1,600 point data logger, RS232, AC/DC adapter
auto calibration

DISSOLVED OXYGEN METER

Model : DO-5519

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

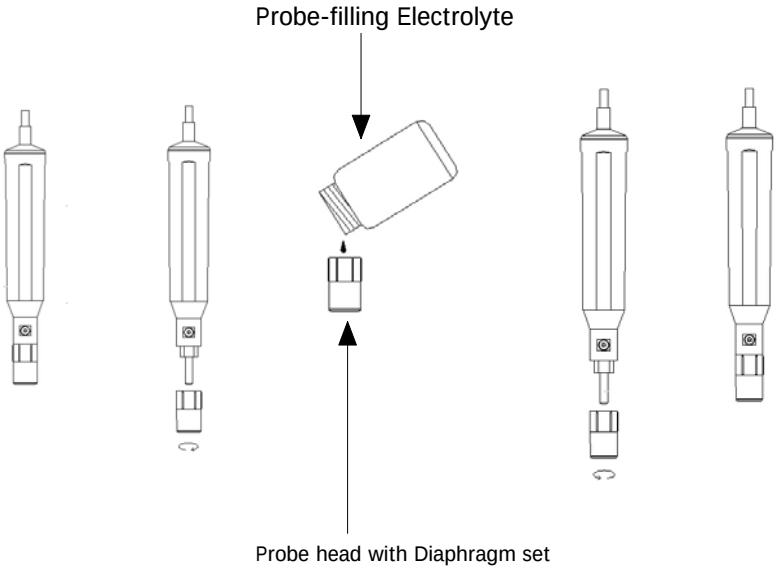
QUALITY ASSURED FIRM ISO 9001 SGS
UKAS QUALITY MANAGEMENT 005

OPERATION MANUAL

ATTENTION :

Fill the Probe's Electrolyte at first.

Intend to keep the DO probe under the best condition, when user receive the DIGITAL OXYGEN METER along the PROBE, it should fill the Probe's Electrolyte at first.



The procedures that to fill the Probe's Electrolyte, refer the chapter 8 " PROBE MAINTENANCE ", page 13 .

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1. FEATURES

* This Digital Oxygen Meter is supplied with a polarographic type probe with an incorporated Temp. sensor which serves for precise Dissolved Oxygen (DO) and Temp. measurement.
* Applications for Aquarium, Medical research, Agriculture, Fish hatcheries, Laboratory, Water conditioning, Mining industry, Schools & Colleges, Quality control...
* Heavy duty dissolved oxygen probe, probe head size can connect with BOD bottle
* Separate probe with 4 meters cable.
* Automatic Temp. compensation from 0 to 50 ℃ for sensor.
* Build in advanced setting procedures, it can adjust the " % SALT " & " Height " compensation value.
* Microprocessor circuit assures high accuracy and provides special functions and features.
* Multi-display, show Dissolved oxygen & Temp. at the same time.
* RS 232 PC serial interface.
* Build in temperature ℃,℉ measurement.
* LCD with two display, easy readout.
* Manual and auto data logger, with flexible sampling time selection, can save max. 1,600 reading data.
* Power function can default to auto off or manual off.
* Temperature unit can default to ℃ or ℉.
* Microcomputer circuit, intelligent function, high accuracy.
* Records Maximum and Minimum readings with recall.
* Data hold function for freezing the desired value.
* Build in the input socket for DC 9V power adapter.
* RS232 PC serial interface.
* Use the durable, long-lasting components, including a heavy duty & compact ABS-plastic housing case.

2. SPECIFICATIONS

Display	LCD size : 44 mm x 29 mm. Dual function LCD	
Circuit	Custom one-chip of microprocessor LSI circuit.	
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 ** For reference only*	± 0.7% O2.
	Temperature	± 0.8 ℃/1.5 ℉.
Sensor Structure	The polarographic type oxygen probe with an incorporated temperature sensor.	
Probe Compensation and Adjustment	Temperature ** Automatic adj.*	0 to 50 ℃,
	Salt ** Manual adj.*	0 to 39 %Salt (% Weight)
	Height ** Manual adj.*	0 to 3,900 meter
Memory Recall	Records Maximum, Minimum readings with recall.	
Power off	Auto power off saves battery life, or manual off by push button.	
Data Output	RS 232 PC serial interface.	
Sampling Time of Data Logger	Manual	Push the data logger button once will save data one time. ** Set sampling time to 0 second.*
	Auto	1, 2, 5, 10, 30, 60, 600, 1800, 3600 seconds.
Data Logger number	Max. 1,600-point Data logger	
Data Hold	Freeze the display reading.	
Sampling Time of display	Approx. 1 second.	

