JENCO®

QUALITY INSTRUMENTS

Operation Manual

MODEL 6309PDTF

pH/DO/Temperature
Transmitter/Controller

6309PDTF

CONTENTS

GENERAL INTRODUCTION

The Jenco Model 6309PDTF (pH, DO and Temperature) system is a rugged microprocessor based meter assembled in a watertight ¼ DIN case, designed for use in laboratories and process control applications.

The model 6309PDTF microprocessor allows the user to easily recalibrate the parameters for the probes. The DO system requires only a single point calibration, regardless of which dissolved oxygen display used. The microprocessor also performs a self-diagnostic routine every time the user turns on the unit providing basic information about the stability of the meter.

The system simultaneously displays pH, DO, temperature, relay status and current output in one graphic LCD screen. The LCD also includes a backlight for low-lit environments. This system uses pH electrode for the pH, a "polygraphic clark" membrane for the DO and a precise thermistor for temperature, providing the user with accurate readings for all measurements.

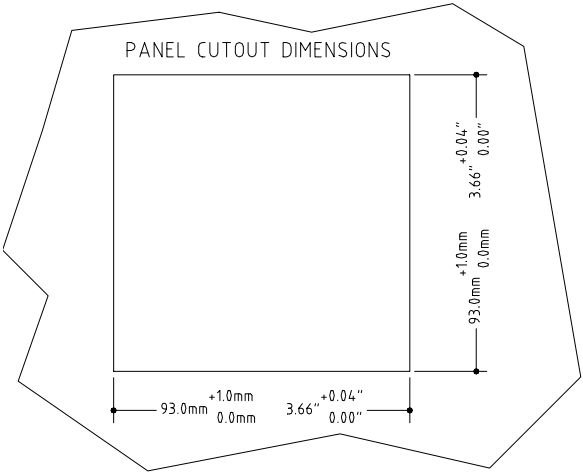
The model 6309PDTF is equipped with 5 relays (2 programmable high/low action relays for pH. 2 programmable high/low relays for DO and 1 programmable high/low relay for temperature). All relays are hysteresis driven and configurable to CENTER or EDGE mode. The system also has an isolated 4-20 mA analog output, offset and span configurable for the pH or DO display.

The model 6309PDTF comes with a RS485 interface which can easily let the user log all data (from multiple model 6309 or 6308) with an PC.

ASSEMBLY

Carefully unpack the meter and accessories. Inspect for damages made in shipment. If any damage is found, notify your Jenco representative immediately. All packing materials should be saved until satisfactory operation is confirmed.

A. Mounting Procedure



1. Make a cutout on any panel, with a thickness of 1/16 in. (1.5 mm) to 3/8 in. (9.5mm).
2. Remove the mounting assembly from the controller and insert the controller into the cutout.
3. Replace the mounting bracket assembly onto the controller and secure the controller to the mounting panel.

Warning: If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

B. Cleaning The Meter

1. Be sure to remove the power before attempting to clean the meter.
2. Use a lint free cloth and clean water or neutral detergent.
3. Wipe the outer surface of the meter only.
4. Wipe-dry the meter before powering again.

