OPERATION MANUAL

Hand Held
Dissolved Oxygen Meter

$C\epsilon$

Model: ■ 8401
■ 8402
■ 8403

INTRODUCTION

Thank you for purchasing Dissolved Oxygen meters (8401/8402/8403) ,the meter will display all LCD segments when it is first turned on for approx. 3 seconds.

The LCD is divided into five distinct sections ,see the description below . The meter includes dissolved meter with temperature compensation , electrolyte solution and batteries , please read this manual thoroughly before operating your meter , you will find it is a very easy to operate and a valuable instrument to measure dissolved oxygen and temperature .

DISPLAY

- The primary display shows the measured DO in % or ppm/mg/l for all models (8401/8402/8403) .
  Barometric in mmHg or kPA , Salinity in ppt reading only available for models 8402 and 8403.
- The secondary display below primary display shows the temperature of the reading for all models .
- Year/Month/Date and Hour/Minute/Second are displayed interchangeably at the bottom in the middle of the screen for model 8403 only.
- HLD(Hold)/Ready/CAL at the left side of the screen for all models .
  MAX/MIN/AVG is for model 8403 only.
- REC (Recall for model 8403) at the left bottom while "88" displays at the right by temperature value.
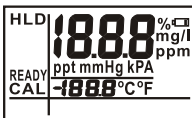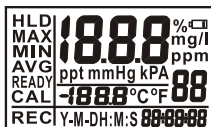
CONTROLS & INDICATORS

Top view   Right side view

DO probe connector port   IrDA port

DC 9V

RS232
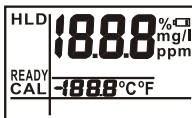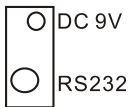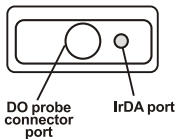
Model: 8401   Model: 8402

Model: 8403

SPECIFICATIONS

| MODEL NO	8401	8402	8403
D.O %	0.0~199.9%	0.0~199.9%	0.0~199.9%
RES.	0.1%	0.1%	0.1%
ACCURACY	±1.5% of F.S	±1.5% of F.S	±1.5% of F.S
D.O. ppm	0.00~19.99ppm	0.00~19.99ppm	0.00~19.99ppm
RES.	0.01ppm	0.01ppm	0.01ppm
ACCURACY	±1.5% of F.S	±1.5% of F.S	±1.5% of F.S
TEMP.	0~30ºC	0~50ºC	0~50ºC
RES.	0.1ºC	0.1ºC	0.1ºC
ACCURACY	±0.5ºC	±0.3ºC	±0.3ºC
SALINITY		0.0~50.0 ppt	0.0~50.0 ppt
RES.		0.1 ppt	0.1 ppt
PRESSURE		500~1499mmHg/L 66.6~199.9kPA	
RES.		1mmHg/0.1kPA	
MEMORY			99 point
REAL TIME			YES
RS232	YES	YES	YES
IrDA PORT			YES

AUTO POWER OFF

The meter lets you set up auto power
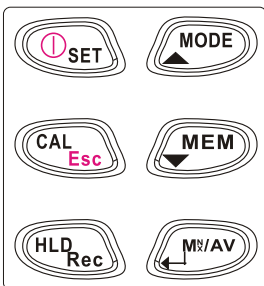off (Sleep function) to save the battery
life.
When the meter is off , press and hold
POWER key until it enters to **SET** mode.
Press ▲or▼ to select **AUTO-SLEEP**
at P5.0 , there are 6 time intervals for
your selection : 20,30,40,60,90,120
minutes . Meter will automatically
power off according to the time interval
you have selected .

KEY PAD OPERATION

8401,
8402
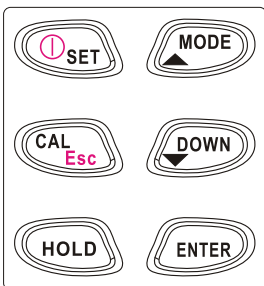
8403

1. ⏻ (**POWER**)**SET** key:
   Turn on and power off t he meter in any mode. When the meter is power down,press this key more than 1 second to enter setting (**SET**)mode.

