

d) The sensor may be attached to float assembly in one of two ways:

1. With sensor EXTENDED FROM BOTTOM of flotation ball:

Insert 12-inch long extender pipe into the flotation ball and fasten it to the end of adapter pipe. This will extend the sensor's membrane 12 inches below the flotation ball. NOTE: Extender pipe supplied only when ordered.

2. With the sensor membrane FLUSH WITH BOTTOM of flotation ball:

Disregard using extender pipe and proceed with Step e).

- e) Route sensor cable through assembled pipe sections, starting from bottom section, and fasten sensor to pipe.

CAUTION: Do not remove measuring cell cartridge from hermetically sealed package until it is to be used in step f). (Membrane will dry out and damage measuring cell).

- f) Install measuring cell cartridge. Unfasten union nut from sensor and make sure to remove any moisture from cavity area and brass contact strips. Insert cartridge in its correctly "keyed" position. Fasten union not tightly so that O-ring compresses to create an effective water-tight seal.

- g) Calibrate system in accordance with the procedure described in Section 5.3 before placing sensor into operation.

- h) Install pivot mounting bracket and mount junction box on the bracket. Insert pipe/sensor assembly through the bracket to the desired position. Tighten pipe locking screw.

3.6 Sensor Installation, Submersion Mounting

- 3.6.1 a) Refer to diagram below and proceed as follows:
- b) Route sensor cable through pipe and fasten sensor to pipe. The use of thread sealant (Teflon tape) on all mounting hardware and sensor threads is recommended to avoid leaks.

CAUTION: Do not remove measuring cell cartridge from hermetically sealed package until it is to be used in step b). (Membrane will dry out and damage measuring cell).

- c) Install measuring cell cartridge. Unfasten union nut from sensor and make sure to remove any moisture from cavity area and brass contact strips. Insert cartridge in its correctly keyed position. Fasten union tightly so the O-ring compresses to create an effective water-tight seal.
- d) Mount the junction box within reach of the sensor cable.
- e) Calibrate system in accordance with the procedure described in Section 5.3 before placing sensor into operation.

3.6.2 The terminal strip on the power supply board at the back of the instrument is labeled for power supply, relay outputs and analog outputs. Connect wiring in accordance with this labeling. *CAUTION: Connecting the line voltage power supply to incorrect terminals may cause serious damage.*

3.7 Probe Connections

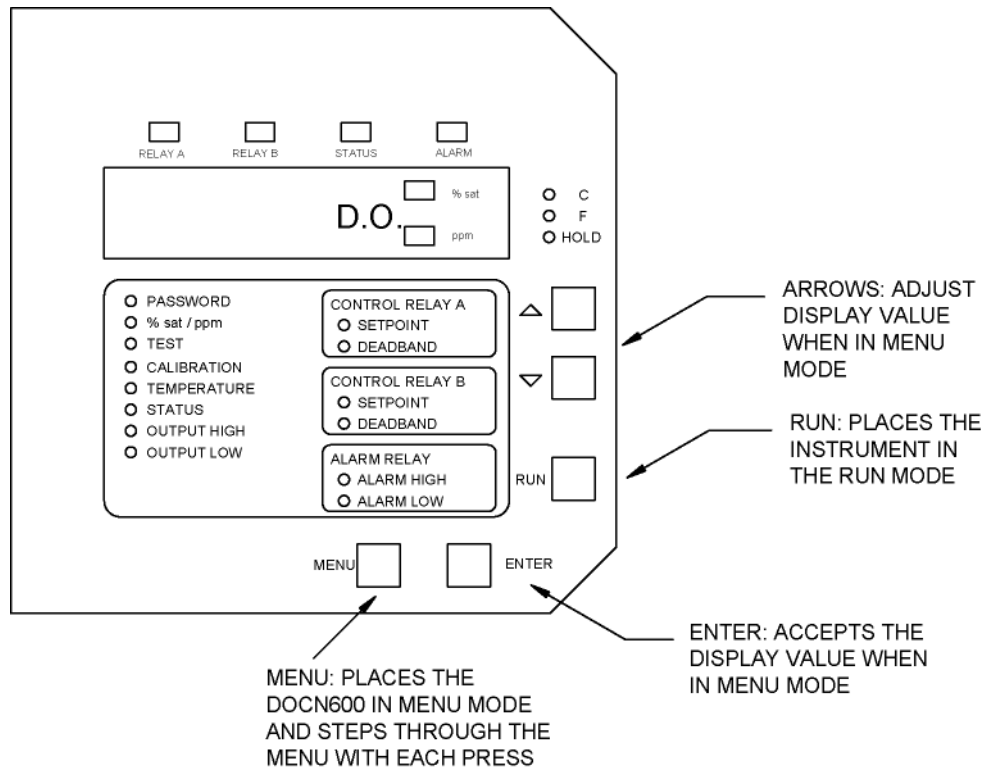
3.7.1 The interconnect cable as supplied will normally be connected to the sensor cable in the junction box. If this is not the case, connect the six wires and the shield of the extension cable to the numbered wires in the junction box as shown below:

<u>Extension Cable</u>	<u>Junction Box</u>
Blue	1
Red	2
Black	3
Green	4
White	5
Yellow	6
Shield	Unnumbered (Green/Yellow)

3.7.2 Connect the six wires of the interconnect cable to the terminal strip on the swing-out board being sure to match colors as printed on the board. Connect the shield to the terminal post located above the terminal strip.

3.7.3 Running the sensor and interconnect cable in 1/2" metal conduit for protection against moisture and mechanical damage is recommended. Do not run power or control wiring in the same conduit ("electrical noise" may interfere with sensor signal).

4.0 DESCRIPTION OF FUNCTIONS



4.1 Overview

- 4.1.1 The DOCN600 is a microprocessor based dissolved oxygen analyzers are designed for industrial applications. They operate in conjunction with the DOE-601 sensor. The software in the unit makes the instrument very easy to operate and maintain.
- 4.1.2 The outputs include voltage-free relay contacts and industry standard analog transmission signals. A relay to indicate a perforated membrane is provided. The analog output signals transmit low power signals to peripherals such as data recorders or control systems.
- 4.1.3 The software is designed for ease of operation. It uses a simple menu with all items indicated on the panel. The user interface consists of six buttons on the front panel. The buttons are scanned and responded continuously. In addition, an extensive system checking for values and parameters is performed by the software. All of the operating parameters are stored in non-volatile memory, without the need of a battery.
- 4.1.4 The DOCN600 operates like a normal analog converter with a number of additional functions made possible by the microprocessor in the instrument.

Some of these are:

- Recall and easy adjustment of relay and output parameters
- Push button calibration
- A HOLD function for outputs
- Continuous sensor check during measurement
- Continuous self check and watch-dog timer to ensure correct operation
- Password protection of stored values
- Temperature Output
- Simulated input for testing

4.2 Calibration

- 4.2.1 The DOCN600 is calibrated at the factory, with the sensor purchased with the instrument. However, the system should be field calibrated when installed and from time to time thereafter. The calibration procedure is given in Section 5.3.

4.3 Temperature Compensation

- 4.3.1 A temperature sensor in the DOE-601 sensor provides the means of continually compensating the D.O. reading for variation in the temperature of the process.

4.4 Relay Outputs

- 4.4.1 Three SPDT relays are provided. The normally open contacts, NO, are open when no alarm or control is active.
- 4.4.2 The two control relay can be programmed to close on either rising or falling D.O. They can be set to close at any point on the scale. The deadband, sometimes termed hysteresis, defines the point at which the relays open. See Sections 4.8, 5.8, and 5.9.
- 4.4.3 The third relay functions as a high-low alarm. It has two programmable setpoints (high and low). The deadband is fixed at 2% of full span. This relay is also activated in the event of a perforated membrane. (See Section 4.5) The alarm contact can be programmed to also signal memory loss in the DOCN600 controller. See Section 4.8, 5.12, and 5.13.
- 4.4.4 All relays can be programmed for "fail-safe" operation which reverses the normal operation of the relay. In this mode the relays will fail-safe (transfer) in the event of power failure.

4.5 Membrane Alarm Relay

- 4.5.1 A single pole double throw relay is provided to give an output in the event of a perforated membrane.
- 4.5.2 This relay can be programmed to also signal memory loss. See Section 4.8.
- 4.5.3 When this relay is activated the contacts will close and the FAIL LED will be indicated on the panel.