DISPLAY & KEY FUNCTIONS

A. Display

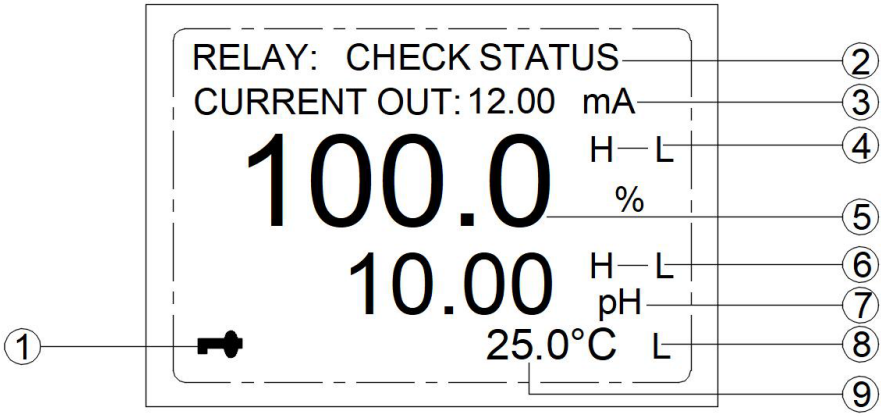


Figure 1

1. 🔑**-** This will be displayed if Calibration/Setting pages are password locked meaning the user can't change the values unless the correct 4 digit number has been entered.	**2. RELAY-** This will show the status of the relays. At Power-ON a "DISABLED" message will be displayed for about three seconds before going to "NORMAL or CHECK STATUS" operation. After exiting the Calibration/Setting pages and the unit is not password locked, a "FROZEN" message will be displayed for about three seconds before returning to "NORMAL or CHECK STATUS" operation. If no relay is ON then the "NORMAL" message will be displayed. If any relay is ON then the "CHECK STATUS" will be displayed.

3. CURRENT OUT- This will display the actual output of the 4-20 mA output. At POWER-ON this will show "OFF" for about three seconds before going to normal operation. After exiting the Calibration/Setting pages a "FROZEN" message will be displayed for about 3 seconds before returning to normal operation. An "ERROR" display here means that the absolute difference between 4 mA and 20 mA is less than 1.0 pH (If pH LINEAR or pH ANTILOG is selected) or less than 1.0% (If DO LINEAR is selected and RELAY/mA is set at %) or 0.10 ppm (If DO LINEAR is selected and RELAY/mA is set at ppm) and that the current output is disabled.	**4. H, L-** One or both of these annunciators will be displayed if the left side reading (LARGE FONT DISPLAY) triggered the respective relay settings. The rightmost character will indicate RELAY 1 if the display is pH or RELAY 3 if the display is DO. The leftmost character will indicate RELAY 2 if the display is pH or RELAY 4 If the display is DO. If the display is DO, the annunciators will only indicate the unit selected at the RELAY/mA option in the "DO calibration page". **H :** High action relay and the relay is energized. **L :** Low action control and the relay is energized.
5. MAIN DISPLAY- This reading uses the biggest font and the reading here is the only one that will affect the analog output. You can only select the DO or pH reading to be shown here by changing the Transmitter Output option.	**6. H, L-** One or both of these annunciators will be displayed if the left side reading (MEDIUM FONT DISPLAY) triggered the respective relay settings. The rightmost character will indicate RELAY 1 if the display is pH or RELAY 3 if the display is DO. The leftmost character will indicate RELAY 2 if the display is pH or RELAY 4 If the display is DO. If the display is DO, the annunciators will only indicate the unit selected at the RELAY/mA option in the "DO calibration page". **H :** High action relay and the relay is energized. **L :** Low action control and the relay is energized.
7. SECONDARY DISPLAY- This is the secondary reading and no analog output is supplied.	**8. H, L-** One of these annunciators will be displayed if the temperature reading triggered the temperature relay setting. The temperature relay setting can be configured to HIGH or LOW. **H :** High action relay and the relay is energized. **L :** Low action control and the relay is energized.
9. TEMPERATURE- The current temperature of the solution.	

