (% weight).
* Hardness : 0 to 100,000 ppm .
* Resistivity : 5 ohm to 99999 * 1000 ohm .
* Dissolved oxygen : 0 to 20.0 mg/L.
* Optional PH, ORP, CD/TDS/Salt, Dissolved Oxygen and ATC probe.
* 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.
* 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.
* LCD with green light backlight, easy reading.
* Can default auto power off or manual power off.
* Data hold, record max. and min. reading.
* Microcomputer circuit, high accuracy.
* Power by DC 9 V (UM-3 1.5V X 6 PCS) batteries or DC 9V adapter.
* RS232/USB PC COMPUTER interface.

2. SPECIFICATIONS

2-1 General Specifications

Circuit	Custom one-chip of microprocessor LSI circuit.
Display	LCD size : 55 mm x 96 mm LCD with green backlight (ON/OFF).
Measurement Function	PH/ORP Conductivity/TDS(Total Dissolved Solids) Salt Hardness Resistivity Dissolved Oxygen
Advanced setting	* Auto power OFF management * Set beep Sound ON/OFF * Set temperature unit to ℃ or ℉ * Set DO salt% compensation value * Set DO height (meter) compensation value * Set DO height (feet) compensation value * Set CD temperature compensation factor * Set pH manual Temp. compensation 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	0 to 50 ℃.
Operating Humidity	Less than 85% R.H.

Power Supply	Alkaline or heavy duty DC 9 V (UM-3 1,5V X 6 PCS) battery or equivalent.
	DC 9V adapter input. (AC/DC power adapter is optional).
Power Current	Normal operation (w/o SD card and LCD Backlight is OFF) : Approx. DC 11 mA.
	When SD card save the data and LCD Backlight is OFF) : Approx. DC 31 mA.
	If LCD backlight on, the power consumption will increase approx. 16 mA.
Weight	1400 g/3.08 LB.
Dimension	290 x 220 x 90 mm (11.5 x 8.7x 3.6 inch)
Accessories Included	* Instruction manual..... 1 PC * Pt Conductivity probe CDPB-04.....1 PC It is available for Conductivity/TDSHardness/ Resistivity/Salt, probe, Salt prob, hight performance for pure water low conductivity measurement
Optional Accessories	* PH electrode..... PE-03, PE-11, PE-01, PE06HD PE-04HD, PE-05T, PE-03K7 * ATC probe (Automatic Temperature Probe)..... TP-07 * pH 7 buffer solution..... PH-07 * pH 4 buffer solution..... PH-04
	* 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
	* ORP Electrode..... ORP-14

Optional Accessories	AC to DC 9V adapter. USB cable, USB-01. RS232 cable, UPCB-02. Data Acquisition software,SW-U801-WIN. SD memory card (4G).....1 PC

2-2 Electrical Specifications (23±5 ℃)

A. PH/ORP

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 , ORP-15

Measurement	Range	Resolution	Accuracy
PH	0 to 14 PH	0.01 PH	±(0.02 PH + 2 d)
mV	-1999 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 Temp.	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
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℃*

* Probe, CDPB-04 is included as the standard accessory

2. TDS (Total Dissolved Solids)

Range	Measurement	Resolution	Accuracy
20 PPM	0 to 13.2 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℃*

3. Temperature

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

** @ 23±5℃*

C. Salt

Conductivity probe	Optional, Carbon rod electrode for long life.
Measurement Range	0 to 12 % salt (% weight).
Resolution	0.01 % salt.
Accuracy	± (0.5 % F.S.) ** F.S. - full scale*
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 ℃.

Hardness

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

Resistivity

Range	Measurement	Resolution	Accuracy
50 ohm	5 to 50 ohm-cm	0.01 ohm	±(2% F.S.+1d) * F.S. - full scale
500 ohm	50 to 500 ohm-cm	0.1 ohm	
5,000 ohm	500 to 5000 ohm-cm	1 ohm	
5000 *10 ohm	5000 to 5000 *10 ohm-cm	10 ohm	
5000 *1000 ohm	500 *100 to 99990 *1000 ohm-cm	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℃*

D. Dissolved oxygen

Oxygen Probe	Optional, OXPB-11 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	

@ *Above specification tests under the environment RF Field Strength less than 3 V/M & frequency less than 30 MHz only.*

