

omega.com e-mail: info@omega.com For latest product manuals: omegamanual.info



DOB21 Portable Dissolved Oxygen Meter



OMEGAnet® Online Service omega.com

Internet e-mail info@omega.com

Servicing North America:

U.S.A.: ISO 9001 Certified	One Omega Drive, P.O. Box 4047 Stamford, CT 06907-0047 TEL: (203) 359-1660 FAX: (203) 359-7700 e-mail: info@omega.com	
Can ada:	976 Bergar Laval (Quebec) H7L 5A1, Canada TEL: (514) 856-6928 FAX: (514) 856-6886 e-mail: info@omega.ca	
For immediate technical or application assistance:		
U.S.A. and Canada:	Sales Service: 1-800-826-6342/1-800-TC-OMEGA® Customer Service: 1-800-622-2378/1-800-622-BEST® Engineering Service: 1-800-872-9436/1-800-USA-WHEN®	
Mexico:	En Español: (001) 203-359-7803 e-mail: espanol@omega.com FAX: (001) 203-359-7807 info@omega.com.mx	
Servicing Europe:		
Czech Republic:	Frystatska 184, 733 01 Karviná, Czech Republic TEL: +420 (0)59 6311899 FAX: +420 (0)59 6311114	
	Toll Free: 0800-1-66342 e-mail: info@omegashop.cz	
Germany/Austria:	Daimlerstrasse 26, D-75392 Deckenpfronn, Germany TEL: +49 (0)7056 9398-0 FAX: +49 (0)7056 9398-29 Toll Free in Germany: 0800 639 7678 e-mail: info@omega.de	
United Kingdom: ISO 9002 Certified	One Omega Drive, River Bend Technology Centre Northbank, Irlam, Manchester M44 5BD United Kingdom TEL: +44 (0)161 777 6611 FAX: +44 (0)161 777 6622 Toll Free in United Kingdom: 0800-488-488 e-mail: sales@omega.co.uk	

It is the policy of OMEGA Engineering, Inc. to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice. WARNING: These products are not designed for use in, and should not be used for, human applications.

Instruction Manual Dissolved Oxygen Meter DOB21

Index

Specifications	3
DO Theory	4
Panel Description	10
Equipment Operation	11
Equipment Operation Turning On	13
Equipment Operation DO - Set Up	
Equipment Operation DO - Read	17
Equipment Operation DO - Calibration.	
Equipment Operation DO - Register.	
Equipment Operation O ₂ - Set Up	D21
Equipment Operation O ₂ - Read	
Equipment Operation O ₂ - Calibration	25
Equipment Operation O ₂ - Register	26
Equipment Operation %Sat - Set Up	28
Equipment Operation %Sat - Calibration	31
Equipment Operation %Sat - Read	
Equipment Operation %Sat - Register	
Equipment Operation Turning Off	35
Cell Types.	36
Cell Maintenance	37

Dissolved Oxygen / O2 / % Saturation / Temperature Simple 3 key operation Automatic Resolution Selection Scale exchange in Auto-range Continuous or Hold Readings Non-Volatile Memory, even when turned off the program set up will be sustained Automatic Calibration for all parameters Automatic Temperature Compensation Maximum and Minimum Sound Alarm Battery charge Auto Monitoring Dataloging up to 99 Readings Salinity and Barometric Pressure Compensation Clark Polarographic Cell Automatic or Manual Zero and SPAN adjustment

Dissolved Oxygen

Range	0 to 60 mgO ₂ /l
Resolution	1 / 0.1 / 0.01
Relative Precision	0.02 % (full scale)
	O ₂ Gas
Range	0 to 30% O ₂
Resolution	1/0.1
Relative Precision	0.33 % (full scale)
	% Saturation
Range	0 to 100% of saturation
Resoluton	1/0.1
Relative Precision	0.1 % (full scale)
	General
Enclosure	IP-67
Temp. Comp. Manual/Auto	0 to 60 °C
Display	Alphanumeric 2 Lines x 16 Characters
Output	RS-232
Power	Battery 9 VCC
Battery Life Time	Up to 60 hours
Dimensions (LHD)	100 x 75 x 180 mm
Weight	0.45 kg



Specifications

Supplied with equipment		
Amperometric Cell	DOE-21L	
Cell mainutenance Kit	DOM-21L	
BOD Kit	DOM-ADP	
Carrying Case		
Instruction Manual		
Optional		
Immersion Probe	DOE-21S	
AC Adapter	CDH-30PW	

The Oxygen meter has a electrolyte cell, with Platinum Cathode and Silver tubular Anode separated by cast epoxy. Both are immersed in electrolyte and the set is isolated by a gases permeable PTFE membrane. In order to determine the dissolved oxygen apply a polarization potential differential between the Anode and the Cathode. The sample's oxygen diffuses thru the membrane, reducing at the Cathode and creating the oxidation product at the Anode. The resulting current is proportional to the oxygen present.

Varying just the membrane's thickness you can determine the solutions's oxygen in a range form 0.2 to 60ppm. Reduced gases interferences will occur, such as halogen and SO₂, and H₂S will infect the electrode.