B. Operational Keys Description

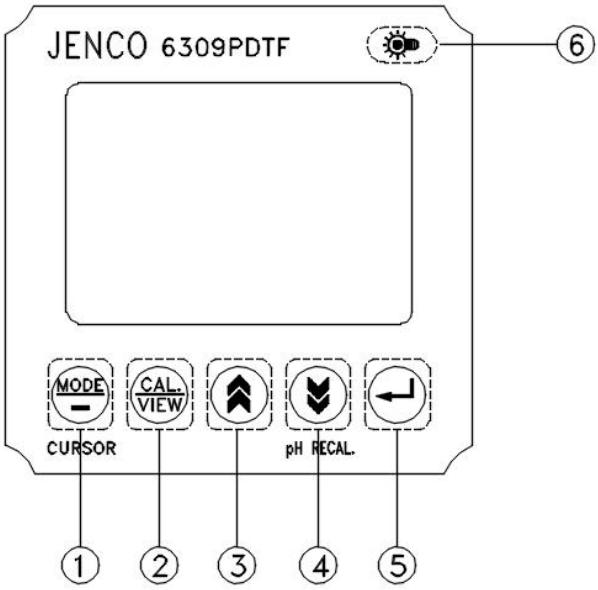


Figure 2

NO.	Key	Description
1		**MODE-** In the measure mode, this key will change the DO display to DO % or DO ppm. In the Calibration/Setting mode this key will move to the next digit of the current active parameter. In the Calibration/Setting mode, pressing this key for two seconds will move the user back to the previous parameter.
2		**CAL/VIEW-** Pressing this key for about two seconds, during normal display mode will switch to Calibration/Setting mode. During Calibration/Setting mode, pressing this key will switch to the next available Calibration/Setting page. Pressing this key at the last User/Calibration page will return the user to the normal display mode.
3		**UP-** During Calibration/Setting mode, this key will increment the current blinking digit of the active parameter.
4		**DOWN-** During Calibration/Setting mode, this key will decrement the current blinking digit of the active parameter. During pH calibration, the user can press this key to recalibrate the stand or slope buffer again.

5		**ENTER-** During Calibration/Setting mode, this key will save the current modified parameter and move to the next parameter.
6		**LIGHT-** This key will turn on or turn off the backlight of the LCD. The backlight will automatically turn off if there is no key activity within two minutes.

REAR CONNECTORS

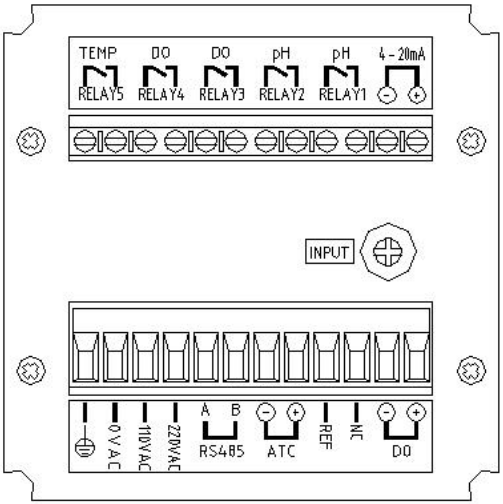


Figure 3

For wiring the probes, relays, analog output, RS485 and power cord, please see proper wiring instructions indicated below. Be sure the AC plug is not plugged-in. Remember that the unit is ON once the user plugs in the power cord to an AC power supply.

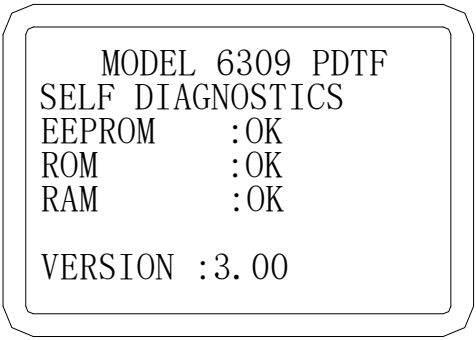
1. Connect the AC line to the rear of the meter. The model 6309PDTF can be used with 115 or 230 VAC 50/60 Hz. Power consumption is 6 watts. **Make sure the EARTH connector is connected to the earth lead of the AC power line.**

2. Connect the proper load to the output relays. **Make sure that the load does not exceed the relay rating, 5 Amp at 115 VAC and 2.5 Amp at 230 VAC.**

3. Set the proper load to the 4-20 mA-output connector. **Make sure that the load impedance is less than 500 Ohms.**

   [**Note:** MAKE SURE YOU CONNECT THE AC POWER CORD TO THE CORRECT AC TERMINALS. CONNECTING INCORRECTLY MAY DAMAGE THE UNIT PERMANENTLY.]

TURNING ON/OFF THE METER



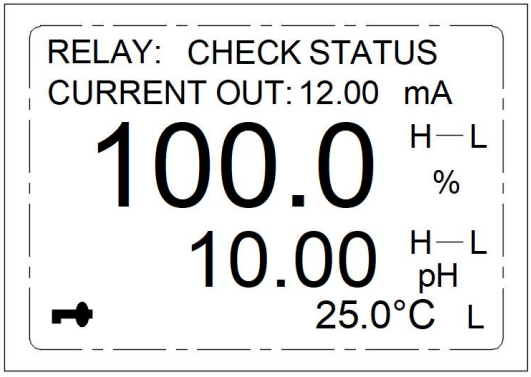
By just plugging the unit to a correct AC voltage, the unit will be ready for use. There is no Power key so unplugging and plugging the unit will turn OFF or turn ON the unit respectively.
After the unit is turned on, it will perform some basic self-diagnostics and will display “OK” or “BAD”. If you received any “BAD” messages turn OFF the unit and turn it ON again. (See **ERROR DISPLAYS AND TROUBLESHOOTING)**.