3. FRONT PANEL DESCRIPTION

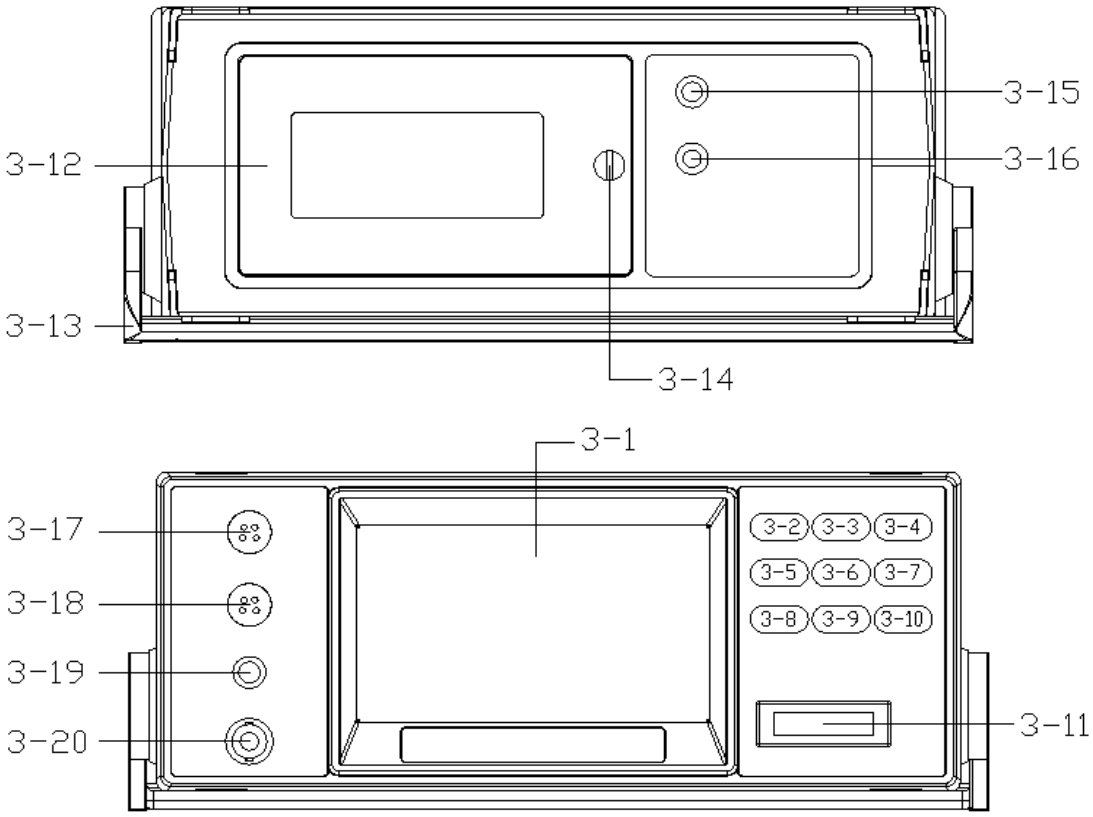


Fig. 1

3-1 LCD Display
3-2 RANGE Button
3-3 HOLD
3-4 REC
3-5 FUNCTION Button
3-6 ▲ Button
3-7 ▼ Button
3-8 TIME/SET Button
3-9 POWER/Backlight Button
3-10 ENTER/Log Button
3-11 SD card Socket
3-12 Battery Compartment/Cover
3-13 Stand
3-14 Battery Cover Screws
3-15 RS-232 Output Terminal
3-16 DC 9V Power Adapter Input Socket
3-17 DO Socket
3-18 CD Socket
3-19 Temp. Socke
3-20 PH Socket/BNC Socket

4. FUNCTION SELECTION

1) Turn on the meter by pressing the " Power Button " (3-9, Fig. 1) momentarily.

   * *Pressing the " Power Button " (3-9, Fig. 1) continuously and > 2 seconds again will turn off the meter.*

2) The meter can select 9 kind Function as :
   a. **pH measurement**
   b. **mV (ORP) measurement**
   c. **Dissolved Oxygen measurement**
   d. **Air Oxygen measurement**
   e. **Conductivity measurement**
   f. **TDS measurement**
   g. **Salt measurement**
   h. **Hardness measurement**
   i. **Resistivity measurement**

Use the " Function Button " (3-5, Fig. 1) Key to select intent test function. Display will show the following text in sequence :

PH	**pH measurement**
OrP	**mV (ORP) measurement**
do	**Dissolved Oxygen measurement**
O2	**Air Oxygen measurement**
Cd	**Conductivity measurement**
tdS	**TDS measurement**
SALt	**Salt measurement**
H-nEs	**Hardness measurement**
reS	**Resistivity measurement**

Until the Display show the desired mode the meter will execute this Function 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.

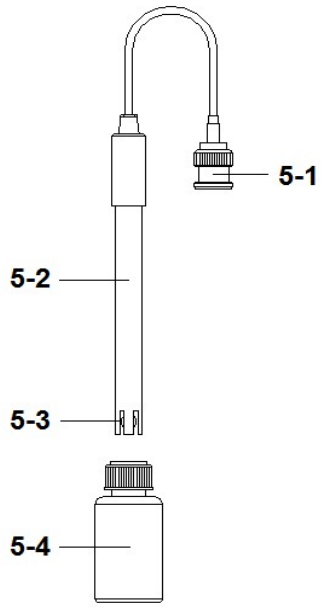


Fig. 2

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

5-1 pH measurement (manual Temp. compensation)

1) Power on the meter by pressing " Power Button "(3-9, Fig. 1) >2 sec. .Use the " Function Button " (3-5, Fig. 1) Key, select to pH measurement Function.refer to Chapter 4, page 11.
2) Prepare the pH Electrode (optional), install the " Probe Plug " (5-1, Fig. 2) into the " PH Socket/BNC Socket " (3-20, Fig. 1).
3) **Adjust the manual Temp. value same as the solution's temperature exactly, the procedures refer chapter 9-8, page 34.**
4) Hold the " Electrode Handle " (5-2, Fig. 2) by hand and let the " Sensing head " (5-3, Fig. 2) immersed wholly into the measured solution and little shake the electrode.
5) The main display will show the pH value, the 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 Temp. compensation) but should prepare one temperature probe (optional,TP-07), insert the TP-07's plug into the " Temp. Socket "(3-19, Fig. 1), immerse the sensing head of temperature probe (TP-07) into the measurement solution.
2) The main display will show the pH value, the bottom display will show the sensing Temp. value of the measured solution (measured from ATC probe, TP-07).

When not use the Electrode, it should immerse the " Electrode sensing head " (5-3, Fig. 2) into the " Protection bottle " (5-4, 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) Use the " Function Button " (3-5, Fig. 1) Key, select to mV (ORP) measurement Function. the Display unit will show " mV "
2) Prepare the ORP Electrode (optional, ORP-14), install the " Probe Plug " of ORP electrode into the " PH Socket/BNC Socket " (3-20, Fig. 1).
3) The 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

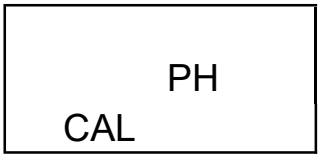
1) Prepare the pH Electrode (optional), install the " Probe Plug " (5-1, Fig. 2) into the " PH Socket/BNC Socket " (3-20, Fig. 1).
2) Power on the meter by pressing " Power Button "(3-9, Fig. 1) once.Select the Meter's measurement Function to " PH ".
3) Adjust the " Temperature Compensation Value " to make it same as the temperature value of the pH buffer solution.