4.6 Analog Outputs

- 4.6.1 The analog output signals consist of a non-isolated 0-1 mA, 0-5 Vdc, and isolated 4-20 mA signals.
- 4.6.2 From the factory all of the analog outputs have a linear range corresponding to the full range of the instrument. The 4-20 mA output can be programmed to another linear range by entering two values:
- Output High: This is the D.O. value at which you wish to have 100% output.
 - Output Low: This is the D.O. value at which you wish to have 0% output.
- 4.6.3 When programming, you must ensure that the output range has a span of at least 10% of the full range of the instrument. For applications that require the output to decrease as the process value increases, i.e. an inverted output, the Output High value will be less than the Output Low. See Section 5.4.
- 4.6.4 The instrument may be used to measure the temperature of the process either in Celsius or in Fahrenheit. The DOCN600 does not control temperature but the 0-5 Vdc and 0-1 mA analog outputs can be dedicated to follow the process temperature. See Sections 5.6.

4.7 Operation Menu

- 4.7.1 The operation menu allows the user to recall and to adjust the parameters, required by the analyzer functions.
- 4.7.2 When the analyzer is powered up, the program will display D.O. readings. None of the LEDs in the operation menu will be illuminated.
- 4.7.3 Five buttons on the panel are used to operate the menu. Use the CALL button to step through the items in the menu, one at a time. The red LEDs beside each item makes it very easy to follow the menu. The function of the RUN button is to return to the on-line D.O. display from anywhere in the menu. The analyzer has a built-in timer which, when enabled, by DIP Switch 7 Bank S1 (Section 4.8), returns the program to RUN mode if no button has been pressed for 10 minutes. This time-out has the same effect as pressing the RUN button.

- 4.7.4 When in the menu mode, the display initially shows the current value of the parameters, such as the Setpoint of the control relay, while putting all of the outputs on hold. The two arrow buttons are used to adjust the display value up or down. To accept the new value press ENTER twice. While the value on the display is being changed, the relay outputs and the analog outputs remain on hold.

The items that appear in the operation menu are:

- Password
- % Sat/ppm
- Test
- Calibration
- Temperature
- Status
- Output High
- Output Low
- Relay A Setpoint
- Relay A Deadband
- Relay B Setpoint
- Relay B Deadband
- Alarm Relay High
- Alarm Relay Low

4.8 DIP Switches

- 4.8.1 The controls which are frequently used in the normal operation of the instrument are all accessible on the control panel. Some switches, which are infrequently used are located on the back of the swing-out board.
- 4.8.2 The DIP switches are scanned on RESET, power-up and every time the instrument is taken into the menu mode. Therefore, after changes to the DIP switch settings, you must take the unit offline by pressing CALL in order for the instrument to scan the new DIP switch values.
- 4.8.3 The following table describes the use of the 16 DIP switches:

<u>DIP Switch</u> <u>Bank S1</u>	<u>Description of Use</u>	<u>Switch</u> <u>OFF</u>	<u>Switch</u> <u>ON</u>
1	Selects temperature unit	°F	°C
2	Enables use of Password Feature	YES	NO
3	Fail Safe mode for Relay A	NO	YES
4	Direction of Control Relay A	Rising	Falling
5	Alarm Relay to Activate for Memory Loss	YES	NO
6	Fail Safe mode for Alarm Relay	NO	YES
7	Auto Return from menu if no button pressed	NO	YES
8	0-5 Vdc / 0-1 mA selector	Temperature	D.O.

Dip Switch
Bank S2

1	Fail-safe for Relay B	NO	YES
2	Direction of Control for Relay B	Rising	Falling
3	Reserved		
4	Reserved		
5	Reserved		
6	Reserved		
7	Reserved		
8	Reserved		

4.9 Output Hold

- 4.9.1 Output hold, is a function which freezes all output signals at the last value to prevent the occurrence of wild distortions during programming and maintenance.
- 4.9.2 When the Operation Menu is entered by pressing CALL, the alarm relays and the analog outputs are automatically placed on hold and remain on hold until the instrument returns to on line. The output hold will remain for a maximum of 10 minutes after the last button was pressed, if this feature has been enabled. See Section 4.8.

4.10 Parameter and Operation Checking

- 4.10.1 The instrument continuously checks all parameters in its memory, while taking D.O. readings. When it detects an invalid value, it flashes the LEDs in the operation menu to indicate the parameter is at fault. You must then access the operation menu to take corrective actions.