If the message persists then you might need to call your distributor. (See **WARRANTY**) .

After the self-diagnostic is complete, the temperature reading will be displayed on the lowest part of the screen and the user is ready to make DO or pH measurements.

MODEL 6309PDTF MODES

A. Measure Mode



Turning ON the unit will always display in the measure mode.

The position of pH and DO display can be switched depending on the selected analog output on the Current out setting page of the Calibration/Setting mode. (See **Calibration/Setting Mode)**

This meter is designed to provide 4 distinct measurements:

1. **Temperature**

   Current temperature of the solution, which is always displayed.

2. **pH**

   The degree of acidity or alkalinity of the solution (with automatic temperature compensation).

3. **Dissolved Oxygen %**

   A measurement of oxygen in percent saturation.

4. **Dissolved Oxygen ppm**

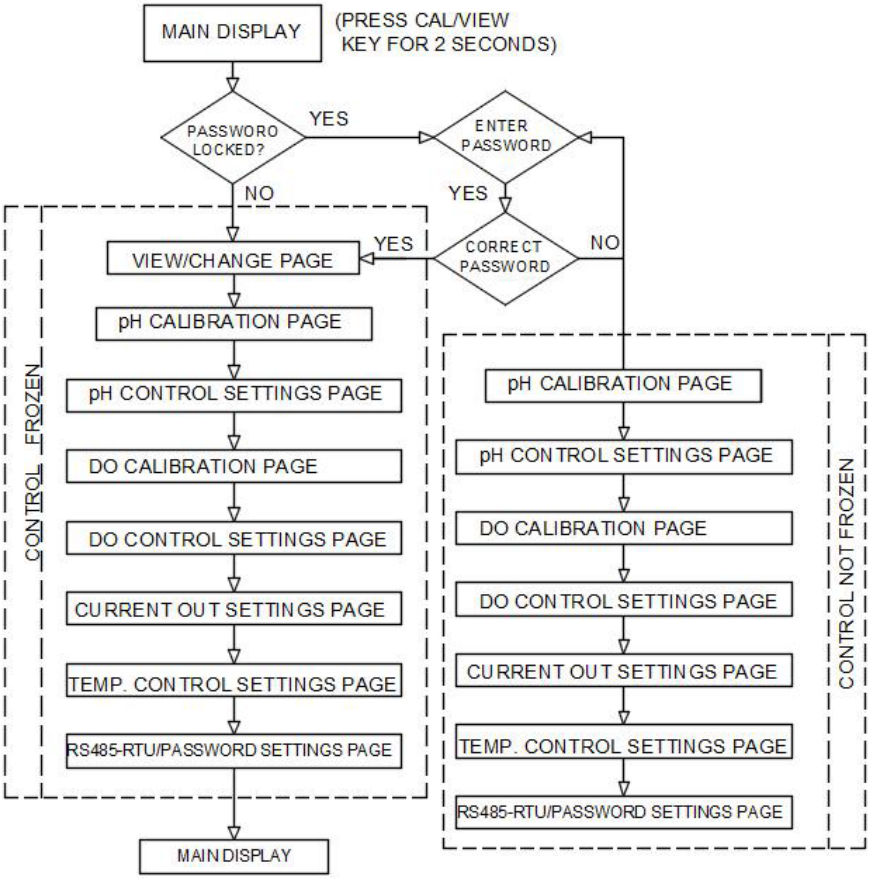
   A measurement of oxygen in ppm.

Temperature, pH, and DO (% or ppm) are always simultaneously displayed in the graphic LCD screen in normal mode. The user can select which DO unit to display by pressing the "**MODE"** key.