   * **Manual temperature compensation value adjustment procedure, refer to 10-8, page 36.**
   * **Automatic temperature compensation, it should plug in the ATC probe (optional, TP-07).**

4) Hold the " Electrode Handle " (5-2, Fig. 2) by hand and let the " Sensing head " (5-3, 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 imerse the ATC ptobe into the solution together.**

5) Use the two fingers to press the " ▲ Button " (3-66,Fig 1) and " ▼ Button " (3-7, Fig. 1) continuously at least 2 seconds, at the same time Display will show the following screen.



6) Press the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) once in sequence to select the following screen.

a | 7.00 CAL | For pH 7.00 calibration

b | 4.00 CAL | For pH 4.00 calibration

c | 10.00 CAL | For pH 10.00 calibration

d | CLr CAL | Clear the existing calibration data

* After the above a, b, c screen is selected, then cooperate the relative standard solution, for example the
  b screen should cooperate the pH 7.00 standard solution.
  a screen should cooperate the pH 4.00 standard solution.
  Press the " Enter Button " (3-10, Fig. 1) will save the calibration data and finish the calibration procedures.
* If select the d screen, press the " Enter Button " (3-10, Fig. 1) will clear existing calibration data.

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

   PH7 calibration
   PH4 calibration (or 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.

6. Conductivity/Tds/Salt/Hardness/Resistivity Measurement 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.

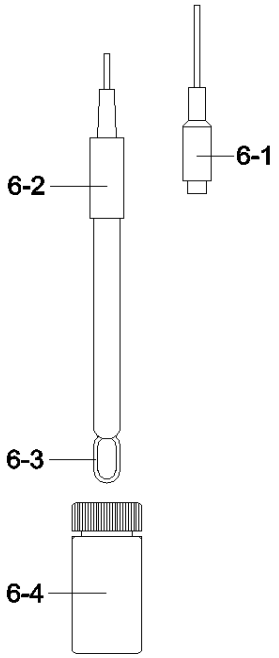


Fig 3

If the meter along with the conductivity probe are used for a certain period, then it should execute the calibration procedures, refer chapter 6-2-1, page 19.

6-1 Conductivity measurement

1) Prepare the Conductivity Probe (included, CDPB-04), install the " Probe Plug " (6-1, Fig. 3) into the " CD Socket " (3-18, Fig. 1).
2) Power on the meter by pressing " Power Button "(3-9, Fig. 1) > 2 sec. . Select the Meter's measurement Function to " Cd " (Conductivity measurement), refer to chapter 4, page 12.
3) Hold the " Probe Handle " (6-2, Fig. 3) by hand and let the " Sensing head " (6-3, 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.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. Push the " Range Button " (3-2, Fig. 1) once in sequence will change the range from 20 uS, 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 9-3 page 32.

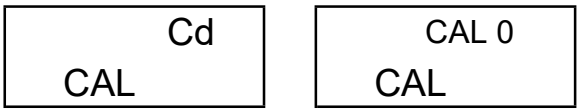
Change the Temp. Coefficient Factor

The default Temp. compensation factor value of the measurement solution is to 2.0% per ℃. If intend to change it, please refer to chapter 8-7, page 33.

Zero adjustment

If the probe not immerse the measurement solution and display not show zero value,Use the two fingers to press the "▲ Button " (3-6, Fig. 1) and " ▼ Button " (3-7, Fig. 1) continuously at least

2 seconds ,display will show the following screen A ,then release the two button,,display will show the following screen B,then press the " Enter button "once,will let the CD display value show zero .



screen A screen B

Remark : The zero function only valid for the 20 uS range and the not zero value is < 2.00 uS.

6-2 TDS (PPM) measurement

The measuring procedures are same as above
6-1 Conductivity (uS, mS) measurement.
Then use Function key select to TDS Function position.

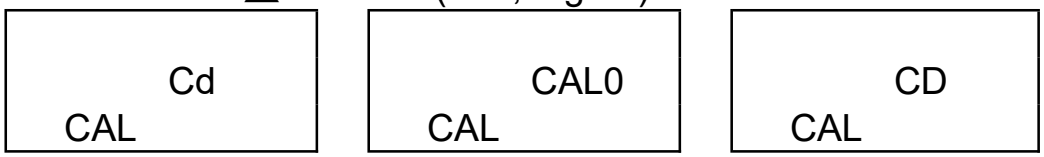
When not use the Probe, it should immerse the " CD probe sensing head " (6-3, Fig. 3) into the " Protection bottle " (6-4, Fig. 3)

6-2-1 CD 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 " (6-1, Fig. 3) into the " CD Socket " (3-18, Fig. 1).
3) Power on the meter by pressing " Power Button " (3-9, Fig. 1) > 2 sec..
   Select the Meter's measurement Function to " Cd " (Conductivity measurement)

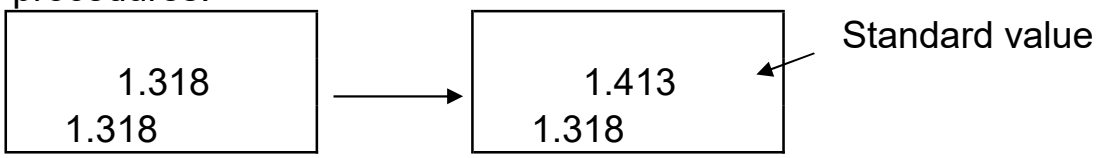
4) Hold the " Probe Handle " (6-2, Fig. 3) by hand and let the " Sensing head " (6-3, Fig. 3) immersed wholly into the measured solution. Shake the probe to let the probe's internal air bubble drift out from the sensing head. Display will show the conductivity mS (uS) values.