Stir Dependence

The cell's oxygen consumption will result from the oxygen's extraction from the solution at membrane's proximity. The oxygen is extracted by diffusion, not allowing the real value of the sensibility reading. Therefore, there is a need to stir the solution so the oxygen can be extracted per diffusion as per convection, allowing a sensibility rate increase that will allow adequate readings. This way it is evident that in order to perform a correct reading, it is necessary to maintain the solution under constant stir (10 cm/seg over the cell).

BOD Kit

The BOD Kit was developed specifically for Dissolved Oxygen (DO) readings, to determine the Biochemical Oxygen Demand (BOD), composed by:

1. Stir Cap

Works by magnetic principle. Once submitted to a magnetic field generated by a magnetic stir, makes it rotate (by attraction / repulsion) the magnet installed at the body cap. Through this effect, the magnet turns at a constant speed in order to release O₂.



2. Funnel

Use to retain the overflow volume at cell insertion at BOD bottle.



3. Sealing Rubber

It is used specifically to seal the BOD.

ATTENTION: It is CRUCIAL, to avoid bubbles at BOD bottle, after introducing the cell. In case bubbles occur, take out the cell and repeat the procedure until bubbles are not present.

The lateral opening is exclusively build in order to allow the release of bubbles that possible appear.



3. DO Theory (cont.)

DO Determination

All life organisms depend on oxygen to sustain their metabolism process for growing and reproduction, and we could classify them as:

Aerobic Organisms: those who depend on free oxygen for organic material mineralization, resulting in most simple Inorganic final products.



Anaerobic Organisms are those that to for oxidizing the organic material, use oxygen from organic salts, such as sulfites, resulting partial oxidized final products.



The pollutant organic material, has a tendance to mineralize naturally by existing aerobic microorganisms, which consume dissolved oxygen.

When the pollutant is excessive, the free oxygen will finish and from this point on the anaerobic organism will predominate which partially oxidize.

Therefore, it is important to sustain the aerobic conditions, supplying more free oxygen to the organic charge, this Way the complete mineralization will occur.

The "BOD" (Biochemical Oxygen Demand) is used to determine the pollution levels, evaluate pollutant charge and the treatment system efficiency (together with "QOD" and "TOC").

The "BOD" is the quantity of DO necessary for biological oxidation of oxide substances present at the sample, at test conditions.

The used method to determine, is the dilution, incubation and determination, by DO quantity difference consumed during the incubation.

%O₂ Consumido durante = <u>(ODi - OD5dias) x 100</u> a incubação ODi

Therefore the "DO" measurement is the key for water pollution analysis.

For "DO" measurements, you will find 2 methods:

A. Winkler's Method and it's variations.

B. Membrane Electrode Method, this is the most common method. The measuring is ease, does not suffer certain interferences as Winkler's Method, allowing IN-SITE measurements it eliminates errors caused when collecting Or storing the samples.

The oxygen determination is important for:

Life conditions for fishes and microorganisms in water;

In water treatment station process;

Corrosion;

Food Packaging Control.



In practice it is fundamental to obtain the precise measurements to consider the temperature factor that is very significant over the electrode's sensibility.



Because of that, a automatic temperature compensation must be done using a thermo-resistor, in a convenient Position at the cell in order to establish a Reference Temperature and consequently a fixed sensibility.



If the system temperature increases, the **Idif** increases, the thermo-resistor increases the Rth, lowering **Idif** and vice versa, which means, the thermo-resistor sustains the Id constant for various temperatures. In reality, the thermo-resistor will correct:

a -The oxygen solubility in water, decreasing or increasing with the temperature.

b-The coefficient is 4%/C of PTFE membrane permeability so the O2 diffusion through the membrane increases in relation to the temperature.

c - The oxygen's partial pressure at electrolyte, varies related to the temperature, varying the **Idif** consequently the sensibility.

Therefore it is crucial for a bigger measurement precision wait a temperature stabilization in the hole system in order to be detected by the thermo-resistor (aprox. 1 minute).

The Membrane Electrode Methode

This method is well used, allowing IN-SITE readings, eliminating errors generated by collecting and storage, allow readings in minutes, economy of solutions used at titlelometric method and the measurement repeat, if necessary and it is not a destructive method.

The method consists in using an amperometric electrode with Clark's polarographic construction type, composed of a Ag anode and one Pt cathode for oxidized solutions, containing chloride, natural water and others or of Au for strong oxidized solutions, supported by a glass body, immersed into a electrolyte (Na₃PO₄) or Sodium Sulfate Sulfite (Na₂SO₃) that allows more stable readings and shorter polarization times (15 minutes) in relation to Kcl, interfacing the solution to measured by a Polyethylene or Fluorcarbonate membrane (PTFE) permeable to gases and not to ions, depending on thickness could determine the range from 0.1 to 60 ppm.