Data Output	RS 232 PC serial interface.
Operating Temperature	0 to 50 ℃.
Operating Humidity	Less than 80% RH.
Power Supply	006P DC 9V battery (Alkaline or Heavy duty type) or DC 9V adapter input. ** AC/DC power adapter is optional.*
Power Current	Approx. DC 6.2 mA.
Weight	446 g/0.98 LB. ** Include probe and batterry.*
Dimension	*Main instrument:* 135 x 60 x 33 mm.
	Oxygen probe : 190 mm x 28 mm Dia. (7.5" x 1.1" Dia.) Probe's cable length : 4 meters.
Accessories Included	Oxygen probe (OXPB-11)..... 1 PC. Soft carrying case (CA-05A)..... 1 PC. Operation manual..... 1 PC. Spare Probe head with Diaphragm OXHD-04..... 2 set Probe-filling Electrolyte OXEL-03..... 1 set
Optional probe and accessories	* Oxygen probe..... OXPB-11 * Spare Probe head with Diaphragm set..... OXHD-04 * Probe-filling Electrolyte..... OXEL-03 * RS232 cable..... UPCB-02 * USB cable..... USB-01 * Data Acquisition software..... SW-U801-WIN * Data logger software..... SW-DL2005 * Hard carrying case..... CA-06 * AC to DC 9V adapter

3. FRONT PANEL DESCRIPTION

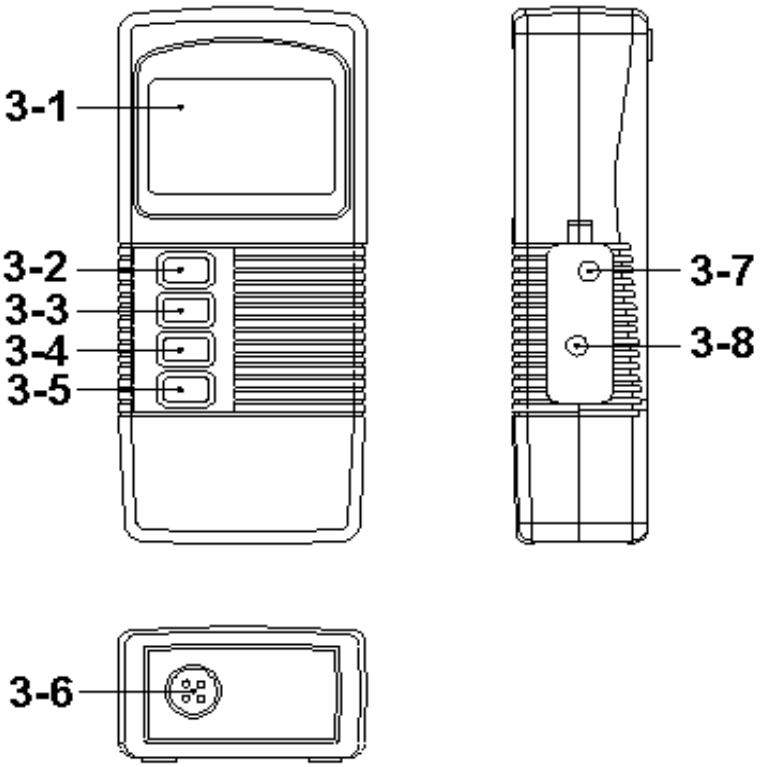
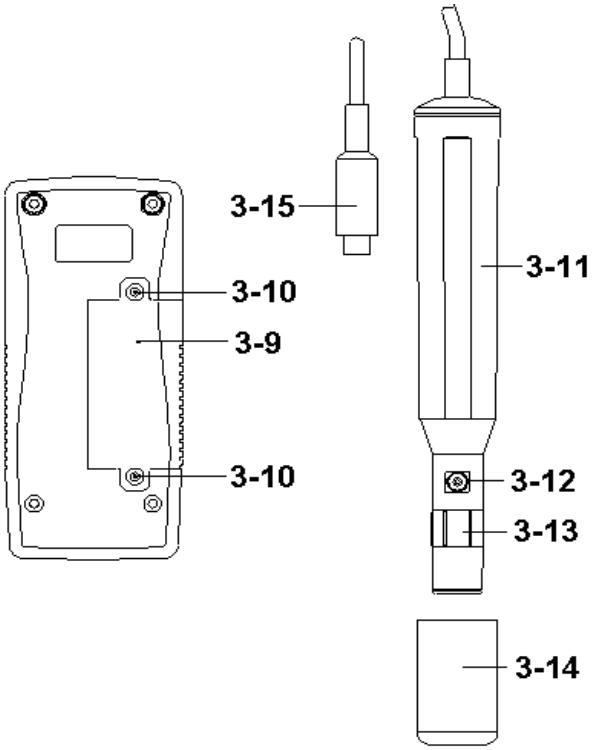