2. **MODE** key:(8401/8402 models)
   Press this key to toggle %Saturation and mg/l(ppm) reading of Dissolved Oxygen.(See the following illustration)
   MODE ▲ key:(8403 model)
   Press the key to toggle or select up-ward the setting. Or view the memory under Recall mode.

3. **CAL/Esc** key:
   Press this key to enter 100% satura-tion calibration when it is in normal mode. Use **ESC** in other modes.

4. **MEM** ▼(8403 model only):
   In normal mode ,press the key to store the current reading of the measurement with RTC(real time clock),the display will flash about 3 seconds. **MEM** figure changes from 00 to 01,press **MEM** (store the reading) again from 01 to 02.....

   This key may also to be used to toggle the selection while in setting mode .

5. **DOWN** ▼ (8401/8402 models):
   Press the key to select setting in SET mode. Or read memory under Recall mode.
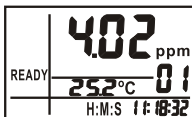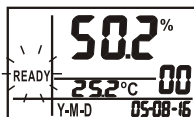
If you set **READY** while measuring, you will see a flashing **READY** in the screen, when the reading is stable, it stops flashing.(See illustration) While measuring , **YMD** and **HMS** will be displayed interchangeably .
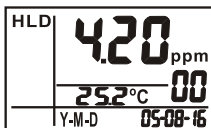
6.**HOLD** key (8401/8402 models)
In normal mode, press the key to hold the current reading, then press this key again to unlock the holding .

HLD(REC) (8403 model only):
In normal mode, press the key to hold the current reading, then press the key again to unlock the holding .
Press **HLD+ENTER** to activate backlight. Backlight will turn off automatically after 10 seconds.
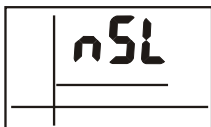

7.**ENTER** key (8401,8402 models):
To confirm the setting, the calibration and so on by pressing this key.
MI/MX/AV key (8403 model):
In recall mode , press the key to view Minimum/Maximum/Average reading in the memory.

8. ○SET +HLD :
When the meter is power down ,press simultaneously these keys more than one second to disable auto-sleep mode.

5

RECALL MODE

In the normal mode, press the key more than one second to enter **RECALL (REC)** mode, then press **MIN/MAX/AV** to view Minimum , Maximum and Average of memorized data in turn.
REC icon is flashing now, press **HLD** key more than one second to return to normal mode.
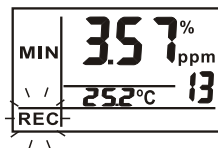
While **REC** is flashing ,press **MX/MN/AV**key , **MIN** first shows at the left , the value is the minimum from total 13 records in the memory (See above illustration). Press **MX/MN/AV** key again to view **MAX** ,press again to view **AVG** ,the number of total record will not be changed during your pressing and viewing **MX/MN/AV** key , because there might have more than one record with same value.

When you back to normal mode by long pressing **HOLD(HLD** Rec) key LCD will show the last memory point number which you had viewed before you entered Recall mode.

% SATURATION CALIBRATION

Users need to calibrate the meter when first operate it.Recommend to check the meter whenever power on. If the stable reading (around 15 mins later) exceeds the 100%+/-0.5% range, please do the calibration.

Note:
Recommend to rinse the probe well with deionized rinse water or rinse solution for best accuracy.

Do not try to touch the membrane.

Most users will calibrate to100% air saturation, make sure you have set in % air saturation. All new calibrations automatically override existing calibration data.

1.In normal mode, hold the probe in the air , wait for few minutes until the reading on LCD is stable enough. Press **CAL/Esc** to calibrate for 100% saturation calibration, **CAL** icon is flashing on LCD.

2.Wait couple seconds, when the reading is stable ,press **ENTER** to finish the calibration, the meter is automatically calibrates to 100% air saturation and return to normal mode..

3.You can stop the calibration by pressing **CAL/Esc** .

4.Whenever an error occurs during calibration , the ERR indicator will appear .

$$99.8\%$$
$$CAL \quad 25.0°C$$

7
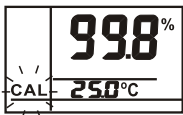
PARAMETER SETTING

1. When the meter is power off, press **POWER** more than one second to enter to **SET** mode.
2. Press ▲or▼ to switch the setting parameter one by one.
3. Press **ENTER** or ↵ to enter to each parameter setting as below:

a) P0.0: Print(model 8403 only) Press **ENTER** to P0.1, transmit the memories through IrDA port.