Applying a convenient potential differential between tow electrodes, aprox. 800 mV, for polarization. At cathode occurs a oxygen's reduction for ion hydroxyle

O2 + 2H2O + 4e- --> 4OH-

And at the anode a oxidation for silver ions

4Ag --> 4Ag+ + 4e-

We will obtain, a diffusion current (Idif) that will be proportional to the consumed oxygen, therefore we can create the proportionality

Idif = Molecular Oxygen Concentration

In practice, the dissolved oxygen of the sample to be measured diffuse thru the membrane, reduce at cathode and creates at anode the oxidized product, in order to guarantee a stable Idif, it is necessary to wait for total polarization (aprox. 15 min.). Some equipments have the characteristics of not allowing the reading before the real polarization for ions or hydroxyles formation. Therefore In order to obtain a better sensibility, less oxygen consumption, it is interesting to have a smaller possible area of the cathode. (1 μ A, consumes aprox. 8,3x10-11g of O2/seg), with this the Idif error is minimized, with one smaller 1 of zero. On practice a solution at a temperature of 20°C, at atmospheric pressure of 1013 mm in saturated water, we will find that the O2 solubility is 9 mg/L, with ethanol up to 40 mg/L and in glycerol only ~ 2 mg/L, so, the oxygen solubility in solutions depends on factors: Temperature, Atmospheric Pressure and Salinity, these must be correctly compensated.

1 - Relating to absolute pressure at the solution to be measured, we shall consider that Idif is composed by ions OH- whose quantity is proportional to O₂ activity, or better the O₂ partial pressure (PO₂), such as: Where: K = constant

A = cathode area

$$I_{PO_2} = K \cdot A.P.PO_2$$

P = membrane permeability

DO Theory (cont.)

- d = membrane thickness
- PO₂ = O₂ partial pressure

The electrode can be used in liquid or gas phase, where we will have an absolute pressure that will also differentiate O₂ partial pressure, the it will be necessary to correct this error, that the equipment will be able to do automatically thru a factor, related to the barometric pressure.

2 - The diffusion thru the membrane is direct proportional to the external pressure.



For a bigger precision it is necessary that the reading time be enough in order to stabilize the temperature allowing the O₂ flow thru the membrane (~25sec.)

As follow:

Where d = membrane thickness

P = permeability (material characteristics) - better permeability PTFE than Polyethylene The membrane is ideal when you reach a thickness, that allow a certain resistance, with no sacrifice of T 3 - As seen before, one important sensibility's factor is O₂ flow that goes thru the membrane, in order to be consumed, that why it is important to have a sufficient and constant flow at the sample, as seen below:



4 -The O₂ solubility varies related to the sample, so when the electrode is used in samples of great ionic activity it is necessary to correct the salinity effect that interferes with solubility. The effect is significative when found "TDS" over 1000 ppm at samples, below this value the water is considered fresh, that is reason the used correction factor will be "1". $mg/L \times 10^3$





Interferences:

1 - The membranes are permeable to O₂ molecules and to various other halogen gases, Cl₂, SO₂ and others that can cause measurement errors, by reducing at the cathode.

2 - The long use of electrode in water containing gases such H₂S, will cause a loss of sensibility by contamination of the electrode.

3-Acid or Basic gases (CO₂, NH₃) change the solution's internal pH, generating errors.

4 - Clogging of microorganisms at the membrane, hydrocarbonates, will cover the membrane, diminishing O2 flow, diminishing response time and requiring calibrations in shorter period of time.

5-Fats.

Cell Maintenance

It is possible to observe that is fundamental periodical maintenance, because of all interferences already mentioned it is important to change the membrane, of the electrolyte and cleaning of the cathode / anode.

Cell Storage

-For shorter storage time, leave the cell in distilled water. -For longer storage time, leave the cell dry.

Calibration

SPAN - the electrode can be calibrated at atmosphere or in a known sample (Winkler).

ZERO - Electronically, thru a simulation of the equipment of zero or thru the solution with excess of Sodium Sulfate (Na2SO3).

Preferentially, we should perform a calibration with water sample in test, mostly when we believe that the Winkler's method has interferences.



Items Description

- 1 Display: Alphanumeric 2 Lines x 16 characters
- 2 Membrane Keyboard
- 3 Battery compartnment lid
- 4 RS 232 Output
- 5 Portection lids for field protection
- 6-ACAdapter inlet
- 7-PA Connector: Oxygen and Temperature cell inlet

To turn ON the equipment, press and hold **<ENTER>** key. Make sure the power cord is plugged correctly! The menus are self-explanation with it's respective options, selected by pressing the **<SELECT>** key. After making your selection(flashing option), using **<SELECT>** key, press the **<ENTER>** key to confirm Your selection. This manual will represent the Flashing Option always in <u>Blue Color</u>.

In case of any error or if you decide to change your selection, press the **<ESCAPE>** key to move the screen one step back so you can make the necessary changes, or hold this key for about 5seconds in order to turn OFF the equipment, until the message "SWITCH OFF? YES / NO" shows off on screen. SETUP OPERATION

This equipment is supplied with a non-volatile memory (E2PROM), to store it's operational set up (resolution, reading mode, calibration, etc).

Even if **disconnected** from it's power supply, it **will not** loose the information saved for work! Before you start to work with this equipment, please review the setup, so you can program the equipment based on your application!