Fig. 1

Fig. 2



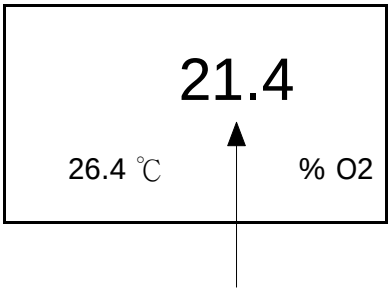
3-1 Display
3-2 Power/ESC/Send button
3-3 FUNC/Hold button (Send quit/▲ button)
3-4 REC/Enter button
3-5 Setting/Logger button (▼ button)
3-6 Probe input socket
3-7 DC 9V adapter socket
3-8 RS-232 output terminal
3-9 Battery compartment/Cover
3-10 Battery cover screws
3-11 Oxygen Probe handle
3-12 Temperature sensor
3-13 Probe head with diaphragm set
3-14 Protection cover for probe head
3-15 Oxygen probe plug

4. MEASURING PROCEDURE

4-1 Calibration

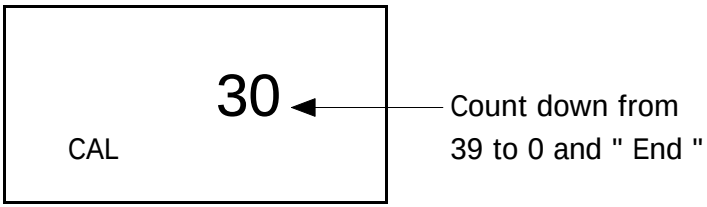
Before the measurement, the meter should be processed the following calibration procedures :

1) Connect the " Oxygen probe plug " (3-15, Fig. 2) into the " Probe input socket " (3-6, Fig. 1).
2) Power on the instrument by pushing the " Power Off/On button " (3-2, Fig. 1).
   The " Display " (3-1, Fig. 1) will show the " O2% " and the " Temp. " value as example :

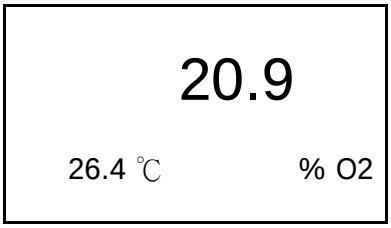


The upper display (%O2 display) value will increase, wait for approx. 3 minutes at least until the upper display reading values become stable & no fluctuation.

Press the " Hold button " (3-3, Fig. 1) once, the " Display " (3-1, Fig. 1) will show the " Hold " indicator, then following press the " REC button " (3-4, Fig. 1) once, the Display will show :



The text " CAL " will flash, the upper value will count down from 30 to 0 and " End " , then show as :



The upper display will show the values exactly same as 20.9 or 20.8. (As the oxygen in air is 20.9 % typically, so use the environment air 02 value for quick & precise calibration).

Now the calibration procedures are finished !