5) Use the two fingers to press the "▲ Button " (3-6, Fig. 1) and " ▼ Button " (3-7, Fig. 1) continuously at least 2 seconds at the same time. the display will show the following screen A , then release the two button,display will show the following screen B. then use the "▲ Button " (3-6, Fig. 1) to select to screen C.



screen A screen B screen C

6) Press the " Enter Button " (3-10, Fig. 1), the measuring value will present on both upper and lower Display. Use "▲ Button " (3-6, Fig. 1), " ▼ Button " (3-7, Fig. 1) to adjust the up display value exact same as the standard conductivity value. Press the " Enter Button " (3-10. 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.***

6-3 Salt measurement

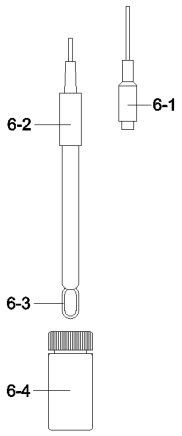


Fig 4

6-3-1 Salt measurement

1) Prepare the Conductivity Probe (included, CDPB-04),install the " Probe Plug " (6-1, Fig. 4) into the " CD Socket " (3-18, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-9, Fig. 1) > 2 sec.. Select the Meter's measurement Function to " SALt " (Conductivity measurement)
3) Hold the " Probe Handle " (6-2, Fig. 4) by hand and let the " Sensing head " (6-3, Fig. 4) 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).

6-3-2 Calibration

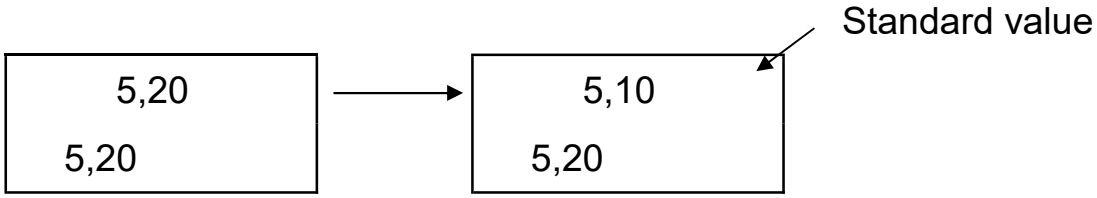
(1). Use the two fingers to press the "▲ Button " (3-6, Fig. 1) and " ▼ Button " (3-7, Fig. 1) continuously at least 2 seconds at the same time. the display will show the following screen A , then release the two button,

SALT
CAL

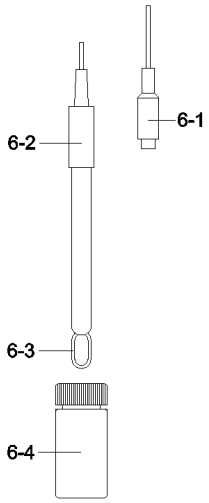
screen A

(2).Press the " Enter Button " (3-10, Fig. 1), the measuring value will present on both upper and lower Display. Use "▲ Button " (3-6, Fig. 1), " ▼ Button " (3-7, Fig. 1) to adjust the up display value exact same as the standard salt value.

Press the " Enter Button " (3-10. Fig. 1) will save the calibration data and finish the calibration



6-4 Hardness measurement



1) Prepare the Conductivity Probe (included, CDPB-04), install the " Probe Plug " (7-1, Fig. 4) into the " CD Socket " (3-18, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-9, Fig. 1) > 2 sec..
   Select the Meter's measurement Function to " H-rEs " (Conductivity measurement)
3) Hold the " Probe Handle " (7-2, Fig. 4) by hand and let the " Sensing head " (7-3, Fig. 4) 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).

6-5 Resistivity measurement

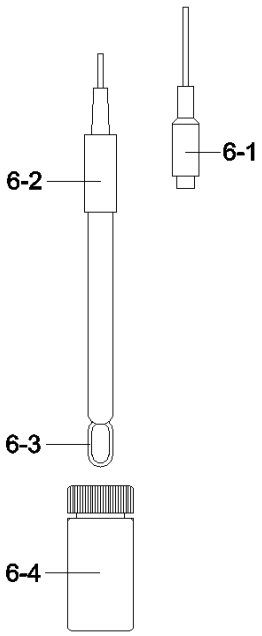


Fig 4

1) Prepare the Conductivity Probe (included, CDPB-04), install the " Probe Plug " (6-1, Fig. 4) into the " CD Socket " (3-18, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-9, Fig. 1) > 2 sec..
   Select the Meter's measurement Function to " r-es " (Conductivity measurement)
3) Hold the " Probe Handle " (6-2, Fig. 4) by hand and let the " Sensing head " (6-3, Fig. 4) 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 resistivity values.

7. DO (Dissolved Oxygen) MEASURING and CALIBRATION PROCEDURE

7-1 Dissolved Oxygen measurement

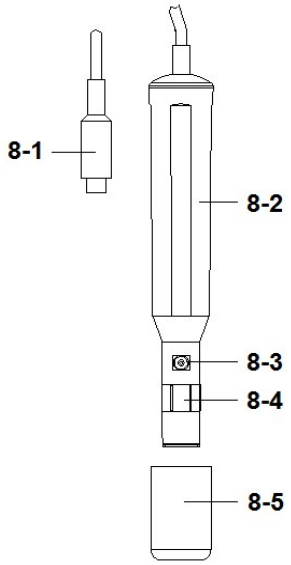


Fig. 5

1) Prepare the Oxygen Probe (optional, DOPB-11),install the " Probe Plug " (8-1, Fig. 5) into the " DO Socket " (3-17, Fig. 1).
2) Power on the meter by pressing " Power Button "(3-9, Fig. 1) once.
   Select the Meter's Function to " do " (Dissolved Oxygen " measurement, refer to chapter 4, page 11.