After powering the equipment on, by pressing and holding **<ENTER>** key, the equipment will perform an Auto Check and will then stop at Main Menu(Select Function) with options for the user to Select the desired Function. pH function will be flashing as a default. Press **<SELECT>** key to move around until you reach the desired selection(flashing option) then press **<ENTER>** key to access the sub-menu were you will find the SETUP FUNCTION(SET.). Press the **<SELECT>** key until SET is flashing, then press **<ENTER>** key to confirm it. The equipment will prompt for a password, press the following keys in sequence **<SELECT><ENTER><ESCAPE>** and follow the instructions on the display.

Always use **SELECT>** key to move around the options and press **SELECT>** key to confirm this option.

Refer to page 13 for description of Set Up Screens.

CHECK OPERATION

The Check Sensor option is very useful, it gives the user the conditions to check the sensibility of the sensor. The operation is self-explanatory! From main menu press the **SELECT**> key to choose the desired function, then press **SENTER**> key to confirm. Select option Check, then press **SENTER**> key to confirm option. The display will guide you thru the process.

READING OPERATION

Under this operation, you'll find CALIBRATION and READING options .If you want to calibrate the sensor, press the **SELECT**> key to select the Calibration option(flashing option - CAL), then press **SELECP**> key to confirm. The program will guide you step by step on how to calibrate the sensor. If you need to use the READING option, press the **SELECT**> key to select READ (flashing option), then press **SELECP**> key and the display will show the following format:

- 1 The Prompt signal will flick at each reading.
- 2 The Measured Value.
- 3 Sample Temperature.
- 4 -Barometric Pressure.



IMPORTANT INFORMATION

1 - In case you want to quit Reading operation, press and hold **<ESCAPE>** key for about 5 seconds in Order to be recognized by the equipment. This time is necessary to certify the user desires to quit this mode.

2 - When the equipment is turned on again, the set up will follow initial conditions including the changes prior to when it was turned off.

To turn off the equipment, press and hold **<ESCAPE>** key until the message to Switch Off shows on screen, then by pressing **<SELECT>** key, choose YES to turn if off or NO to continue working and press **<ENTER>** key to confirm the option c

BASIC OPERATION

The menus are self-explanatory for easy operation. To input new information or change the pre-seted information, the menu offers flashing options, selected by **SELECT**> key and confirmed by **SELECT**> key is used to change options or to correct data (every time the user press **SECAPE**> The screen will move back one step or one option).

This manual will represent the Flashing Option always in **BLUE Color**.

CELL POLARIZATION

This instrument is supplied with a Clark Polarographic Cell, so Polarization is necessary before the reading. Every time you turn on the instrument, Cell Polarization will be performed. This procedure takes 12minutes.

If you turn on your instrument, use it and now you are going to use again in a short period of time, after performing the Reading, press **<ENTER>** key, so the instrument will be in Stand By, this way the instrument will not turn himself off.

To return to Reading operation, press **<ENTER>** key again.

If on the field, make sure to perform the same operation and while in Stand By the battery consumption will

Attention: when replacing the Cell, user must access DO Set Up Mode and perform Themostatization, as described on Page 16.

The instrument is supplied with a Cell and this operation is not necessary, as this operation was already performed at the factory. So every time the user is prompted with "NEW CELL?" while at Set Up Mode, answer NO, as the cell is not new to the instrument. Also answer NO if a Cell maintenance is performed, as the Cell is not new!

Basic Operations

1 - The software offers self explanatory menus for easy interaction with the user. The menu shows the selected option as Flashing. Use the **<SELECT>** key to modify the flashing option and select a different one, then press **<ENTER>** to confirm it. 2 - In case of a mistake, or data modification or to return to a prior menu, press **<ESCAPE>** key. While at Reading Mode, press and hold **<ESCAPE>** key for about 5 seconds in order to exit this mode. This is necessary in order for the instrument understand that the user really desires to exit the Reading Mode.

3 - The equipment stores the configuration on a non volatile memory (E²PROM). Even when turned off, the last set up Configuration will be stored.

Turning On the equipment

1-Turn on the equipment by pressing **<ENTER>**. The display will show the following menus until reached the Main Menu.



Every time you see the symbols ">" or "<", that means that the user can adjust the displayed value up or down. To increase the value press <SEL> key until ">" flashes, then press <ENT> to confirm, then press <SEL> key and at every touch the value will increase by one unit. To decrease the value press <SEL> key until "<" flashes, then press <ENT> to confirm, then press <SEL> key and at every touch the value will decrease by one unit. If a mistake is made, press <ESC> key to return and correct the value! If user press and holds <SEL> key, the units will move faster, but be careful when gets closer to the desired number, as you can miss it and if that happens, press <ESC> key to move back and Correct the mistake.