Calibration Consideration :

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

4-2 Dissolved Oxygen (DO) measurement

1) After the meter be calibrated (above procedure 4-1), the meter is ready for measurement.
2) Press the " FUNC button " (3-3, Fig. 1) continuously at least two seconds, the display indicator will change from " % O2 " change to " mg/L ".
3) 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 automatic temperature compensation circuit..

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.

4) 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.

Measuring consideration :

The DO (Dissolved Oxygen) " measurement will be effected by the following factor :

"Height" value of the measured environment
"% Salt" in the measured solution

For the above factor, the meter's default value are :
" Height " value is " 0 meter " (sea level).
" % Salt " value is 0 %Salt (9 % Weight).

The method to adjust the " % Salt " value and " Height value ", refer to
Chapter 5-1 Height Value Setting, page 13.
Chapter 5-2 Salt Value Setting, page 13.

5) Rinsed the probe accurately with normal tap water after each series of measurement.
Install " Probe head protection cover " (3-14, Fig, 2) into the " Probe head " (3-13, Fig. 2).

4-3 Oxygen in Air (O2) measurement

After the meter be calibrated (above procedure 4-1), the meter is ready for O2 (Oxygen in air) measurement, the display will show the indicator " O2% " .

** The Air oxygen measurement value only for reference.*

4-4 Temperature measurement

During the measurement, the lower LCD Display will show the temperature values of measuring solution.

** The method to change the Temp. unit from " ℃ " to " ℉ " or " ℉ " to " ℃ ", please refer to : Chapter 5-3 Change the Temp ℃, ℉ unit, page 14.*

4-5 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.*

4-6 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, press the " Hold button " (3-3, Fig. 1) once, 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, 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 for 2 seconds at least. The display will revert to the current reading.

4-7 Data Logger

The data logger function can save 1,600-point measuring data.

The data logger procedures are following :

a) 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.

b) **Auto Data Logger (Sampling time should select to 1, 2, 5, 10, 30, 60, 600, 1800 or 3600 seconds)**

   Press the " Logger button " (3-5, Fig. 1) once to start the Data Logger function. The " REC " symbol will flash per 1.5 second and the beeper will sound when save the data into the memory. Now the Data Logger function is executed.

Manual Data Logger (Sampling time should set to 0 second)

Press the " Logger button " (3-5, Fig. 1) once will save the data one time into the memory, at the same time the symbol " REC " will flash once and the beeper will sound.

Memory full

When execute the data logger function, if the upper display show " FULL " with flashing, it indicate the memory data already over 1,600 no. and the memory is full.

c) During the Data Logger function is executed, press the " Logger button " (3-5, Fig. 1) once will stop the data logger function, the " REC " symbol will stop to flash.
If press the " Logger button " (3-5, Fig. 1) once again will continuous the Data Logger function.

Note :

1) If intend to change the data logger sampling time, please refer to chapter 5-5, page 15.

2) If intend to know the space of balance data numbers into the memory IC, please refer to chapter 5-6, page 15.

3) If intend to clear the saving data from the memory please refer section 5-7, page 15.

5. ADVANCED SETTING PROCEDURES

Before executing Advanced Setting Procedures, exit the " Hold function " and the Record " function first.

* **Press " Setting button " continuously at least 5 seconds to enter the setting function.**
* After already set the desiring value (function), press the " Enter button " to save with default.
* Press the " Esc button " to escape the setting procedures.

a. Hold the " Setting button " (3-5, Fig. 1) at least five seconds will enter the Advanced Setting Procedures.

b. One by one to press the " Setting button " (3-5, Fig. 1) once a while to select the main setting function in sequence and show on the text the lower display as :

High..... Change the height compensation value
SALt..... Change the % salt compensation value
℃..... Change the Temp ℃, ℉ unit
OFF..... Auto power ON/OFF management
SP-t..... Change the data logger sampling time
SPACE To show the balance data numbers in the memory
CLr..... Clear the existing saving data from the memory
Code..... Code entering for the further calibration usage

5-1 Height Value Setting

(Lower display show " High ")

Bear in mind that the DO measurement is considered to be taken at sea level. However if the measuring environment is not at sea level (0 meter), then should adjust the " Height " values for the probe compensation when intend to make the DO measurement precisely.