Calibration at first !

If it is the first time to use the Dissolved Oxygen meter or after a certain period to use the meter again, then it should to execute the calibration procedures at the first. For the measurement precisely consideration, it recommend to make the calibration before each measurement.Calibration procedure, refer to chapter 7-2,page 26.

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 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

Use the " Function Button " (3-5, Fig. 1) Key, select to O2 measurement Function.
the Display unit will show " %O2 ",and show the air Oxygen value for reference.

Change the Temp. unit to ℉

If intend to change the Temp. unit from ℃ to ℉, please refer to chapter 9-3, apge 32.

"% Salt" compensation value adjustment

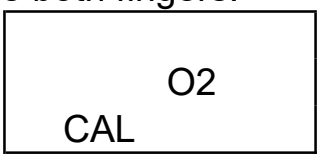
If intend to change the % Salt compensation value,
refer chapter 9-4, page 32.

"Height" compensation value adjustment

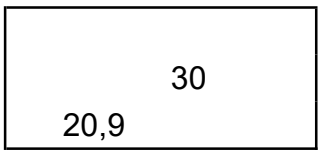
If intend to change the Height compensation value,
refer to chapter 9-5, 9-6, page 32 page 33.

7-2 Calibration

1) Install the " Probe Plug " (8-1, Fig. 5) into the " DO Socket " (3-17, Fig. 1).
2) Power on the meter by pressing " Power Button " (3-9, Fig. 1) > 2 sec..
   * Select the Meter's Function to " O2 " (Air Oxygen) measurement.
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 " ▲ Button " (3-6, Fig 1) and ▼ Button " (3-7, Fig. 1) continuously at least 2 seconds , the display will show the following screen A. then release the both fingers.



screen A



screen B

5) Press the " Enter Button " , the display will show the following screen B, the upper Display value will count from 30 to 0, then return to normal measuring screen and finish the calibration procedures. The complete calibration procedures will take 30 seconds approximately.

Use the " Function Button " (3-5, Fig. 1) Key select to " dO" test Function , Display unit will show " mg/L ".

Calibration Consideration :

a. ***As the oxygen in air is 20.9 % typically, so use the environment air 02 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.

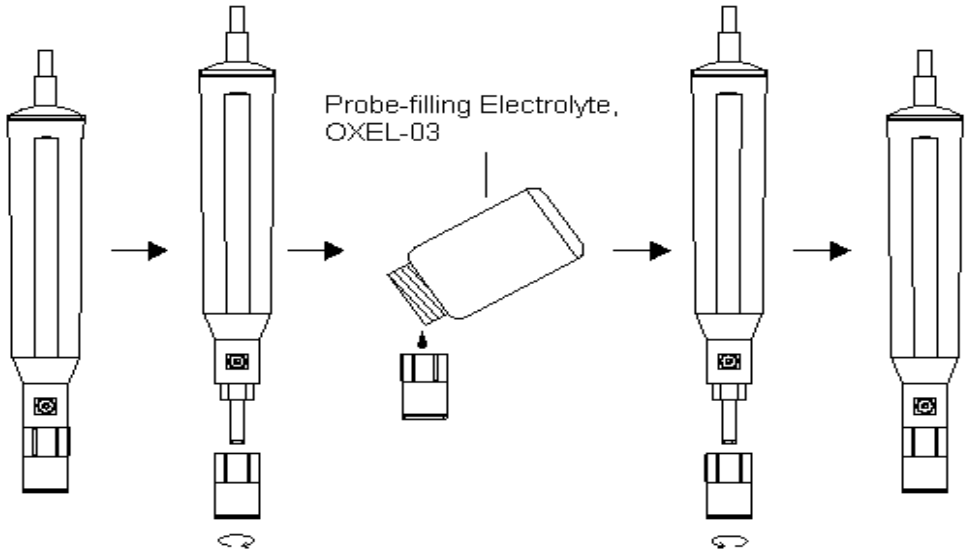
User already use the probe for a certain period :

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.



1) Unscrew the " Probe head " (9-3, Fig 6).
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 " (9-3, Fig 6) into the probe body.
5) **When not use the probe, should insert the " Probe head " into the " Probe protection cover " (8-5, Fig. 5)**

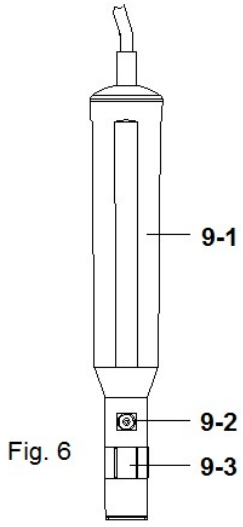


Fig. 6

9-1 Probe handle
9-2 Temp. sensing metal
9-3 Probe head

8. OTHER FUNCTION

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)

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 along with the maximum value will appear on the display.
   b) Press the " REC Button " (3-4, Fig. 1) again, the " REC. MIN. " symbol along with the minimum value will appear on the display.
   c) Press the " REC Button " (3-4, Fig. 1) again, *the display will show the " REC. " symbol only & execute the memory function continuously.*
   d) To exit the memory record function, just press the " REC " button for 2 seconds at least. The display will revert to the current reading.

8-3 LCD Backlight ON/OFF

After power ON, the " LCD Backlight " will light automatically. During the measurement, press the " Backlight Button " (3-9, Fig. 1) once will turn OFF the " LCD Backlight ". Press the " Backlight Button " once again will turn ON the " LCD Backlight " again.