Make sure you have followed the pictures (IrDA printer to DO meter) IrDA port to port in 30 degree angle.
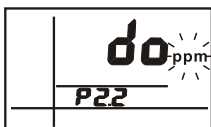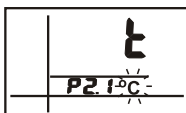

b) P1.0:Clear(model 8403 only) Press **ENTER** to P1.1 , then press ▲or▼ to select "**n**"-NO or "**y**"-YES, then press ↵ to confirm to clear or not to clear all memories.

c) P2.0:Unit
Press **ENTER** to P2.1 ,press ▲or▼
to toggle Temperature C/F.
Press **ENTER** to P2.2,press ▲or▼
to toggle DO unit mg/l/ppm

d)P3.0:Coefficient(models 8402,8403)
Press ◄┘ to P3.1(Barometric in
mmHg),press ▲or▼ to change
the value.
Press ◄┘ to P3.2(Barometric in
kPA), press ▲or▼ to change the
value.
Press ◄┘ to P3.3(Salinity in ppt),
press ▲or▼ to change the value.

Above illustrations show the default
value for barometric is 760mmHg and
101.3kPA ,the default Salinity value
is 0.0ppt .

9

e)P4.0:Ready
Press **ENTER** to P4.1,press ▲or▼
to toggle Ready ON and OFF. If you
select ON , **READY** will be flashing
while you are measuring .And stop
flashing when readings are stable.
It won't present on the screen when
you set it "**OFF**".
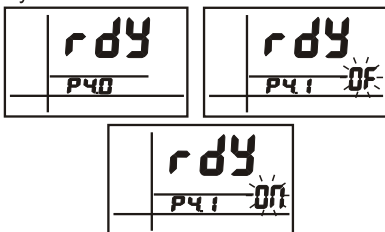
f)P5.0:Auto-Sleep
Press **ENTER** to P5.1,press ▲or▼
to select auto-sleep time.
Save the setting value by pressing
ENTER(models 8401/8402)or ◄┘
(model 8403) key.
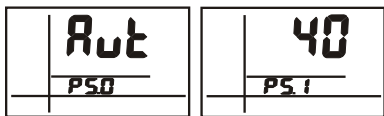
g)P6.0:RTC:(model:8403 only)
Press ◄┘ to P6.1,press ▲or▼
to set Year.
Press ◄┘ to P6.2,press ▲or▼
to set Month.
Press ◄┘ to P6.3,press ▲or▼
to set Day.
Press ◄┘ to P6.4,press ▲or▼
to set Hour.
Press ◄┘ to P6.5, press ▲or▼
to set Minute.
Press ◄┘ to P6.6,press ▲or▼
to set Second.

10

The procedure lets you set Y-M-D first after every selection , press ◄┘ to confirm the value , next digits will be flashing until you press ◄┘ to save. After setting Y-M-D, you then may set H:M:S,the first digits will be flashing until you press ◄┘ to confirm .
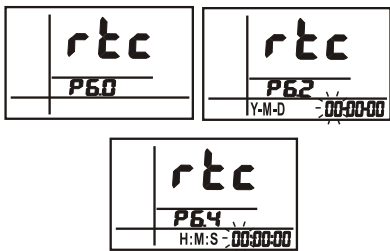
h)P7.0:Beta
Press **ENTER** to P7.1,press ▲or▼ to change the value of Beta the temperature coefficient of the membrane.
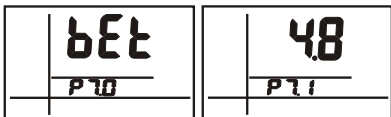
The membrane temperature coefficient is 4.8 (as default),if you are using a different membrane , you have to get the Temp. coefficient value of the membrane.
NOTE:
Refer to the membrane pack (attached) , you will see a temperature coefficient value is shown on the pack . If it is not 4.8 as default , you have to adjust with the correct value.

11

i)P8.0:CAL Data
Press **ENTER or** ↵ to P8.1to view calibration data **Slope** and **RTC**. LCD shows the date of last calibration and the slope value (sensor sensitivity).