B. Calibration/Setting Mode

Pressing the "**CAL/VIEW"** key for about two seconds during the measure mode will bring-up the first page of eight pages of the **Calibration/Setting** mode. Pressing "**CAL/VIEW"** key will switch to the next page. At the last page, press "**CAL/VIEW"** key again will return the user to measure mode.

Below is a simple flowchart showing the path of the "**CAL/VIEW"** key:



The user can change any blinking words or digit by pressing the **"UP"** or **"DOWN"** keys. For options in digit format, the user needs to press the **"MODE"** key to move to the next digit. If the user is satisfied with the selection made, press the "**ENTER"** key to save the changes and move to the next option. If the user does not need to change the current blinking option just press the "**ENTER"** key to move to the next selection.

1. Password check page

a. Screen illustration

The user will only see this page if the unit is password locked.

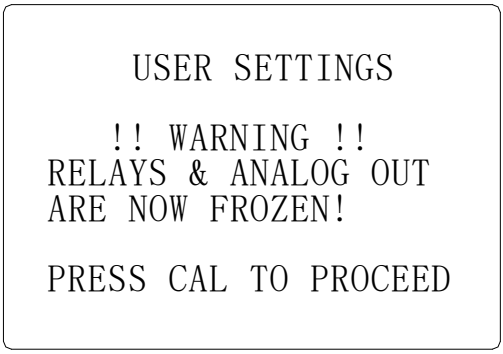
To change any settings or calibration, the user needs to unlock the system to remove the "**PASSWORD LOCKED**" message by entering the correct 4-digit password.

The user can still view all the pages of **Calibration/Setting mode** if the system is password locked by just pressing the "**CAL/VIEW"** key on this page. If the unit is "**PASSWORD LOCKED**", going to **Calibration/Setting mode** will not affect the function of the relays.

[**Note:** If the unit is **not locked** then every time the user enters the **Calibration/Setting mode** the relays and analog out will be **frozen**.]

2. User setting page

a. Screen illustration



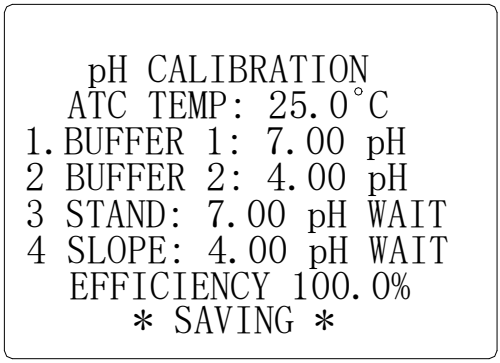
The user will only see this page if the unit is not password locked. This page is just a

warning, telling the user that all relays are frozen and that the user can calibrate and change the settings.

[**NOTE: FROZEN** means all the relays and the analog out will maintain their last status until the user returns to normal display mode.]

3. pH calibration page

a. Screen illustration



1) **ATC TEMP.**- The ATC temperature indicates the current temperature of the selection.

2) **BUFFER 1** - In this option the user can select which buffer to use for the standardization calibration. The user can choose **7.00** or **6.86** pH by using the **"UP"** and **"DOWN"** keys and pressing the "**ENTER"** key to save the choice.

3) **BUFFER 2** - After the user selected the buffer 1, this option will let the user select the second buffer to use to calibrate the slope. The user can choose 4.00 pH, 4.01 pH, 9.18 pH or 10.01 pH by using **"UP"** and **"DOWN"** keys and pressing the "**ENTER"** key to save the choice.

4) **STAND** - This is the actual pH calibration process. This line will display the buffer to be used for STAND (OFFSET) calibration, depending on the choice the user made in **BUFFER 1**. (See **"Step by Step pH Calibration"**)

5) **SLOPE** - This is part 2 of the pH calibration process. This line will display the buffer to be used for SLOPE calibration, depending on the choice the user made in **BUFFER 2**. (See **"Step by Step pH Calibration"**.)

b. pH calibration

1) Press the "**CAL/VIEW**" key to go to pH Calibration page. If the unit is password locked, enter the correct password to remove the password lock first.

2) Select **BUFFER 1** (7.00 or 6.86), by using the **"UP"** or **"DOWN"** keys, then press the "**ENTER"** key to save the selection.

3) Select **BUFFER 2** (4.00, 4.01, 9.18 or 10.01), by using the **"UP"** or **"DOWN"** keys, then press the "**ENTER"** key to save the selection.

