

AquaCOMBO

pH DO Cond Salinity
temperature meter
HM3070

Operation Manual

INTRODUCTION

Your purchase of this AquaCOMBO meter marks a step forward for you into the field of precision measurement. Although this meter is a complex and delicate instrument; its usability will allow many years of use if proper operating techniques are observed and practiced. Please read the following instructions carefully and always keep this manual within easy reach.

1. FEATURES:

- a. Simultaneous display of pH, Dissolved Oxygen, Conductivity/ Salinity and temperature.
- b. 3 point calibration with automatic pH buffer recognition with built in ISO and NIST standard
- c. 1 point calibration at each Conductivity range
- d. In air DO calibration
- e. Automatic salinity compensation for D.O. at preset value
- f. Automatic altitude compensation for D.O. at preset value
- g. 99 data memory recording

2. CONTENT:

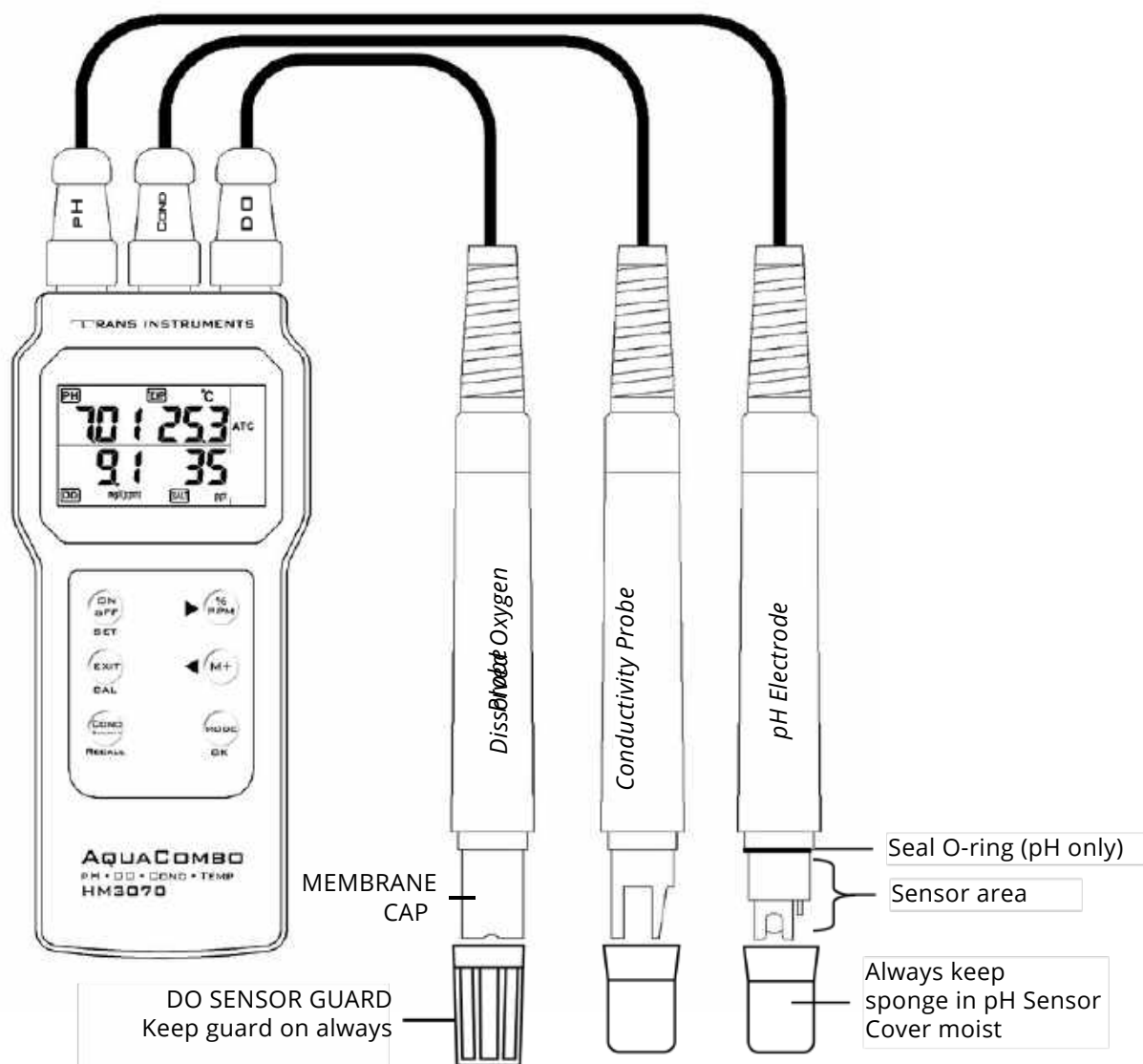
Carefully unpack the box. It should contain the following items:

- a. Main unit
- b. Combination pH electrode with 1 meter cable
- c. Conductivity probe with 1 meter cable
- d. Dissolved Oxygen probe with 3 meter cable
- e. 2 x DO membrane cap
- f. 1 x DO sensor electrolyte
- g. 6 x AAA size batteries
- h. Operations manual

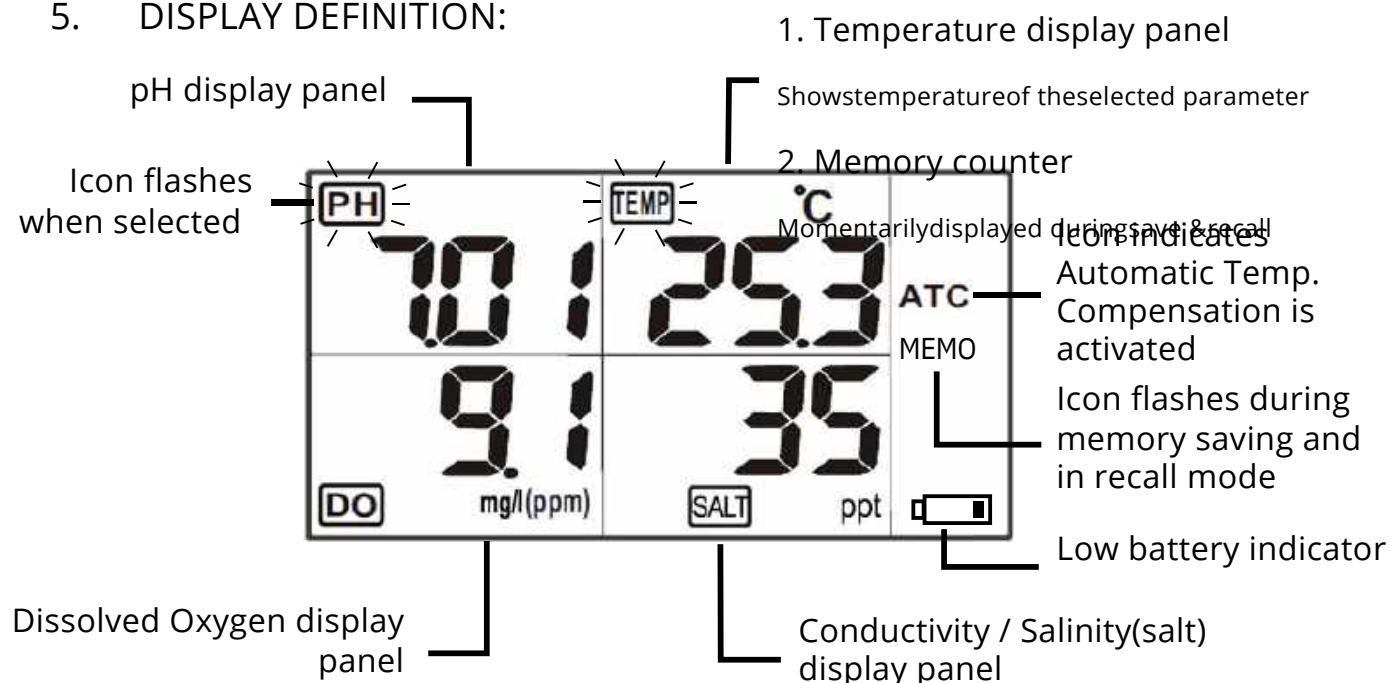
3. PRODUCT SPECIFICATION:

	pH	DO	Conductivity	Salinity	Temperature
Measure range	2~12pH	0~30ppm	0~200/~2000μS/ ~20/~70mS	0~10ppt 0~42ppt	0~60℃
Measuring Temp.	0~50℃	±10% of last Cal. Temp.	0~50℃		
Display resolution	0.01pH	0.1ppm	0.1 / 1μS 0.01 / 0.1mS	0.01 / 0.1ppt	0.1℃
Accuracy	±0.1pH	±1ppm	±1.5% full scale of each range	±0.15ppt / ±0.5ppt	±0.5℃
Calibration points	pH7.00 / 4.01 / 10.01	1 point in air Manual Set Salinity:0~42ppt Altitude:0~3500M	1 point at each range	n.a.	
Compensation			Automatic: 0~50℃		
Operating Humidity	<80% R.H.				
Storage Humidity & temperature	<90% R.H., -20~60℃				
Product size / Weight	169 x 78.3 x 43.4 mm (L x W x H) / 200gram				
Battery type / Life	6 x AAA size battery /				

4. PRODUCT LAYOUT:



5. DISPLAY DEFINITION:



6. KEYPAD FUNCTIONS:



Press once to switch ON or OFF power
Hold-down to enter SETUP mode



Press once to exit CALIBRATION or SETUP mode
Hold-down to enter CALIBRATION mode



Press once to switch Conductivity / Salinity display panel to show readings in (μ S/mS) or Salinity (ppt)
Hold-down to enter RECALL MEMORY mode



Press once to switch Dissolved Oxygen display panel to show readings in percentage (%) or ppm (mg/L)
In SETUP mode, press once to scroll forward setting or up digit



Press once to store displayed readings to MEMORY
In SETUP mode, press once to scroll previous setting or down digit



Press once to select display panel (Icon will flash or blink)
In SETUP mode, press once to confirm a setting

7. SETUP:

Though this meter is simple to use, but its accuracy can be greatly enhanced when proper setup is made.

7.1 Unscrew the battery cover at back of meter and install 6 new AAA

size batteries according to marked polarity.

7.2 Replace the battery cover making sure O-ring is fully seated in the compartment groove and close cover and tighten with screws.

7.3 Always switch off the unit before attaching all the probes, then switch on the unit.

7.4 Attach each probe accordingly to the marking on the connector plug to the meter socket as in product layout.

7.5 Switch on the unit.

7.6 For the DO sensor to fully activated, please wait for 30 minutes for the probe to be fully polarized every time when the probe is reconnected to the meter.

8. PARAMETER SETUP:

8.1 This section allows user to review, customize display units and setup automatic compensation of the unit.

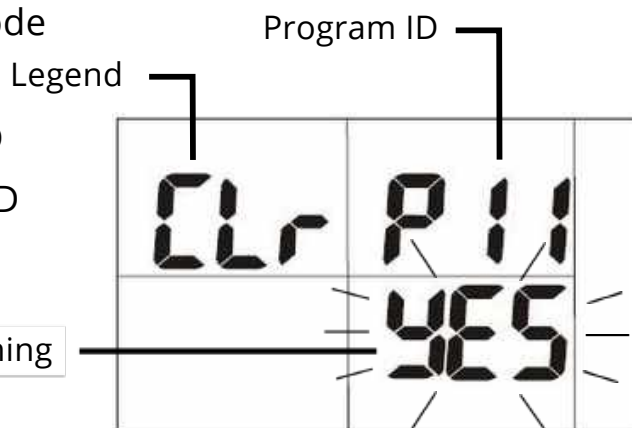
Hold down  to enter setup mode

Press  to forward Program ID

Press  to previous Program ID

Pre  twice to Exit SETUP

SS Adjustable parameter flashing



Legend	Program ID	Description of function
CLr	P10	CLEARs ALL STORED DATA MEMORY This setting allow youto clear stored data memory Press  to enter setting or  to next ID
	P11	memory or  or  to select YES to clear na to retain, press  to confirm or  to return to P10