Press **ENTER or** ↵ to P8.2 to view calibration data Temperature with unit side by P8.2.
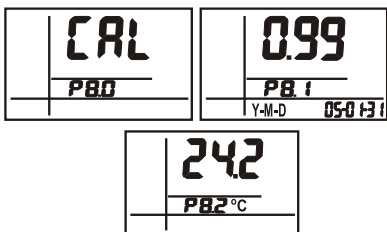
j)P9.0:Reset
Press **ENTER** or ↵ to P9.1,then press ▲or▼ , press **ENTER** or ↵ to confirm to reset the meter to factory's default.
While "**n**" is flashing ,press **ENTER** or ↵ to not to reset ,toggle "**n**" to "**y**" to reset.
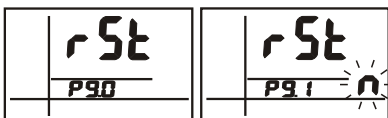
4.Press **CAL/Esc** to return to normal mode. You may press the key to exit while you are setting anyone of above programs.

12

SALINITY ADJUSTMENT

Using Salinity correction mode to correct the variation in oxygen solubility due to salt concentration in the water. Use a Salinity meter to get the salt concentration reading, correct with the value before measuring.

In SET mode, select P3.0, press **ENTER** or ⏎ to P3.3, press ▲or▼ to change the salinity value.

```
  0.0
ppt
 P3.3
```
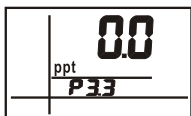
PRESSURE ADJUSTMENT

Barometric pressure is important to correct dissolved oxygen measure-ments. Make sure you have correct barometric pressure of the area you are going to measure in order to get an accurate reading.

If the barometric pressure setting has been changed from default 760mmHg, the calibration value in air will auto-matically adjust to a value other than 100%.
In **SET** mode, select P3.1 and P3.2 to change the barometric values.

```
101.3
  kPA
 P3.2
```

```
 760
  mmHg
 P3.1
```

PRESSURE vs ALTITUDE

If you don't have equipment to measure the exact barometric pressure at your altitude , you may have an estimate chart for Pressure vs. Altitude to let you enter the correct barometric pressure for measuring DO readings, as barometric pressure affects DO reading .

The % saturation calibration value in air will automatically adjust to a value except 100% when you change the barometric pressure setting from default value 760mmHg .

Altitude (Meter/Ft)	Pressure(mmHg)
0 (Sea level)	760mmHg
152 / 500	746
305 / 1000	732
457 / 1500	720
610 / 2000	707
762 / 2500	694
914 / 3000	681
1067 / 3500	668
1219 / 4000	656
1372 / 4500	644
1524 / 5000	632
1676 / 5500	621
1829 / 6000	609

HOW TO REPLACE MEMBRANE

M3 screw nut
1xwasher
1xo-ring

Solution filling port

Cathode Anode &Temp. sensor

Oring

Membrane lock ring

Membrane

Probe guard

Membrane lock cap
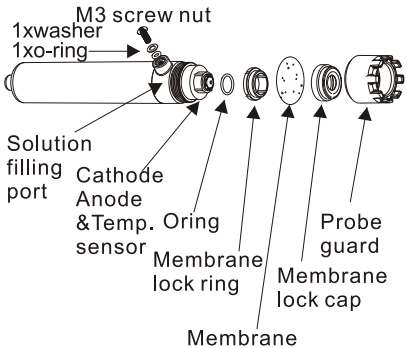
The meter includes the pack of membranes which is required to be replaced only in case you can not calibrate or the membrane is damaged.

HOW TO REPLACE MEMBRANE:

1. Prepare a new membrane.
2. Unscrew the probe guard.
3. Remove the membrane from the membrane lock cap.
4. Remove the O-ring and membrane lock ring.
5. Rinse the membrane cap and lock ring in the tap water.
6. Install a new O-ring.
7. Install a new membrane.
8. Cover with membrane lock ring and lock cap , then probe guard to complete membrane replacement.

TO REFILL ELECTROLYTE SOLUTION

The electrolyte solution in the probe will periodically evaporate, you may see through from the probe and you need to replace with refilling the solution .

There are two bottles of electrolyte solution in the package , they are ready to use for refilling.