4) Clean the pH electrode and temperature probe with de-ionized or distilled water.

5) Place the pH electrode and temperature probe into **BUFFER 1**.

6) Press the "**ENTER"** key. A "WAIT" message will blink indicating that the meter is waiting for a stable reading. The display will be locked to the buffer value corresponding to the temperature of **BUFFER 1**. When a stable reading is reached, the unit will blink a "SAVE" message.

7) Press the "**ENTER"** key to save the STAND calibration and prepare to do a SLOPE Calibration. If the STAND calibration is not satisfactory, press the **"DOWN"** key to recalibrate **BUFFER 1** and repeat from step 6).

   If "OVER" or "UNDER" is displayed or a blinking "SAVE" does not show after more than few minutes then something is wrong with the **BUFFER 1** or electrode. Be sure the **BUFFER 1** is correct or change a new electrode and repeat from step 4).

8) Clean the pH electrode and temperature probe with the de-ionized/distilled water.

9) Place the pH electrode and Temperature probe into **BUFFER** 2.

10) Press the "**ENTER"** key. A "WAIT" message will blink indicating that the meter is waiting for a stable reading. The display will be locked to the buffer value corresponding to the temperature of **BUFFER 2** . When a stable reading is reached, the unit will blink a "SAVE" message.

11) Press the "**ENTER"** key to save the SLOPE calibration. If the SLOPE calibration is not satisfactory, press the "DOWN" key to recalibrate BUFFER 2 and repeat from step 10.

    If "OVER" or "UNDER" is displayed or a blinking "SAVE" does not show after more than few minutes then something is wrong with your **BUFFER 2** or electrode. Be sure the **BUFFER 2** is correct or change a new electrode and repeat from step 4).

12) Set-up the Relay, mA OUT and Temperature control.

13) The unit is ready for measurement and control.

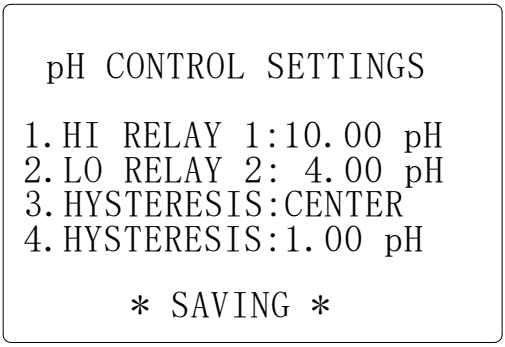
EFFICIENCY – After saving the SLOPE a new efficiency will be displayed for about 4 seconds and then will move to the next page.

**** (Efficiency = (new slope/ ideal slope)* 100%)***

[**NOTE:** We recommend that the user uses a new electrode if the electrode efficiency is lower than **80%**.]

4. pH control settings page

a. Screen illustration



1) **HI RELAY 1** - The control type for this relay is changeable, the user can choose "**HI**"-type or "**LO**" type. In HI-type, **RELAY 1** will turn **ON** if the pH is greater than the **RELAY 1** setting. In LO-type, **RELAY 1** will turn **ON** if the pH is less than the **RELAY 1** setting which is modified by the hysteresis value and hysteresis mode.

   Use **"UP"** and **"DOWN"** keys to change the **RELAY 1** type then press "**ENTER"** key to save. After selecting the **RELAY 1** type, the user can now select the **RELAY 1** setting.

   Use **"UP"** and **"DOWN"** keys to change the blinking digit. Use the "**MODE"** key to select another digit and the "**ENTER"** key to save the new setting.

2) **LO RELAY 2** - The control type for this relay is changeable, the user can choose "**HI**"-type or "**LO**" type. In HI-type, **RELAY 2** will turn **ON** if the pH is greater than the **RELAY 2** setting. In LO-type, **RELAY 2** will turn **ON** if the pH is less than the **RELAY 2** setting which is modified by the hysteresis value and hysteresis mode.

   Use **"UP"** and **"DOWN"** keys to change the **RELAY 2** type then press "**ENTER"** to save. After selecting the **RELAY 2** type, the user can now select the **RELAY 2** setting.