ELE	P20	REVIEW pH ELECTRODE STATUS This setting enable user to review the pH electrode's condition. Percentage slope of below 85% or above 105 percent indicates electrode should be replaced. Press  to enter setting or  to next ID
	P22	Displays % of slope at pH4 Press  to display next slope
	P23	Displays % of slope at pH10 Press  to return to P20
CAL	P30	REVIEW CONDUCTIVITY CALIBRATION POINT This setting allow user to review the last calibration point at each range Press  to review or  to next ID
	P32	Displays last calibration point for range 0 to 199uS. Press  to review next range
	P33	Displays last calibration point for range 200 to 1999uS. Press  to review next range
	P34	Displays last calibration point for range 2 to 19mS. Press  to review next range
	P35	Displays last calibration point for range 19 to 199mS. Press  to return to P30
	Note: Meter will assume factory default when calibration is made.	
CEL	P40	REVIEW CELL CONSTANT This setting allow user to review the cell constant. If cell constant is below 0.8 or above 1.2, then cell should be replaced Press  to review or  to next ID
	P42	Displays cell constant for range 0 to 199uS. Press  to review next range
	P43	Displays cell constant for range 200 to 1999uS. Press  to review next range
	P44	Displays cell constant for range 2 to 19mS. Press  to review next range
	P45	Displays cell constant for range 19 to 199mS. Press  to return to P40

COE	P60	D.O. COMPENSATION SETTING Dissolved Oxygen readings are affected by altitude and salinity. This setting allow user to preset D.O. automatic compensation. Press  to enter setting or  to next ID
	P61	Displays the temperature reading of the last calibration. Use this to determine E21 error if Calibration temperature exceeds +/-10°C of measured temperature. Press  for next setting
	P62	For Salinity compensation, Press  to decrease salinity from 42.0ppt or  to increase digit from 0ppt. Use the measured salinity readings as reference Press  to confirm setting
	P63	For altitude compensation above sea level, Press  to decrease altitude from 3500 Meter or  to increase digit from 0. (see appendix table for pressure conversion) Press  to return to P60

Reference for altitude against pressure			
Altitude in Feet	Altitude in Meters	Barometer in mmHg	Atmospheric Pressure in kPa
0	0	760	101.0
500	152	746	99.5
1000	305	733	97.7
1500	457	720	96.0
2000	610	707	94.2
2500	762	694	92.5
3000	914	681	90.8
3500	1067	669	89.1
4000	1219	656	87.5
4500	1372	644	85.9
5000	1524	632	84.3
6000	1829	609	81.2
7000	2134	586	78.2
8000	2438	564	75.3
9000	2743	543	72.4
10000	3048	523	69.7
11482	3500	461	61.46

Unit	P70	TEMPERATURE UNIT This setting allow user to set temperature unit between Celsius or Fahrenheit Press  to enter setting or  to next ID
	P71	Press  or  to select C or F press  to confirm or  to return to P70
rSt	P90	MASTER RESET This setting allow user to clear all data memory, calibration data and reset all settings to factory default: P20 100% P30: 146.6uS,1413uS,12.88mS,51.5mS : 1.00 P60: 25°C,0ppt,0Met P70:°C P40 Press  to enter setting or  to next ID
	P91	Press  or  to select YES to reset or NO to retain press  to confirm or  to return to P90

9 CALIBRATION

9.1 This unit is factory calibrated and the meter and sensors are optimized accurate at the point of completion.

9.2 But due to transport and storage, the nature of these electro-chemistry sensors needs to be re-calibrated before use.