Use a screw driver to screw out the nut , washer and o-ring , then fill up the electrolyte solution from the sprue on the probe.
Close with o-ring,washer and Nut.

M3 screw nut

1 x washer+1 x O-ring

Sprue for solution filling

Note:
Before refilling electrolyte solution , make sure you have put the probe lied down flat on the table and hold the electrolyte bottle vertically. Refill it slowly to ensure no bubble in the probe.

Electrolyte solution:
The electrolyte solution we used is Kbr , it needs to be refilled when bubbles are seen around the membrane or changing the membrane .

Users may need to replace with fresh electrolyte when the sensitivity is getting low or error message tells there are inaccurate readings.

PROBE F.A.Q

1) <u>Normal temp. but E03/E02 on D.O.</u>
   Reason:
   a) Low on electrolyte
      Solution: See page 16 to refill the
      electrolyte and run 100% calibration.
   b) Membrane defect
      Solution: See membrane change
      procedure and run 100% calibration.
   c) D.O. sensor damage
      Solution: Can't be fixed by user.

2) <u>E01 on temp. and D.O. reading</u>
   Reason:
   a) The probe is disconnected
      Solution: Plug on the probe and
      make sure it's in good contact.
   b) The wire inside the probe connector
      is broken.
      Solution: Can't be fixed by user.
   c) The inside wire of the probe is broken
      Solution: Can't be fixed by user.

3) <u>E03 on temp. and E04 on D.O. reading</u>
   Reason:
   a) The temp. sensor is damaged.
      Solution: Can't be fixed by user.
   b) The temp. related wire inside the
      probe connector is broken.
      Solution: Could not be fixed by user.

4) <u>E17 on D.O. Reading</u>
   Reason:
   a) 100% saturation calibration error
      Solution: see membrane change
      procedure and run calibration again.

*NOTE: see E2/E3-->Run calibration -->if see
E17-->loose the outer cover-->run
calibration -->tighten the outer cover
--> run calibration --> Finished!!*

5) <u>E31 on temp. and D.O. Reading</u>
   Reason:
   The inside wire of the probe is broken.
   Solution: Can't be fixed by user.

MEMBRANE CHANGE

1

Remove the old mem-
brane from the cap

2

Put the new membrane on
the top & center of the ring
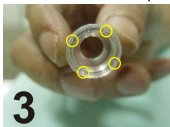
3

Find out the four align-
ment points on the cap
before putting it on ring
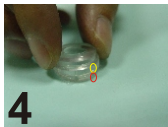
4

Put the cap onto the mem-
brane. Make sure the align-
ment points on cap and ring
are matched.

5

Put the black O-ring on
the top of sensor. Make
sure the O-ring is flat.

6

Find out the alignment
points inside the ring of
step4 semi-assembly part

7

Put the semi assembly
part (finished in step4)
on the top of the O-ring.

8

Put on the probe guard
and screw tight.

9 Run the calibration. If E17 appears on meter LCD,
slightly loose the outer cover until a reading
appears on LCD and then run calibration again.

10 After calibration, turn the probe guard tightly
and run the calibration again.

18

TROUBLESHOOTING

**1.Power on but no display or it
doesn't work .**

a)The meter doesn't work ,because
the electrode needs polarization
time before any readins is taken.
Make sure you have connect the
electrode to the meter,polarization
time is dependent on different
meter, it could be 10 minutes or
more .

b) Check the membrane to see if air
is trapped under the membrane.

c)Make sure the time of pressing
power key is more than 100 mS.

d)Check the battery are in place
and make sure good contact and
correct polarity.

e)Replace a new battery and try
again.

f)Move the battery for one minute
and replace back again.

2.Probe is not reading correctly.
1). Check the membrane and replace
with new membrane if it is clogged
by something.

2). Clean the cathode and anode if
they are tarnished.

3).Check for significant concentration
of H_2S , SO_2 , H_2 , Neon and NO...
because some gases can interfere
with DO readings.

3. **Display disappear.**
Check whether the low battery indicator is displayed on before the display is disappeared ,if yes, replace with new batteries.

4. **E 1.** : The probe is disconnected or damaged.
5. **E 2.** : The value is underflow.
6. **E 3.** : The value is overflow.
7. **E4.** : The original data that is related to this value error.