5. Equipment Operation - DO - Set Up

Press <select> key until option DO flashes, then press <enter> key to confirm the option chosen.</enter></select>	SELECT FUNCTION
Press <select></select> key until option Set Up flashes, then press <enter></enter> key to confirm the option chosen.	DO: Read / Set Up
A password is required to access the Set Up mode. Press in sequence <select>, <enter>, <escape>.</escape></enter></select>	PASSWORD
Program will display the battery life left.	BATTERY
User has the option to choose the desired language. Press <select></select> key until the desired option flashes, then press <enter></enter> key to confirm the option chosen.	LANGUAGE:PORTG./ ENGLISH/SPANISH
User has the option to choose between DO or BOD. Press <select> key until the desired option flashes, then press <enter> key to confirm the option chosen.</enter></select>	SELECT: DO / BOD
User has the option to choose between unit desired. Press <select> key until the desired option flashes, then press <enter> key to confirm the option chosen.</enter></select>	UNIT: PPM / m9/L
This Screen is default and cannot be changed.	RANGE Ø to 60 ppm
Select the Resolution by pressing <select></select> key. Option chosen will flash. Then press <enter></enter> key to confirm option chosen.	RESOLUTION 1 0.1 0.01
User has the option to choose the Calibration type desired. Press <select></select> key until the desired option flashes, then press <enter></enter> key to confirm the option chosen. If air, calibrate the cell dry at 2cm from water surface, and if water, dip the cell into Saturated distilled water with Oxygen. See pages 18 & 19	CALIBRATE IN: AIR / WATER

User has the option to choose the Zero calibration type desired. Press **SELECT>** key until the desired option flashes, then press **SELECT>** key to confirm the option chosen. If Zero Auto - Zero is achieved internally by the instrument. If Zero Manual - also known as Zero Chemical, use solution without Oxygen presence.

Span is the second calibration point and user has the option to choose between Span Manual - when user has a solution with a known dissolved oxygen value, obtained thru Winkler Method, so read values can be compared to the Winkler values or Span Auto automatic conditions, with atmospheric air. Press <SELECT> key until the desired option flashes, then press <ENTER> key to confirm the option chosen.

User can adjust the Salinity value, so the salinity compensation can be performed. So the salt concentration of the sample, needs to be known. Remember that at fresh water this value does not exceed 2000µOhms/cm, that corresponds to 1000ppm where use can considres the adjust to 0 (zero). Refer to page 13 for instruction on how to adjust this value. The Span Resolution will depend upon the Reading Resolution chosen above.



If chosen Zero Auto calibration, procedure will follow as page 18. If chosen Zero manual calibration, will follow as page 19.





Go to Page 16 Go to Page 16



5 Equipment Operation - DO - Read

Attention: stirring is a MUST when performing Reading operation. The sample must be stirred by an external stirring device or the user can move the cell in circles inside the sample as DO has stirring dependence!



The End Report screen will only be displayed if user had chosen to use RS 232 during Set Up Mode. If user press and hold **<ESCAPE>** key in order to exit the reading Mode, program will confirm if can end the report and print the final results thru RS 232.

5. Equipment Operation - DO - Calibration



Follow this procedure in order to simulate 100% humidity.



The reading will be displayed.

If user press and hold **<ESCAPE>** key in order to exit the reading Mode, program will confirm if can end the report and print the final results thru RS 232.

Perform this function if user desires to store the results while Reading



press <enter></enter> key to confirm the option chosen.	SET UP/CHECK
Press <select> key until option Register flashes, then press <enter> key to confirm the option</enter></select>	DO: READ / CALIBRATE/ <mark>REG</mark>
Press <select> key until option Consult flashes, then press <enter> key to confirm the option</enter></select>	REG: READ / CONSULT/ERASE
Press <select></select> key until chosen option flashes, then press <enter></enter> key to confirm the option chosen.	CONSULT DISPLAY/PRINTER
Press <enter></enter> key to consult the next registered reading. Press and hold <escape></escape> key in order to exit the Consult Mode.	REG:1 800m 23.2°C -> 8.12 ppm

User can consult the results thru the display or printer.

Perform this function if user desires to earse all data stored

Press <select></select> key until option DO flashes, then press <enter></enter> key to confirm the option chosen.	SELECT FUNCTION
Press <select> key until option Read flashes, then</select>	DO: READ /
press <enter> key to confirm the option chosen.</enter>	SET UP/CHECK
Press <select></select> key until option Register flashes,	DO: READ /
then press <enter></enter> key to confirm the option	CALIBRATE/ <mark>REG</mark>
Press <select> key until option Erase flashes, then</select>	REG: READ /
press <enter> key to confirm the option chosen.</enter>	CONSULT/ERASE
Re-confirm option chosen. This is the last chance not To erase ALL data stored. After this point, if chosen to erase. ALL data will be lost !	CONFIRM? Ves / No