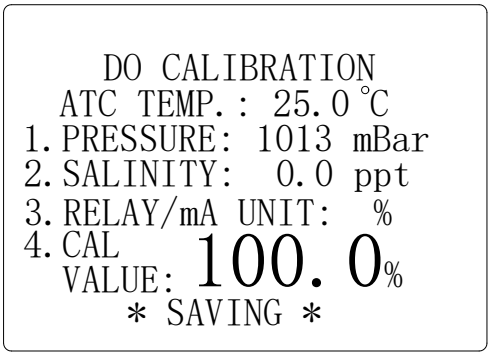
   Use **"UP"** and **"DOWN"** keys to change the blinking digit. Use the "**MODE"** key to select another digit and the "**ENTER"** key to save the new setting.

3) **HYSTERESIS** - This is the hysteresis mode for pH **RELAY 1** and pH **RELAY 2**. The user can choose between "**CENTER**" or "**EDGE**".

4) **HYSTERESIS** - This is the actual value of the hysteresis. The user can change this value from **0.01** to **3.99** pH.

5. DO Calibration page

a. Screen illustration



1) **ATC TEMP.-** This line shows the current temperature of the solution.

2) **PRESSURE-** User changeable atmospheric pressure, range from 600 to 1100 mBar for DO computations. If the user wants to use other pressure unit, go to the **"DO ALTITUDE/PRESSURE TABLE."**

3) **SALINITY** – User changeable salinity range from 0 to 49.9 ppt for DO computations.

4) **RELAY/mA UNIT** - This is the unit which the DO **RELAY 3** and DO **RELAY 4** will be based upon. The DO **RELAY 3** and DO **RELAY 4** values for **%** and **ppm** are saved in different memory location.

5) **CAL VALUE**: This is the DO calibration option. If the user moves the pointer to this Line, a flashing **"↵"** icon will appear. Pressing the **"ENTER"** key will start the DO calibration. ***The unit of this calibration will depend on the unit of DO at the measure mode.*** To accurately calibrate the model 6309PDTF, the user will need the following information:

   i) The approximate atmospheric pressure (in mbar) of the region in which the dissolved oxygen measurements will be taken.

   ii) The approximate salinity of the water will be analyzing. Fresh water has a salinity of approximately zero. Seawater has a salinity of approximately 35 parts per thousand (ppt).

b. DO calibration

1) Clean the DO probe with de-ionized or distilled water.

2) Hold the DO probe in the air gently with the sensor facing down.

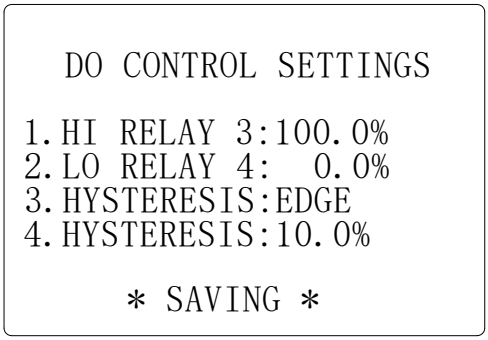
3) Wait around 2 hours for the dissolved oxygen and temperature readings to stabilize. Pressing the **"ENTER"** key will start the calibration.

4) If the user is calibrating in **"%"** then the 100% calibration will be displayed. An error will be displayed if the input is not within the normal DO range. A "↵ " icon will flash. Pressing the **"ENTER"** key will start the calibration. If the input is not within the DO calibration limit then an error message will be displayed. If all is well then it will save the new calibration and move to the next page.

5) If the user is calibrating in **"ppm"** then the current reading in ppm will be displayed. Press the "**ENTER"** key, the unit will capture the current value and then the user can change the value by using the "**MODE", "UP"** and **"DOWN"** keys. If the user is satisfied with the ppm setting, press the **"ENTER"** key to save the new calibration. If the DO input is within calibration range then the new calibration will be saved and move to the next page, otherwise an error message will be displayed.

6. DO control settings page

a. Screen illustration



1) **HI RELAY 3** - The control type for this relay is changeable, the user can choose "**HI**" - type or "**LO**" - type. In HI-type, **RELAY 3** will turn **ON** if the DO is greater than the **RELAY 3** setting. In LO-type, **RELAY 3** will turn **ON** if the DO is less than the **RELAY 3** setting which is modified by the hysteresis value and hysteresis mode.