4.11 Simulated Input for Testing

- 4.11.1 TEST is function for test and diagnostic purposes. Values can be simulated internally and adjusted with the arrow buttons to set display reading and analog outputs to any desired value without disrupting instrument calibration.

4.12 Utility Menu

- 4.12.1 The Utility Menu is provided to enable authorized personnel to change the range and fine tune the analog . See Section 7.0.

4.13 Watchdog Timer and Self Diagnostics

- 4.13.1 The DOCN600 continuously monitors the condition of all key components of the measuring system to ensure that the measurements are reliable. Invalid entries and memory loss are indicated on the panel. See Section 8.0.

5.0 START-UP AND OPERATION

5.1 Password

- 5.1.1 To enter the menu press CALL then PASSWORD will be indicated. With each press of CALL you will step through the menu. When the last item is reached the menu wraps around to "%sat/ppm". If you have enabled PASSWORD by placing DIP Switch 2 Bank S1, in the off position you must enter the password "6" when PASSWORD is indicated if you wish to change any stored value. You do not need to enter the password to proceed to other items in the menu for recall of stored values.

If PASSWORD has not been enabled you do not need to enter the password to change stored values.

5.2 Percent Saturation/ppm

- 5.2.1 The instrument provides measurement of dissolved oxygen in either percent saturation or ppm. In ppm measurement the reading is automatically compensated for temperature changes in the medium.

- a) To select units of measurement enter the menu by pressing CALL to indicate %sat/ppm.
- b) Press the UP arrow button to select %sat or the DOWN arrow button or select ppm.
- c) Press RUN to return to on line or press CALL for another menu selection.

5.3 Calibration

- 5.3.1 To calibrate the instrument you will need a container of fresh clean water. For best results a bubbler such as that used in a tropical fish tank should be in the container.
- a) Clean the sensor with a soft cloth and mild soap solution.
 - b) Place the sensor over the water container for a few minutes. (There is no need to remove it from the float if so installed.)
 - c) Press CALL to enter the menu.
 - d) If the password function is enabled, enter the password then press CALL to illuminate the "%sat/ppm" indicator. If the password function is not enabled, "%sat/ppm" will illuminate at the first press of CALL.
 - e) Use the UP arrow button to illuminate the %sat LED located to the right of the display.
 - f) Press CALL twice to illuminate the CALIBRATION indicator.
 - g) Use the arrow buttons to make the display read 100.0.
 - h) Press ENTER as soon as the reading stabilizes. The display will flash until ENTER is pressed again to confirm entry.

- i) If you wish to change the measuring unit to ppm, press CALL a number of times to return to "%sat/ppm" and change ppm with the down button.
- j) Press RUN to return to on line measurement.

NOTE: If a major change is necessary to make the display read 100% the display will flash when you press ENTER. This is to warn that you may have made a mistake such as using "stale" water. If you are confident your procedure was correct, press ENTER a second time. Otherwise, repeat the calibration procedure by pressing CALL a sufficient number of times to go through the menu and return to CALIBRATION.

5.4 Analog Output Range Expand

5.4.1 The 4-20 mA isolated analog output may be spread over any section of the scale as long as that section is at least 10% of full scale. The best way to describe this setup is by example. Suppose you wish the 4-20mA output to span 5 ppm to 10 ppm. Proceed as follows:

- a) Press CALL as many times as required until OUTPUT HIGH is indicated. Now use the arrows to make the meter read 10 ppm. Press ENTER. The display will flash until ENTER is pressed again to confirm entry.
- b) Press CALL once to indicate OUTPUT LOW. Now use the arrow buttons to make the meter read 5 ppm. Press ENTER twice as above.
- c) The analog output will now be at 4 mA when the D.O. of the solution is 5 ppm and will increase to 20 mA when the D.O. of the solution is 10 ppm.
- d) Press RUN to place the instrument on line or press CALL for another menu selection.
- e) To invert the output (i.e. decreasing output for increasing process value) simply adjust for 4 mA on OUTPUT HIGH and for 20 mA on OUTPUT LOW.

NOTE: A range expand of less than 10% of full scale is an invalid entry which will be indicated by the LED flashing when you return to RUN. To correct, return to the menu and correct the output settings.

5.5 Test

5.5.1 To test your setup press CALL the number of times required to indicate TEST. Now by using the arrow buttons you can "sweep" through the digital display.