After the low display show " High ", press the " Enter button " (3-4, Fig. 1) once. the " High " symbol will flash, the up display will show the Height compensation value ".
Use " ▲ button " (3-3, Fig. 1) and " ▼ button " (3-5, Fig. 1) to adjust the up display value until it same as the desiring height compensation value (unit is meter) exactly.
After select the desiring value, press the " Enter button " (3-4, Fig. 1) to save the data.

Remark :

* *The " Height value " only can adjust from 0 to 3,900 meters.*
* *After power off and on again, the original setting height value will be cleared and return to 0 meter (sea level).*

5-2 Salt Value Setting

(Lower display show " SALt ")

After the low display show " SALt ", press the " Enter button " (3-4, Fig. 1) once. the " SALt " symbol will flash. The up display will show the Salt compensation value.

Use " ▲ button " (3-3, Fig. 1) and " ▼ button " (3-5, Fig. 1) to adjust the up display value until it same as the desiring Salt compensation value exactly, the unit is % Salt (% Weight).

After select the desiring value, press the " Enter button " (3-4, Fig. 1) to save the data.

Remark :

** The " Salt value " only can adjust from 0 to 39 % Salt (% Weight)*

** After power off and on again, the original setting Salt value will be cleared and return to 0 % Salt.*

5-3 Change the Temp ℃, ℉ unit

(Lower display show " ℃ ")

a. Use " ▲ button " (3-3, Fig. 1) to select " ℃ " or " ℉ ".
b. After select the desiring value (℃ or ℉), press the " Enter button " (3-4, Fig. 1) to save the data with default.

5-4 Auto power On/Off

(Lower display show " OFF ")

a. Use " ▲ button " (3-3, Fig. 1) to select " YES " or " no ".
   ** YES : Auto power off.*
   ** no : Auto power disable, it is the manual power off.*
b. After select the desiring function (YES or no), press the " Enter button " (3-4, Fig. 1) to save the function with default.

5-5 Change the data logger sampling time

(Lower display show " SP-t ")

a. Use " ▲ button " (3-3, Fig. 1) to select data logger sampling time to
0, 1, 2, 5, 10, 30, 60, 600, 1800, 3600 seconds
b. After the sampling time value is determined, press the Enter button " (3-4, Fig. 1) to save the sampling time with default.

Note :
Set the sampling time to 0 second is used for the manual Data Logger function.

5-6 To show the balance data numbers in the memory

(Lower display show " SPACE ")

The display will show the balance data no. that exist into the memory (allow memorize data no.).

5-7 Clear the existing saving data from the memory

(Lower display show " CLr ")

a. Use " ▲ button " (3-3, Fig. 1) to select " YES " or " no ".
** YES : It will execute the memory clear function..*
** no : It will be not to clear the memory.*
b. If select " YES ", press the " Enter button " (3-4, Fig. 1) the beeper will sound three sounds for warning, if really intend to clear the memory, then press the " Enter button " again.

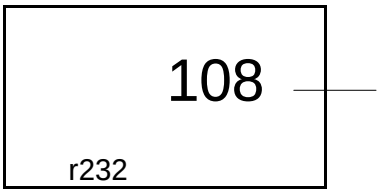
5-8 Code entering for the further calibration usage

(Lower display show " CodE")

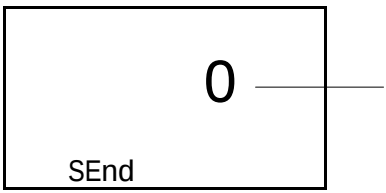
The upper display will show 0.
The code setting is used for the further technician service usage, it do not enter any new code, just press the " Enter button " (3-4, Fig. 1) will finish the Advanced Setting Procedure.

6. SEND THE DATA OUT

1) To send the data out from the meter, exit the " Hold function " and the " Record function " at first.
2) Press the " Send button " (3-2, Fig. 1) at least 5 seconds until the lower display show " r232 ", then release the button.



3) Push the " Send button " (3-2, Fig. 1) once, the lower display will show " SEnd ", the upper no. will count up until reach the data logger storage no., at the same the storage data logger data will send out the meter from the " RS-232 output terminal " (3-8, Fig. 1).