9.3 PH CALIBRATION

9.3.1 pH electrodes are electro-chemistry sensors and requires regular calibration. Depending of usage, if several tests are made in a day, then daily calibration is required. If once a day, then 3-4days to once weekly is required. Follow the below procedure to perform calibration:

9.3.2 This meter is able to calibration up to 3 pH buffers. Use only buffer solutions pH7.00, pH4.01 and pH10.01

9.3.3 Remove the sensor cover. If the sponge inside sensor cover is dry, soak the sensor in water for 10 minutes before calibration. (always keep sponge in cover moist to keep glass sensor hydrated, this will speed up time to stability)

9.3.4 Always begin calibration with pH7 buffer follow by pH4 and 10.

9.3 Be sure to rinse the pH sensor thoroughly in distilled water and blot dry with tissue paper before and after each calibration or test solution. This is to prevent cross contamination of the important pH buffer standard.

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- 9.3.6 Dip the sensor into the buffer solution.
- 9.3.7 Wait for the displayed reading to stabilize fully for 10 seconds. Meaning reading remain the same for 10 seconds without changes in a digit.
- 9.3.8 SELECT: Press  key to set display to select pH icon flashing.
- 9.3.9 Hold down  key to enter calibration mode.
- 9.3.10 Buffer digit will be displayed flashing on the pH display panel while CAL and temperature alternate on the temperature panel.
*Note that buffer digit will vary in accordance to the temperature coefficient of buffer solutions as table below:

Temperature (°C)	ISO standard buffer solution		
15	7.03	4.00	10.12
20	7.01	4.00	10.06
25	7.00	4.01	10.01
30	6.98	4.02	9.97
35	6.98	4.02	9.93

- 9.3.11 Wait for reading to stop flashing and **5A** is displayed momentarily, calibration for the said buffer is completed and display return to reading mode.
- 9.3.12 Make sure reading is displayed according to the above table at the read temperature of the said buffer. A slight deviation of within +/-0.05 is normal and acceptable. Otherwise repeat calibration.
- 9.3.13 Repeat step 9.3.5 to 9.3.12 for pH4 and pH10 solution to complete calibration.

9.4 CONDUCTIVITY CALIBRATION

- 9.4.1 Conductivity or Salinity probe is a solid-state sensor made of stainless steel. This sensor is factory calibrated and calibration is not required for several months. But subject to the contamination of the sensor surface that may alter the cell constant, it is a good practice to clean the sensor cell by soaking in hot mild detergent for few minutes, thoroughly rinse and re-calibrate regularly or when readings in doubt.

Deep clean sensor at least once yearly or half yearly using alcohol rub on sensor surface with cotton bud, rinse and soak in distilled water for a day and recalibrate.

- 9.4.2 This meter is able to calibrate 1 point at 4 ranges within the full scale of 0 to 199mS. Below are the recommended calibration standards at each range:

Calibration Range	Recommended calibration standards	Order Code
0 to 199.9 μ S	74 μ S	SC0074N
200 to 1,999 μ S	1,413 μ S	SC1413N
2mS to 19.9mS	12.88mS	SC1288N
20mS to 69.9mS	46.25mS (30ppt NaCl)	SS0030N

- 9.4.3 Always be sure to rinse the conductivity probe thoroughly in distilled water and blot dry with tissue paper before and after each calibration or test solution. This is to prevent cross contamination of the all important standard solution.

- 9.4.4 Select the recommended calibration solution of the measuring range which covers your measurement. Dip the sensor into the standard solution, shake to remove bubbles. (presence of tiny bubbles on the sensor surface will affect accuracy)

- 9.4.5 Wait for the displayed reading to stabilize fully for 10 seconds. Meaning reading remain the same for 10 seconds without changes in a digit.

SELECT CALIBRATION VALUE:

- 9.4.6 Press  key to select display with  icon flashing then press  key to set Conductivity Display Panel to 

Note: Calibration cannot be performed in Salinity mode.

- 9.4.7 Hold down  key to enter calibration mode.

- 9.4.8 Digit on the Conductivity / Salinity display panel will flash while temperature display panel will alternate display  and the measured temperature reading.