5. Equipment Operation - O₂ - Set Up

Press <select></select> key until option O ₂ flashes, then press <enter></enter> key to confirm the option chosen.	SELECT FUNCTION DO O ₂ %SAT
Press <select></select> key until option Set Up flashes, then press <enter></enter> key to confirm the option chosen.	0 ₂ : READ / SET UP
A password is required to access the Set Up mode. Press in sequence <select>, <enter>, <escape>.</escape></enter></select>	PASSWORD
Program will display the battery life left.	BATTERY
User has the option to choose the desired language. Press <select> key until the desired option flashes, then press <enter> key to confirm the option chosen.</enter></select>	LANGUAGE: PORTG./ ENGLISH/SPANISH
Unit will be displayed.	UNIT: %GAS
This Screen is default and cannot be changed.	RANGE Ø to 40%GAS
Select the Resolution by pressing SELECT> key. Option chosen will flash. Then press SENTER> key to confirm option chosen.	RESOLUTION 1 0.1 0.01
At this option only choose Auto! Do not choose Manual. Press <select></select> key until AUTO flashes, then press <enter></enter> key to confirm the option chosen. Zero Auto - Zero is achieved internally by the instrument	ZERO AUTO / MANUAL
User can adjust the Barometric Pressure Altitude. Up to 4500meters. Find out the Barometric Pressure Altitude of the location where the instrument will beused and refer to page 13 for instruction on how to adjust this value.	BAROMETRIC PRES. ALTITUDE 800m
User can adjust the Temperature Coefficiency. This is used to correct the variation imposed by the Cell Membrane. A membrane of 25 mµ has a Temperature Coefficiency of 4% / °C. In case thinner or thicker membranes are used, the correct value, must be used. Refer to page 13 for instruction on how to modify this	TEMP.COEFIC. 4.00%/°C ♦
User can instruct the instrument to inform that calibration is needed.	INFORM CAL.? VES / NO
User can program the number of readings, before instrument prompts for calibration. Refer to page 13 on how to adjust the number.	INFORM WITH? 200 READINGS
User can choose between the following Reading Modes: Continuous - Read continuously after time is set Average - Reads the average after time is set Hold - user must press <enter></enter> key to Read	READING MODE
User can program the time between Readings. Refer to Page 13 for instructions on how to adjust this time.	TIME BETWEEN READINGS 5s <>
L	→ ▲

Go to Page 22



Go to Page 23 Go to Page 23

5 Equipment Operation - O₂ - Set Up (cont.)



Attention: stirring is a MUST when performing Reading operation. The sample must be stirred by an external stirring device or the user can move the cell in circles inside the sample as O₂ has stirring dependence!



The End Report screen will only be displayed if user had chosen to use RS 232 during Set Up Mode. If user press and hold **<ESCAPE>** key in order to exit the reading Mode, program will confirm if can end the report and print the final results thru RS 232.

5 Equipment Operation - O₂ - Calibration

The **CALIBRATION** option is used, when the instrument had not been used for some days, avoiding to perform erroneous readings

For this operation, the **AUTO ZERO** will be performed automatically, it is not necessary to make the **ZERO CHEMICAL**, as it has been already memorized during the **SET UP** operation.



the reading Mode, program will confirm if can energy report and print the final results thru RS 232.

Follow this procedure in order to simulate 100% humidity.



Perform this function if user desires to store the results while Reading



press CENTER > key to commit the option chosen.	do O ₂ %Sat
Press <select> key until option Read flashes, then press <enter> key to confirm the option chosen.</enter></select>	0 ₂ : READ / SET UP/CHECK
Press <select></select> key until option Register flashes, then press <enter></enter> key to confirm the option	O₂: READ / CALIBRATE∕ <mark>REG</mark>
Press <select></select> key until option Consult flashes, then press <enter></enter> key to confirm the option	REG: READ / CONSULT/ERASE
Press <select></select> key until chosen option flashes, then press <enter></enter> key to confirm the option chosen.	CONSULT DISPLAY/PRINTER
Press <enter></enter> key to consult the next registered reading. Press and hold <escape></escape> key in order to exit the Consult Mode.	REG:1 800m 23.2°C -> 20.90 %Gas

User can consult the results thru the display or printer.

Perform this function if user desires to earse all data stored

Press <select> key until option pH flashes, then press <enter> key to confirm the option chosen.</enter></select>	SELECT FUNCTION DO O2 %SAT
Press <select> key until option Read flashes, then press <enter> key to confirm the option chosen.</enter></select>	0 ₂ : READ / SET UP/CHECK
Press <select> key until option Register flashes, then press <enter> key to confirm the option</enter></select>	O₂: READ ∕ CALIBRATE∕ <mark>REG</mark>
Press <select></select> key until option Erase flashes, then press <enter></enter> key to confirm the option chosen.	REG: READ / CONSULT/ERASE
Re-confirm option chosen. This is the last chance not To erase ALL data stored. After this point, if chosen to erase ALL data will be lost!	CONFIRM? Ves / No