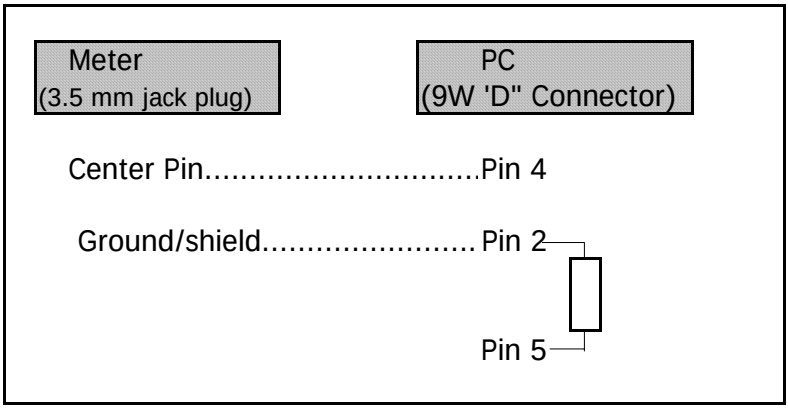
4) If intend up load the data to the computer, then should connect the optional RS232 cable/UPCB-01 or USB cable/USB-01 and cooperate the Data Logger software (optional, Model : SW-DL2005).
5) Press the " Send quit button " (3-3, Fig. 1) will escape the data sending function.

7. RS232 PC SERIAL INTERFACE

The instrument has RS232 PC serial interface via a 3.5 mm terminal (3-8, Fig. 1).

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

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



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

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

Each digit indicates the following status :

D15	Start Word		
D14	4		
D13	When send the upper display data = 1 When send the lower display data = 2		
D12 & D11	Annunciator for Display		
	℃ = 01	℉ = 02	
	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, D8 = MSD, D1 = LSD. For example : If the display reading is 1234, then D8 to D1 is : 00001234		
D0	End Word		

RS232 setting

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

8. PROBE MAINTENANCE

User first time to use the meter :

Intend to let the DO probe keep the best condition. When user receive the DIGITAL OXYGEN METER along the PROBE, it should fill the Probe's Electrolyte at first.

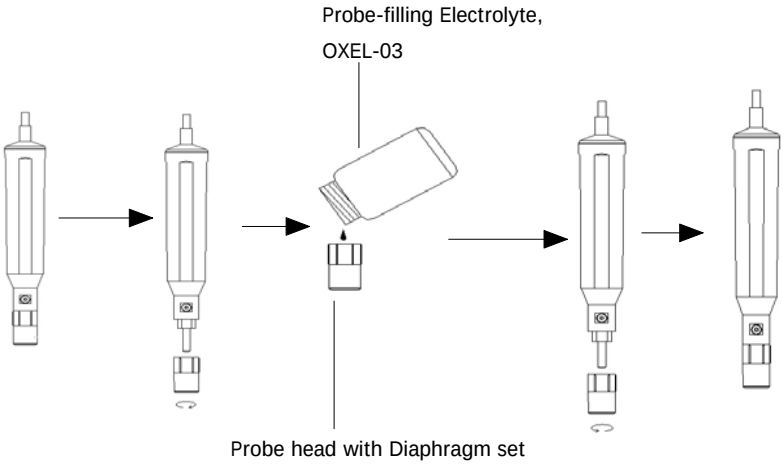
User already use the meter for a certain period :

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 " (8-3, Fig 3).
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 " (8-3, Fig 3) into the probe body.

Fig. 3

8-1 Probe handle
8-2 Temp. sensing metal
8-3 Probe head

9. BATTERY REPLACEMENT

1) When the upper 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) Open the " Battery Cover " (3-9, Fig. 2) away from the instrument by loosing the " Battery cover screws " (3-10, Fig. 2) and remove the battery.
3) Replace with 9V battery (Alkaline or Heavy duty type) and reinstate the cover.
4) Make sure the battery cover is secured after changing the battery.

10. OPTIONAL ACCESSORIES

Carrying case CA-06	Hard carrying case. (280 x 195 x 65 mm) 

RS232 cable UPCB-02	* Isolated RS232 cable. * Used to connect the meter to the computer
RS232 cable USB-01	* USB Computer interface cable. * Isolated USB cable.
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.
	AC 220V/230V to DC 9V. Germany plug.