- 9.4.9 Press   or   to adjust the display reading to be exactly the standard solution reading. Example: Standard solution 1,413 μ S should adjust to display as *14 13*.

- 9.4.10 Press  key to confirm setting while  is displayed momentarily, calibration for the said standard is completed and display return to reading mode.

- 9.4.11 Make sure reading is displayed according to the value of the calibration standard. A slight deviation of +/-3 of the last digit is normal and acceptable. Otherwise repeat calibration.

- 9.4.12 To calibrate another range or solution, repeat step 9.4.3 to 9.4.11 to complete calibration for each range.

9.5 DISSOLVED OXYGEN CALIBRATION

- 9.5.1 The DO sensor comes empty without electrolyte. Please remove the Membrane Cap and 70% fill with electrolyte. Replace Membrane Cap fully closed. Cap should not be loosened and re-tighten again as this will affect its proper operation.
- 9.5.2 This meter employs a galvanic Dissolved Oxygen sensor. The sensor is required to be polarized for 90 minutes upon first time connected to the meter with batteries powering it. After which, there is no need for polarization. This polarization sequence is required every time whenever probe is disconnected from the meter or when batteries are removed.
- 9.5.3 If E03 display during polarization, it is normal. Once sensor is fully polarized, display will return to normal.
- 9.5.4 Polarization sequence is also required every time the electrolyte or membrane is changed.
- While the DO sensor is an electro-chemistry sensor, it consists of a semi-permeable membrane and a chamber filled with electrolyte. This makes it volatile and requires calibration every time before measurements.
- 9.5.6 Calibration cannot be performed whenever the low battery sign  appear or while E03 appears during calibration. Please change batteries before proceeding.
- 9.5.7 Calibration can be easily performed in air. Make sure the environment has good airflow and not crowded and only at temperature of within 10°C of the measured temperature in the liquid. Example: If measure liquid is 15°C, air temperature must be between 5 to 25°C.
- 9.5.8 Switch on unit and remove the Sensor Cover.
- 9.5.9 Press  key to set display to select  and press  to display reading % in display panel. Calibration cannot be performed in ppm mode.
- 9.5.10 Hold the probe in air with sensor pointing downward, wait for the DO reading to stabilize fully for 10 seconds. Meaning reading remain the same for 10 seconds without changes in a digit.
- 9.5.11 Hold down  key to enter calibration mode.
- 9.5.12 Percentage reading on the Dissolved Oxygen display panel will flash while Temperature Display Panel will alternate displaying  and the measured temperature reading.
- 9.5.13 Wait another 10 seconds and press  to confirm. Display will momentarily show 100% and return to normal measuring mode.
- 9.5.14 Calibration is completed. On subsequent measurement, recalibrate as needed if display does not show desired % in air.

10 TAKING MEASUREMENT

- 10.1 This meter comes with 3 probes with the following cable length:
pH Electrode with 1 meter cable
Conductivity probe with 1 meter cable
Dissolved Oxygen probe with 3 meter cable

10.2 Before taking measurement, please ensure meter is calibrated.

10.3 pH electrode should be calibrated as frequently as recommended in paragraph 9.3.1.

10.4 Conductivity probe should be calibrated at least once a year or where readings are in doubt. If sensor is in a dry state, soak

sensor in liquid for 5 minutes before taking the reading. Always shake sensor to remove bubbles on cell surface as bubbles will affect readings.

10.5 Dissolved oxygen probe should be calibrated before a series of tests. DO probe will require 90 minutes polarization if probe had been detached during storage and meter is re-connected with battery. Please follow calibrate instructions in section 9.5

10.6 Remove the Sensor Cover and switch on meter, then wait for 10 seconds.

10.7 If displayed reading is not 100%, then perform a calibration.

10.8 Press  once to display dissolved oxygen in ppm.

10.9 Dip the sensor into measuring water. As this sensor consumes oxygen on the membrane surface, a continuous stirring or jiggling is necessary to refresh liquid on the contact surface of the membrane. Otherwise, reading will lower by 2-3ppm.