9. ADVANCED SETTING

press the " SET Button " (3-8, Fig. 1) continuously at least two seconds will enter the " Advanced Setting " mode.
then press the " SET Button " (3-8, Fig. 1) once a while in sequence to select the eight main function, the display will show :

Sd F.....	SD memory card Format
dAtE.....	Set clock time (Year/Month/Date,Hour/Minute/Second)
SP-t.....	Set sampling time (Hour/Minute/Second)
PoFF.....	Auto power OFF management
bEEP.....	Set beeper sound ON/OFF
dEC.....	Set SD card Decimal character
t-CF.....	Select the Temp. unit to ℃ or ℉
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*
t-SEt.....	*Set pH manual Temp. compensation value, pH 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 SD memory card Format

When the lower display show " Sd F "

1) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) to select the upper value to " yES " or " no ".

   yES - Intend to format the SD memory card
   no - Not execute the SD memory card format

2) If select the upper to " yES ", press the " Enter Button " (3-10, Fig. 1) once again, the Display will show text " YES Ent " to confirm again, if make sure to do the SD memory card format, then press " Enter Button " once will format the SD memory clear all the existing data that already saving into the SD card.

9-2 Set clock time (Year/Month/Date,Hour/Minute/ Second)

When the lower display show " dAtE "

1) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) to adjust the value (Setting start from Year value). After the desired value is set, press the " Enter Button " (3-10, 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).
2) After set all the time value (Year, Month, Date, Hour, Minute, Second), press the " ENETER Button " (3-20, Fig. 1) once will save the time value.

   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).

9-3 Set sampling time (Seconds)

When the lower display show " SP-t "

1) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) to adjust the value (0, 1, 2, 5, 10, 30,60, 120, 300, 600, 1800,3600 seconds).
2) After the Sampling value is selected, press the " Enter Button " (3-10, Fig. 1) will save the setting function with default.

9-4 Auto power OFF management

When the lower display show " PoFF "

1) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, 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 " (3-10, Fig. 1) will save the setting function with default.

9-5 Set beeper sound ON/OFF

When the lower display show " bEEP "

1) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, 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 " (3-10, Fig. 1) will save the setting function with default.

9-6 Decimal point of SD card setting

The numerical data structure of SD card is default used the " . " as the decimal, for example "20.6" "1000.53" .But in certain countries (Europe ..) is used the " , " as the decimal point, for example " 20,6 " "1000,53". Under such situation, it should change the Decimal character at first.

When the lower display show " dEC "

1) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) to select the upper text to " USA " or " Euro ".

USA - Use " . " as the Decimal point with default.
Euro - Use " , " as the Decimal point with default.

2) After select the upper text to " USA " or " Euro ", press the " ENTER Button " (3-10, Fig. 1) will save the setting function with default.

9-7 Select the Temp. unit to ℃ or ℉

When the lower display show " t-CF "

1) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, 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 " (3-10, Fig. 1) will save the setting function with default.

9-8 Set DO salt% compensation value

When the lower display show " SALt "

1) This function only for the DO (Disolved oxygen) Function of adjusting the probe's salt% compensation value. The default value is 0% salt.
2) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) to select the upper value to the desired salt% compensation value, then press the " Enter Button " (3-10, 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) Function of adjusting the probe's height compensation value in meter unit. The default value is 0 meter.

2) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) to select the upper value to the desired height compensation value (meter), then press the " Enter Button " (3-10, 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 (Disolved oxygen) Function of adjusting the probe's height compensation value in feet unit. The default value is 0 FEET.
2) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) to select the upper value to the desired height compensation value (feet), then press the " Enter Button " (3-10, 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) Function of adjusting the probe's Temp.compensation value in %/per ℃ unit. The default value is 2 %/ per ℃.
2) Use the " ▲ Button " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) to select the upper value to the desired Temp. compensation value (%/per ℃), then press the " Enter Button " (3-10, Fig. 1) will save the setting value temporally.

9-12 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 " (3-6, Fig. 1) or " ▼ Button " (3-7, Fig. 1) to select the upper value to the desired Temp. compensation value (℃ or ℉), then press the " Enter Button " (3-10, Fig. 1) will save the setting value with default.

9-13 ESC

When the display show " ESC "

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

Remark :

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.

10. DATALOGGER

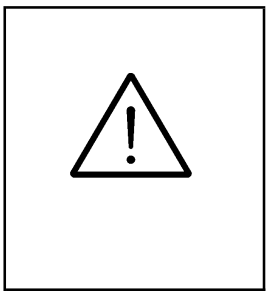
10-1 Preparation before execute datalogger function

a. Insert the SD card
Prepare a " SD memory card " (1 G to 16 G, optional), insert the SD card into the " SD card socket " (3-11, Fig. 1).The front panel of the SD card should face against the the down case.

b. SD card Format
If SD card just the first time use into the meter, it recommend to make the " SD card Format " at first. please refer chapter 9-1 (page 31).

c. Time setting
If the meter is used at first time, it should to adjust the clock time exactly, please refer chapter 9-2 (page 31).

d. Decimal format setting



The numerical data structure of SD card is default used the " . " as the decimal, for example "20.6" "1000.53" . But in certain countries (Europe ...) is used the " , " as the decimal point, for example " 20, 6 " "1000,53". Under such situation, it should change the Decimal character at first, details of setting the Decimal point, refer to Chapter 9-6, page 33.

10-2 Auto Datalogger (Set sampling time ≧ 1 second)

a. Start the datalogger

Press the " LOG Button (3-10, Fig. 1) > 3 seconds continuously, the lower LCD will show the text of " Log "then " REC " symbol will flashing per sampling time, at the same time the measuring data along the time information will be saved into the memory circuit.

Remark :

* *How to set the sampling time, refer to Chapter 9-3, page 32.*
* *How to set the beeper sound is enable, refer to Chapter 9-5, page 32.*

b. Pause the datalogger

During execute the Datalogger function, if press the " LOG Button " (3-10, Fig. 1) once will pause the Datalogger function (stop to save the measuring data into the memory circuit temporally). In the same time the the " Logger " symbol will stop flashing, the lower LCD will show the text of " Log ".