5. Equipment Operation - %Sat - Set Up

Press <mark><select></select></mark> key press <enter></enter> key	ey until option <mark>%Sat</mark> flashes, then / to confirm the option chosen.	SELECT FUNCTION DO 02 %SAT
Press <mark><select></select></mark> key press <enter></enter> key	ey until option Set Up flashes, then / to confirm the option chosen.	*SAT: READ/ SET UP
A password is requi Press in sequence <	ired to access the Set Up mode. SELECT>, <enter>, <escape>.</escape></enter>	PASSWORD
Program will display	the battery life left.	BATTERY
User has the option t Press <select> ke then press <enter< td=""><td>o choose the desired language. ey until the desired option flashes, > key to confirm the option chosen.</td><td>LANGUAGE:PORTG./ ENGLISH/SPANISH</td></enter<></select>	o choose the desired language. ey until the desired option flashes, > key to confirm the option chosen.	LANGUAGE:PORTG./ ENGLISH/SPANISH
Unit v	will be displayed.	UNIT %
This Screen is de	efault and cannot be changed.	RANGE 0 to 100 %
Select the Resolutio Option chosen will fl confirm option chose	n by pressing <mark><select></select></mark> key. ash. Then press <enter></enter> key to en.	RESOLUTION 1 / 0.1 / 0.01
User has the option to choose the Zero calibration type desired. Press SELECT> key until the desired option flashes, then press SELECT> key to confirm the option		ZERO MANUAL / <mark>AUTO</mark>
instrument. If Zero Man use solution without Ox	ual - also known as Zero Chemic ygen presence.	al,
User can adjust the Salini compensation can be per of the sample, needs to b	ity value, so the salinity formed. So the salt concentration e known. Remember that at fresh	SALINITY 0 ppm 🔷
water this value does not corresponds to 1000ppm adjust to 0 (zero). Refer to page 13 for instru	exceed 2000µOhms/cm, that where user can considres the uction on how to adjust this value.	
User can adjust the Ba Up to 4500meters. Find Altitude of the location	rometric Pressure Altitude. d out the Barometric Pressure where the instrument will beused r instruction on how to adjust	BAROMETRIC PRES. ALTITUDE 800m <>
this value.		
User can adjust the le used to correct the var Membrane. A membra	iation imposed by the Cell ne of 25 mµ has a Temperature	TEMP. COEFIC. = 4.0%/°C <>
membranes are used, Refer to page 13 for ir value.	the correct value, must be used. Instruction on how to modify this	Go to Page 29

5. Equipment Operation - %Sat - Set Up (cont.)



29



5. Equipment Operation - %Sat - Calibration

The **CALIBRATION** option is used, when the instrument had not been used for some days, avoiding to perform erroneous readings

For this operation, the **AUTO ZERO** will be performed automatically, it is not necessary to make the **ZERO CHEMICAL**, as it has been already memorized during the **SET UP** operation.



The End Report screen will only be displayed if user had chosen to use RS 232 during Set Up Mode. If user press and hold **<ESCAPE>** key in order to exit the reading Mode, program will confirm if can end the report and print the final results thru RS 232.

Follow this procedure in order to simulate 100% humidity.



Equipment Operation - %Sat - Read

Attention: stirring is a MUST when performing Reading operation. The sample must be stirred by an external stirring device or the user can move the cell in circles inside the sample as %Saturation has stirring dependence!



The End Report screen will only be displayed if user had chosen to use RS 232 during Set Up Mode. If user press and hold **<ESCAPE>** key in order to exit the reading Mode, program will confirm if can end the report and print the final results thru RS 232.

Equipment Operation - %Sat - Register

Perform this function if user desires to store the results while Reading



press <enter></enter> key to confirm the option chosen.	DO O ₂ %SAT
Press <select></select> key until option Read flashes, then press <enter></enter> key to confirm the option chosen.	%SAT: READ / SET UP/CHECK
Press <select> key until option Register flashes, then press <enter> key to confirm the option</enter></select>	%SAT: READ / CALIBRATE/REG
Press <select> key until option Consult flashes, then press <enter> key to confirm the option</enter></select>	REG: READ / CONSULT/ERASE
Press <select></select> key until chosen option flashes, then press <enter></enter> key to confirm the option chosen.	CONSULT DISPLAW/PRINTER
Press <enter></enter> key to consult the next registered reading. Press and hold <escape></escape> key in order to exit the Consult Mode.	REG:1 800m 23.2°C → 8.7%

User can consult the results thru the display or printer.

Perform this function if user desires to earse all data stored

Press <select> key until option %Sat flashes, then</select>	SELECT FUNCTION
press <enter> key to confirm the option chosen.</enter>	DO O2 XSAT
Press <select> key until option Read flashes, then</select>	0 ₂ : READ /
press <enter> key to confirm the option chosen.</enter>	SET UP/CHECK
Press <select></select> key until option Register flashes,	O₂: READ ∕
then press <enter></enter> key to confirm the option	CALIBRATE∕ <mark>REG</mark>
Press <select></select> key until option Erase flashes, then press <enter></enter> key to confirm the option chosen.	REG: READ / CONSULT/ERASE
Re-confirm option chosen. This is the last chance not To erase ALL data stored. After this point, if chosen to erase ALL data will be lost!	CONFIRM? Ves / No

5. Equipment Operation - Turning Off

While during Read Mode, user must press and hold **<ESCAPE>** key and the Select Function Menu will be displayed. Press **<ESCAPE>** key and user will be guided to the Switching Off Screen.



Reading display, when the bargraph function was not

DOE-21L (Replacement Cell for DOB21)

Cell Types

The Dissolved Oxygen Cell is composed of a Gold or Platinum cathode and a Silver tubular anode, separated by cast epoxy, immersed in a electrolyte.