Displayed Readings:

10.10 Temperature is displayed for the parameter where the icon is selected and flashing. Use  button to select. Do note that each probe may have slightly different reading which is normal if within 0.5 degrees variation.

10.11 Press  to display conductivity in $\mu\text{S}/\text{mS}$ or salinity in ppt.

10.12 After taking readings, rinse sensors with distilled water between each test.

10.13 Before storage, always rinse sensors thoroughly with water, blot dry and replace Sensor Cover. Be sure to replace the cover with a sponge only for the pH electrode. Add a few drops of water for sponge to absorb and pour away excess liquid. (see 9.3.3)

11 MEMORY STORAGE AND RECALL

11.1 This meter is able to store up to 99 data memory.

11.2 Press  to store currently displayed data value. Display will momentarily show all digits and MEMO icon flashing, while Memory Counter Display Panel flashing the currently stored count digit. Then display return to normal measuring mode.

11.3 All 3 parameters pH, DO and Conductivity with its relative temperature are stored.

11.4 Key: Display will show  hold down the MEMO icon persistently flashing, while momentarily displays the last stored counter value on Memory Counter Display Panel.

11.5 To view the temperature of each parameter, press  key to scroll between parameters with its icon    flashing.

11.6 Press  to review previous earlier stored data or  to review the next stored data or cycle to first data.

11.7 Press  to exit RECALL MEMORY mode when done.

12 MAINTENANCE

12.1 Main Unit

12.1.1 This meter is splash and weather proof. It is not made to soak under water and if meter drops into water, retrieve it immediately. Open the battery cover to check if any water ingress and clean up if necessary.

12.1.2 When the low battery sign  appear, change all six (6) AAA size batteries with new ones following the batteries polarity.

12.1.3 Remove all five (5) screws on the battery cover, be sure that O-ring is in place after changing batteries before replace cover and tighten all screws.



12.2 pH Electrode:

- 12.2.1 Be sure to rinse the pH sensor before and after each test and thoroughly rinse sensor before storing away.
- 12.2.2 Always keep the sponge inside the sensor cover wet or moist but no excess water seen inside.
- 12.2.3 Never clean the glass sensor with alcohol or solvents as this will dry up the glass surface result is very sluggish readings. Flush with water or use a cotton bud daps with pH4 solution to gently wipe the glass. Note that glass is fragile and can break if rub too hard. Even micro-cracks can damage the sensor.
- 12.2.4 Note that the pH sensor has chemical components and the pH glass has limited lifespan. If the percentage of slope is out of limit (see page 5, *ELLE*), please replace with a new probe.

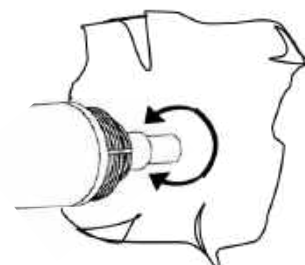
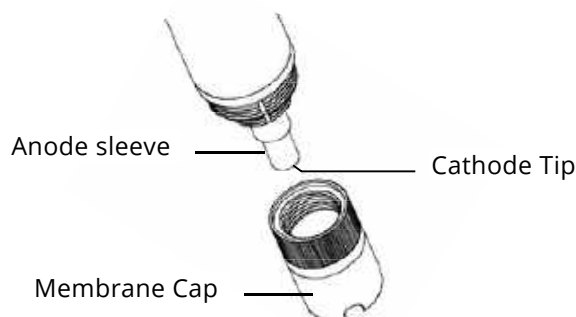
12.3 Conductivity Probe:

- 12.3.1 The conductivity cell is made of stainless steel with a sandblast surface to increase surface area. It can be stained and accumulates dirt which will alter calibration value.
~~Always~~ Always rinse sensor with water before or after each test.
- 12.3.3 Soak in distilled water or clean tap water for few minutes, shake dry before replacing Sensor Cover.
- 12.3.4 To clean sensor cell, soak in warm dilute detergent liquid for 5 minutes, then rinse several times with tap water to completely remove detergent film.