Remark :

If press the " LOG Button " (3-10, Fig. 1) once again will execute the Datalogger again, the " Logger " symbol will flashing.

c.. Finish the Datalogger

During execute the Datalogger function, press the " LOG Button (3-10, Fig. 1) > 3 seconds continuously again will finish the Datalooger function, the " Log " text will be disappeared and finish the Datalogger.

10-3 Manual Datalogger (Set sampling time = 0 second)

a. Set sampling time is to 0 second

Press the " LOG Button (3-10, Fig. 1) > 3 second , the lower LCD will show the " Position no. " , then press the " LOG Button " (3-10, Fig. 1) once, the " Logger " symbol will flashing once and Beeper will sound once, at the same time the measuring data along the time information will be saved into the memory circuit.

Remark :
During execute the Manual Datalogger, it can use the " ◢ Button " (3-6, Fig. 1) or " ◤ Button " (3-7, Fig. 1) to set the measuring position (1 to 99, for example room 1to room 99) to identify the measurement location , the lower Display will show P x (x = 1 to 99). (x = 1 to 99).

b. Finish the Datalogger

During execute the Datalogger function, press the " LOG Button (3-10, Fig. 1) > 3 seconds continuously again will finish the Datalooger function, the Position no. " PXX " will be disappeared and finish the Datalogger. function.

10-4 Check time information

During the normal measurement (not execute the Datalogger), If press " TIME Button " (3-8, Fig. 1) once , the lower LCD display will present the time information of Year/Month, Date/Hour, Minute/Second and the Sampling time information in sequence.

10-5 SD Card Data structure

1) When the first time, the SD card is used into the meter, the SD card will generate a folder :

   WABC01

2) If the first time to execute the Datalogger,under the route WABC01\, will generate a new file name WABC01001.XLS.After exist the Datalogger, then execute again, the data will save to the WAC01001.XLS until Data column reach to 30,000 columns, then will generate a new file, for example WABC01002.XLS
3) Under the folder LXC01\, if the total files more than 99 files, will generate anew route, such as WABC02\ .....
4) The file's route structure :

WABC01\	WABC01001.XLS
	WABC01002.XLS
	.....
	WABC01099.XLS
WABC02\	WABC02001.XLS
	WABC02002.XLS
	.....
	WABC02099.XLS
WABCXX\	.....

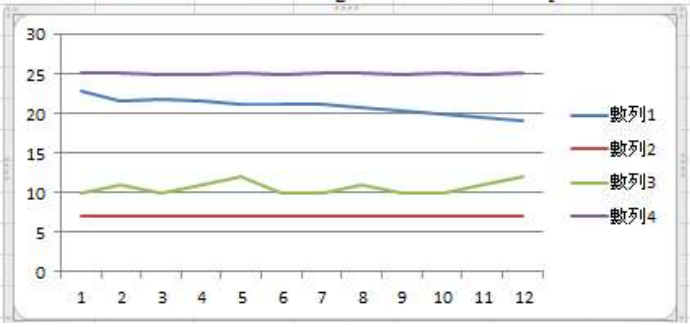
   Remark :
   XX : Max. value is 10.

11. Saving data from the SD card to the computer (EXCEL software)

1) After execute the Data Logger function, take away the SD card out from the " SD card socket " (3-11, Fig. 1).
2) Plug in the SD card into the Computer's SD card slot (if your computer build in this installation) or insert the SD card into the " SD card socket ". then connect the " SD card socket " into the computer.
3) Power ON the computer and run the " EXCEL software ".Down load the saving data file (for example the file name : WABC01001.XLS, WABC01002.XLS) from the SD card to the computer. The saving data will present into the EXCEL software screen (for example as following EXCEL data screens) , then user canuse those EXCEL data to make the further Data or Graphic analysis usefully.

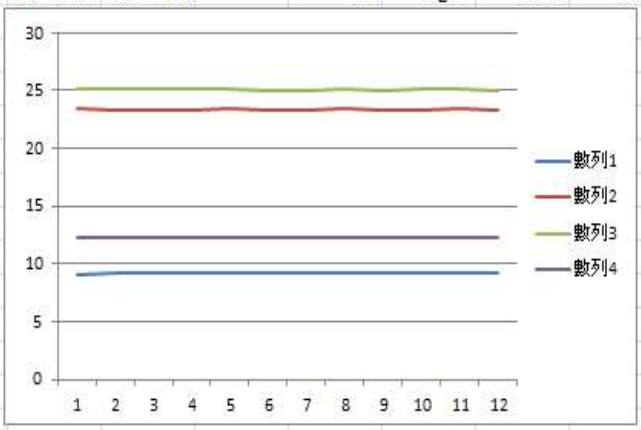
EXCEL data screen (for example)

	A	B	C	D	E	F	G	H	I	J	K
1	Position	Date	Time	Ch1_T(PH	Ch1_unit	Ch2_PH	Ch2_unit	Ch3_ORP	Ch3_unit	Ch4_T(DC	Ch4_unit
2	1	2017/3/7	06:46:31	22.8	Degree C	7.01	pH	10	mV	25.1	Degree C
3	2	2017/3/7	08:34:04	21.6	Degree C	7.02	pH	11	mV	25.1	Degree C
4	3	2017/3/7	08:34:24	21.7	Degree C	7.02	pH	10	mV	25.0	Degree C
5	4	2017/3/7	08:34:44	21.6	Degree C	7.01	pH	11	mV	25.0	Degree C
6	5	2017/3/7	08:35:04	21.2	Degree C	7.00	pH	12	mV	25.1	Degree C
7	6	2017/3/7	08:35:24	21.2	Degree C	6.99	pH	10	mV	25.0	Degree C
8	7	2017/3/7	08:35:44	21.1	Degree C	7.00	pH	10	mV	25.1	Degree C
9	8	2017/3/7	08:36:04	20.7	Degree C	7.10	pH	11	mV	25.2	Degree C
10	9	2017/3/7	08:36:24	20.3	Degree C	7.02	pH	10	mV	25.0	Degree C
11	10	2017/3/7	08:36:44	19.9	Degree C	6.99	pH	10	mV	25.1	Degree C
12	11	2017/3/7	08:37:04	19.5	Degree C	7.00	pH	11	mV	25.0	Degree C
13	12	2017/3/7	08:37:24	19.2	Degree C	7.00	pH	12	mV	25.1	Degree C