8. **E 17.**: 100% saturation Calibration error.
9. **E 21.**
The current temperature is out of +/- 10 C of the temperature when doing 100% saturation calibration. Do 100% calibration again.

10. **E 31.**
A/D error.

11. **E 32.**
IIC memory error.

MATERIAL SUPPLIED

This package contains:
✓ The Dissolved Oxygen meter x 1
✓ Dissolved Oxygen probe x 1
✓ Batteries AAA x 4pcs
✓ D.O. Membrane 5 pcs /pack.
✓ O-rings 5 pcs /pack.
✓ Replacement Electrolyte solution x 2
✓ Operation manual
✓ Hard carrying case

OPTIONAL ACCESSORIES

✓RS232 cable /software
✓IrDA 9680 data receiver /printer
  (Inclusive of paper roll and batteries)
  9680 can be used to receive or print
  any AZ IrDA like meters , find the store
  you have purchased for the product.
  9680 features 3 measurement modes:
   a) Single measurement and print
   b) Multiple measurement and manually
      record or print
   c) Datalogging function , automatically
      record and print if needed .
✓Printing paper roll for 9680 model
✓IrDA 9660 data receiver (w/o printer)
✓Additional replacement solution 25ml
✓Additional replacement probe
✓Additional replacement membrane
✓AC to DC 9V adaptor

WARRANTY

The meter is warranted to be free from
defects in material and workmanship for
a period of one year from the date of
purchase. This warranty covers normal
operation and does not cover battery ,
misuse , abuse , alteration , tampering ,
neglect , improper maintenance , or
damage resulting from leaking batteries .
Proof of purchase is required for
warranty repairs . Warranty is void if the
meter has been opened .

INTERFACE OF IR PORT (model 8403)

1. Ir protocol: It is compatible with SIR,
   19200 bps, 8 data bits, no parity.
2. Data Format: (Transmitting every second)
   8401 :
   Cxx.xxmg/l(ppm):Cxx.xx%:Txxx.xC(F)
   8402 :
   Cxx.xxmg/l(ppm):Cxx.xx%:Txxx.xC(F)
   :PxxxxmmHg(or xxx.xkPA):Sxx.xppt
   8403 :
   Cxx.xxmg/l(ppm):Cxx.xx%:Txxx.xC(F)
   :PxxxxmmHg(or xxx.xkPA):Sxx.xppt
   @xxxx-xx-xx xx:xx:xx LRCCRLF

ExxNul : xx stands for error code:
E01Nul:E01Nul:E01Nul:PxxxxmmHg(
or xxx.xkPA):Sxx.xppt@xxxx-xx-xx
xx:xx:xx ......The probe is disconnected.

When transmitting the memory , the format as following:

Cxx.xxmg/l(pppm):Cxx.xx%:Txxx.xC(F):PxxxxmmHg(or xxx.xkPA):Sxx.xppt
#xx @xxxx-xx-xx xx:xx:xx LRCCRLF

Note: There is a space between #xx and @.

Format of description is transmitting every 15 seconds or records.

RS232 OUTPUT: (9600 bps)

The meter can link with personal computer to capture on-line datas ,display Dissolved Oxygen readings with real-time output, you can retrieve file , save the data for operating data analysis, records statistic ,.... versatile functions for your choice. Connection procedures:
1. Plug the optional accessory RS232 cable onto the DC jack port (at the right side of the meter)
2. Instert the D-sub 9P type connector onto computer's Com.1 or 2 port or....
3. Start to set up RS232 software by inserting the CD-ROM.
4. When installing the RS232 software ,please follow the operation manual procedure in the software package.

Transmitting format of RS232 TTL level is the same as IrDA on line transmitting. Only memory data is not available via RS232.

23

RETURN AUTHORIZATION

Authorization must be obtained from the supplier before returning items for any reason **.** When requiring a RA (Return Authorization) , please include data regarding the defective reason, the meters are to be returned along with good packing to prevent any damage in shipment and insured against possible damage or loss **.**

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Anemometer
Sound Level Meter
Air Flow meter
Infrared Thermometer
K type Thermometer
K.J.T. type Thermometer
K.J.T.R.S.E. type Thermometer
pH Meter
Conductivity Meter
T.D.S. Meter
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