The internal part is isolated by a PTFE membrane, permeable to gases. In order to determine the

Dissolved Oxygen, a potential differential. Is applied, between the anode and the cathode. The sample oxygen, will diffuse thru the membrane reducing at the cathode and forming the oxidized product at the Anode. The resulting electrical current, is proportional to the oxygen concentration present.



Model	Temp.	Туре	Thermo	Membrane	Electrolyte	Application
DOE-21L	0 to 60°C	Amperometric	NTC	PTFE	Na ₂ PO ₄	Waste Water Treatment, Rivers,
		Silver / Platinum		25mµ		Lakes, Sea Water and many more.

DOE-210 (Replacement Cell for DOE-21S



Model	Туре	Thermo	Membrane	Electrolyte	Application
DOE-21P	Polarographic	NTC	PTFE 20mm &	Na.PO.	Depth measurement at industrial process
	Gold / Silver	(Internally)	50µ (optional)		with Auto Cleaning System

Cell Maintenance

The periodical maintenance of the cell consists on replacing the MEMBRANE and cleaning of the Ag/Pt electrodes. The maintenance must be done when calibration sensibility loss occur or deviations of calibration value are frequent.

These factors could occur caused by: accumulation of Silver Phosphate at the Anode, clogging, fat or even mechanical damage at the membrane. Therefore, the user must perform constant verifications and a periodical maintenance should be performed depending on the application. The user should proceed the maintenance always step by step basis, executing only the necessary. Initiate the operation by changing the o electrolyte, if necessary proceed with Ag/Pt electrodes cleaning (verify again) and if needed replace the Membrane.

Electrolyte Filling

The Electrolyte is composed by Tribasic Sodium Phosphate Solution (Na₃PO₄12H₂O) and to replace follow below Steps:

- 1. Turn the Protection Cap or Stir Cap counter clockwise, being careful in order not to damage the PTFE membrane.
- 2. Wash the Electrolyte Reservoir with distilled or deionized water.
- 3. Rinse with Tribasic Sodium Phosphate Solution, taking it out quickly.
- 4. Fill the Electrolyte Reservoir with Tribasic Sodium Phosphate until it overflows. Observe for any bubbles Formation, if necessary shake the Reservoir until noticed that all bubbles are gone.
- 5. Reinstall the Protection Cap(Stir Cap), being careful in order not to damage the membrane.
- 6. Connect the Cell to the equipment and proceed with calibration.



AMPHEROMETRIC CELL

Membrane Replacement

The membrane is composed of a PTFE film of 25µm thickness.

- 1. Turn the Protection Ca or Stir Cap counter clockwise.
- 2. Take out the O-ring and the membrane.
- 3. Be careful when manipulating the new membrane, do not touch it in order to avoid fat and salt clogging. It is recommended the use of gloves or cotton.
- 4. With the Electrolyte Reservoir turned up, install the new membrane over the hole. Place the O-ring at it's housing, so it will secure the membrane in place. Cut the membrane's excess over the O-ring. Fill the reservoir with electrolyte until it overflows. Observe for any bubbles formation, if necessary shack the reservoir until noticed that all bubbles are gone.
- 5. Reinstall the reservoir, verifying the membrane is not damaged, then connecting the cell to the equipment and it's calibration.



7. Cell Maintenance (cont.)

AgPt Electrode Cleaning

The cell electrodes are internally composed by a Ag Anode and a Pt Cathode. Both have a limited life and in general do not require maintenance. But the usage of them in high concentration oxygen solutions, turns the Anode inactive, caused by the deposit of Silver Phosphate, requiring a periodical replacement.

1. Turn the Protection Cap or Stir Cap, counter clockwise, being careful in order not to damage the membrane. 2. Wash the electrodes with running distilled water.

3. Using a cotton ball, clean the electrodes with Nitric Acid solution at 10% in order to remove any impurities. To finish, dep the electrode in Nitric Acid for 5 minutes. After this, rinse it with running distilled water.

Be careful, only work at electrodes area, the acid will damage the PVC body.

In situations when Silver Phosphate clogging are not big, the cleaning can be done with Isopropyl Alcohol and soft Absorbent paper.



Electrode Cleaning

Use the adequate cleaning solutions in order to clean internally and externally the Dissolved Oxygen Cell Model DOE-21L.

For the electrode cleaning use any Silver Cleaning solution (polisher) find at your local supermarket.

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

- Purchase Order number under which the product was PURCHASED,
- Model and serial number of the product under warranty, and
- Repair instructions and/or specific problems relative to the product.

FOR <u>NON-WARRANTY</u> REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

- Purchase Order number to cover the COST of the repair,
- 2. Model and serial number of the product, and
- Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

© Copyright 2007 OMEGA ENGINEERING, INC. All rights reserved. This document may not be copied, photocopied, reproduced, translated, or reduced to any electronic medium or machine-readable form, in whole or in part, without the prior written consent of OMEGA ENGINEERING, INC.

Where Do I Find Everything I Need for Process Measurement and Control? OMEGA...Of Course! Shop online at omega.com

TEMPERATURE

- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- PH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- 🗹 Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Datalogging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- PH, Conductivity & Dissolved Oxygen Instruments