EXCEL graphic screen (for example)

	A	B	C	D	E	F	G	H	I	J	K	L
1	Position	Date	Time		Ch5_DO	Ch5_unit	Ch6_CO2	Ch6_unit	Ch7_T(CI	Ch7_unit	Ch8_CD	Ch8_unit
2	1	2017/3/7	06:46:31		9	mg/L	23.4	%O2	25.1	Degree C	12.27	mS
3	2	2017/3/7	08:34:04		9.2	mg/L	23.3	%O2	25.1	Degree C	12.26	mS
4	3	2017/3/7	08:34:24		9.2	mg/L	23.3	%O2	25.1	Degree C	12.27	mS
5	4	2017/3/7	08:34:44		9.2	mg/L	23.3	%O2	25.1	Degree C	12.27	mS
6	5	2017/3/7	08:35:04		9.2	mg/L	23.4	%O2	25.1	Degree C	12.27	mS
7	6	2017/3/7	08:35:24		9.2	mg/L	23.3	%O2	25.0	Degree C	12.27	mS
8	7	2017/3/7	08:35:44		9.2	mg/L	23.3	%O2	25.0	Degree C	12.28	mS
9	8	2017/3/7	08:36:04		9.2	mg/L	23.4	%O2	25.1	Degree C	12.28	mS
10	9	2017/3/7	08:36:24		9.2	mg/L	23.3	%O2	25.0	Degree C	12.28	mS
11	10	2017/3/7	08:36:44		9.2	mg/L	23.3	%O2	25.1	Degree C	12.26	mS
12	11	2017/3/7	08:37:04		9.2	mg/L	23.4	%O2	25.2	Degree C	12.28	mS
13	12	2017/3/7	08:37:24		9.2	mg/L	23.3	%O2	25.0	Degree C	12.28	mS



12. 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 " (3-16, Fig. 1).

13. BATTERY REPLACEMENT

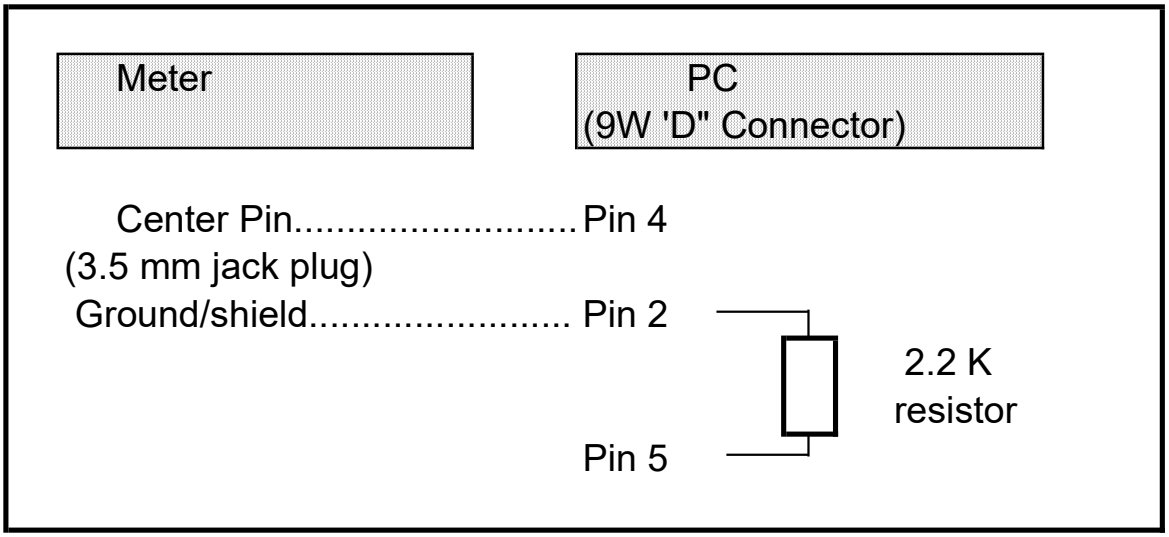
1) When the left corner of LCD display show "  ", it is necessary to replace the battery. However, in-spec. measurement may still be made for several hours after low battery indicator appears before the instrument become inaccurate.
2) Loose the screws of the " Battery Cover Screws " (3-14, Fig. 1) and take away the " Battery Cover " (3-12, Fig. 1) 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 the battery.

14. RS232 PC SERIAL INTERFACE

The instrument has RS232 PC serial interface via a 3.5 mm 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.



RS232 FORMAT : 9600, N, 8, 1

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

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
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			
	℃ = 01	℉ = 02	pH = 05	mV = 18
	ms = 14	us = 13	O2 = 06	mg/L = 07
	ohm = 38	K ohm = 39	M ohm = 40	ppm = 19
D13	When send the upper display data = 1 When send the lower display data = 2			
D14	4			
D15	Start Word			

15. PATENT

The meter (SD card structure) already get patent or patent pending in following countries :

Germany	Nr. 20 2008 016 337.4
JAPAN	3151214
TAIWAN	M 456490
CHINA	ZL 2008 2 0189918.5
	ZL 2008 2 0189917.0