5.5.2 With the instrument in TEST you can check the analog output at any desired reading with a meter connected to the appropriate output terminals.

5.5.3 Another use of this feature is to check the stability of the system. When in TEST, use the arrow buttons to select any value, say 10 ppm. Now return online by pressing RUN. Return to the meter some hours or days later. Press CALL to indicate TEST. If the instrument is still in calibration and if no one has interfered the meter should read 10 ppm.

5.6 Temperature

- 5.6.1 The temperature of the process can be read at any time by entering the menu and calling for TEMPERATURE. Either °C or °F will be indicated depending on the position of DIP switch No. 1. Bank S1. See Section 4.8.
- 5.6.2 The 0-5 Vdc and 0-1 mA analog outputs can be dedicated to follow the process temperature by simply placing DIP switch No. 8 in the off position. The temperature span of the output is set to the utility menu. See Section 4.8 and 7.4.

5.7 Status

- 5.7.1 The DOCN600 continuously checks the integrity of all stored data and monitors the condition of the measuring system. If a fault is detected, the FAIL LED above the display will turn red. The STATUS in the operation menu will provide a numerical code, giving a possible cause and a suggested remedy.
- 5.7.2 The following table shows the display codes, causes and remedies:

<u>Code</u>	<u>Possible Cause</u>	<u>Suggested Remedy</u>
0	Normal Condition	No action required
1	Reserved	
2	Temperature Sensor off Scale	Verify process. Check for open or short connections.
3	D.O. reading off Scale	Verify process. Check for open or short connections.
4*	Memory Loss	Call your OMEGA Rep. Or OMEGA directly
5	Reserved	
6	Sensor Fault	Check probe membrane for perforation
7	Factory Setting in force, as a result of the ESCAPE procedure	Perform procedure according to Section 9.2

NOTE: Code 4 could be a serious failure so the alarm relay will energize in addition to the red illumination of the FAIL LED, if DIP switch 5 Bank S1 is OFF.

5.8 Relay A Setpoint

- 5.8.1 As shipped from the factory, Relay A is configured to control decreasing D.O. However, you may change the direction of control by changing the position of DIP switch 4 Bank S1. Please refer to Section 4.8.

5.8.2 The relay setpoint may be at any place on the scale. To establish the setpoint proceed as follows:

- a) Press CALL to enter the MENU. If the PASSWORD function is enabled, enter the password then press CALL to illuminate the “%sat/ppm” indicator. If the PASSWORD function is not enabled, “%sat/ppm” will illuminate at the first press of CALL.
- b) Use the down arrow button to illuminate the PPM LED located to the right side of the display.
- c) Press CALL the required number of times until RELAY A SETPOINT is indicated. Now use the arrows to make the display read the desired value. Press ENTER. The display will flash until ENTER is pressed again to confirm entry. A LED above the display indicates when Relay A is activated.
- d) Press RUN to place the instrument on line or press CALL for another menu selection.

5.9 Relay A Deadband

5.9.1 If you have configured the instrument with the DIP switch on the back of the panel for falling D.O. you will wish to have the deadband (sometimes called “hysteresis”) at a higher value than the setpoint. If you have established a setpoint of 3 ppm you may wish the deadband to be between 6 ppm and 3 ppm. Proceed as follows:

- a) Enter the menu and press CALL the required number of times to indicate RELAY A DEADBAND. Use the arrow buttons to make the display read the desired value (in this example, 6). Press ENTER. The display will flash until ENTER is pressed again to confirm the entry.
- b) In this example, after the instrument has been returned to RUN, the relay will be energized when the D.O. falls to 3 ppm and will remain energized until the reading rises above 6 ppm.
- c) When Relay A is activated a LED above the display will be illuminated.
- d) Press RUN to place the instrument on line or press CALL for another menu selection.

5.10 Relay B Setpoint

5.10.1 Relay B Setpoint is configured in the same way as Relay A Setpoint. See Section 5.8. A LED above the display indicates when Relay B is activated.

5.11 Relay B Deadband

5.11.1 Relay B Deadband is configured in the same way as Relay A Deadband. See Section 5.9.

NOTE: A deadband setting on the wrong side of the setpoint in an invalid entry which will be indicated by the LED flashing when you return to RUN. To correct return to the menu and change the deadband setting or, if the direction of control is the problem, change the position of the relevant DIP switch. See Sections 4.8 and 5.9.