12.4 Dissolved Oxygen Probe:

- 12.4.1 The dissolved oxygen probe is a galvanic type electro-chemistry sensor. The sensor consists of electrolyte, membrane covering the anode and cathode.
- 12.4.2 The electrolyte solution upon polarization will become cloudy and white residue appearing which is normal.
- 12.4.3 If the white residue become excessive, then replacement is necessary.
- 12.4.4 The membrane is a very thin Teflon material and can be punctured easily. Do take care handling or while taking measurement. Accumulation of white powder on the surface of the membrane is an indicator of a punctured membrane.
- 12.4.5 If the membrane is damaged or where excessive white residue in electrolyte, please replace membrane.

- 12.4.6 Unscrew the membrane cap and dispose it. Once membrane is installed, it should not be reused. Wipe off any white residue on the anode sleeve and cathode tip.



Clean cathode tip with a circular motion on cloth

- 12.4.7 If lots of white residue is attached to the anode sleeve, use a knife or hard object to gently scrap it away. Rinse anode and cathode with water and wipe with clean cloth.
- 12.4.8 With a new membrane cap, fill up to 70% of volume with new electrolyte. The gently screw back to the probe fully.
- 12.4.9 Do note once membrane is installed, it is stretch against the cathode tip. The membrane should not be loosen and re-tighten as this will affect the proper operations of the sensor.
- 12.4.10 Follow calibration in section 9.5 before measurement.
- 12.4.11 Always clean the membrane surface gently by flushing with water after testing and replace Sensor Cover before storage.
- 12.4.12 For long term storage, please disconnect DO probe to stop polarization. This will prolong sensor life.

13 TROUBLE SHOOTING & ERROR CODES:

- 13.1 No display when power on - Check if batteries are placed in correct polarity or batteries are fully exhausted. Replace all batteries and check.
- 13.2 Slow response for pH reading – Check if pH Sensor Cover's sponge had dried up, meaning pH glass sensor is also dry. Soak the pH sensor in tap water for 15-30 minutes and retest.
- 13.3 Error Codes –

Code	Probable Causes	Remedy
E02	1. Temperature is too low. 2. Sensor or probe is damaged.	1. Make measurement within temperature ranges. 2. Replace with new probe.
E03	1. Measured reading or temperature out of meter's range. 2. D.O. probe not fully polarized. 3. Sensor or probe is damaged.	1. Dilute liquid or measure within temperature ranges. 2. Wait at least 90minutes till D.O. probe fully polarized. 3. Replace with a new probe to confirm error.

Code	Probable Causes	Remedy
E04	Original data error	Perform a master reset as Page 7 of SECTION 8
E13	1. pH calibration in wrong solution. 2. Damaged sensor.	1. Perform re-calibration 2. Replace with new sensor.
E16	Conductivity probe cell is dirty or damaged.	1. Clean probe or remove dirt. 2. Replace with new probe.
E21	Temperature of measurement is greater than $\pm 10^{\circ}\text{C}$ of last calibration.	Perform re-calibration in air calibration at temperature nearer to water temperature.
E31	Measuring circuit damage	Return for repair
E32	Main IC chip damage	Return for repair
---	Probe not plug properly or meter unable to sense probe	Unplug and re-plug connector, switch Off then On meter.

WARRANTY:

Trans Instruments (Singapore) Pte. Ltd., warrants this product for a period of 12 months for main unit and 3 months for probe or sensors from date of purchase; against all defects in material and workmanship. This warranty does not apply to the abuse or misuse of the instrument. If repairs or adjustments are required, please return the defective product freight prepaid. Instrument within warranty will be repaired at no charge.

Make sure that the product is properly packed and insured against possible damage or loss in shipment. Purchase invoice MUST be accompanied in returned product or else warranty is considered void.

Please obtain authorization from Trans Instruments (Singapore) Pte Ltd. Directly or through your local sales representatives prior to returning the product. Trans Instruments staff can be contacted at the following email address or through our web-page contacts below.

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