   Use **"UP"** and **"DOWN"** to change the **RELAY 3** type then press **"ENTER"** key to save. After selecting the **RELAY 3** type, the user can now select the **RELAY 3** setting.

   Use **"UP"** and **"DOWN"** keys to change the blinking digit. Use the "**MODE"** key to select another digit and the **"ENTER"** key to save the new setting.

2) **LO RELAY 4** - The control type for this relay is changeable, the user can choose "**HI**"- type or "**LO**" type control. In HI-type, **RELAY 4** will turn **ON** if the DO is greater than the **RELAY 4** Setting. In LO-type, **RELAY 4** will turn **ON** if the DO is less than the **RELAY 4** setting which is modified by the hysteresis value and hysteresis mode.

Use **"UP"** and **"DOWN"** to change the **RELAY 4** type then press **"ENTER"** key to save. After selecting the **RELAY 4** type, the user can now select the **RELAY 4** setting.

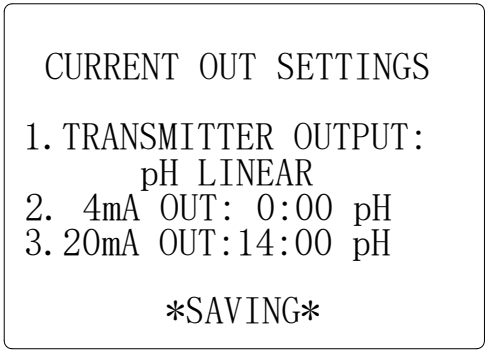
Use **"UP"** and **"DOWN"** keys to change the blinking digit. Use the "**MODE"** key to select another digit and the **"ENTER"** key to save the new setting.

3) **HYSTERESIS** - This is the hysteresis mode for DO **RELAY 3** and **RELAY 4**. The user can choose between "**CENTER**" or "**EDGE**".

4) **HYSTERESIS** - This is the actual value of the hysteresis. The user can change this value from 0.1 to 99. 9 % or 0.01 to 9.99 ppm.

7. Current out settings page

a. Screen illustration



1) **TRANSMITTER OUTPUT-** This option would let the user choose if the current output type is **"pH LINEAR", "pH ANTILOG"** or **"DO LINEAR".**

[**NOTE:** The DO mA output will be based on the **"RELAY/mA UNIT"** where as the **"DO calibration"** is based on the normal mode DO unit.]

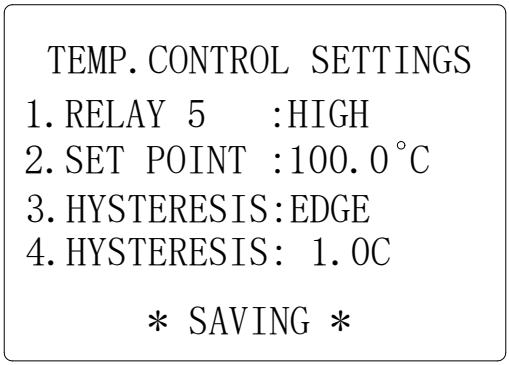
2) **4 mA OUT** – This value will be used in conjunction with 20 mA to plot the current output. (See section **4 - 20 mA OUTPUT**.)

3) **20 mA OUT** – This value will be used in conjunction with the 4 mA value to plot the output. (See section **4 - 20 mA OUTPUT**.)

[**Note:** If the absolute difference between 4 mA and 20 mA is less than 1.00 pH (If pH LINEAR or pH ANTILOG is selected) or less than 1.0% (if DO LINEAR is selected and RELAY/mA is set at %) or 0.10 ppm (if DO LINEAR is selected and RELAY/mA is set at ppm) then the CURRENT OUT will display "ERROR" indicating that the output is disabled.]

8. **Temp. control settings page**

a. Screen illustration



1) **RELAY 5** – The temperature has only one relay to control. The user needs to set what control type it will use, **HIGH** or **LOW** type. (In HIGH-type, **RELAY 5** will turn **ON** if the temperature is greater than the **RELAY 5** setting. In LOW-type, the **RELAY 5** will turn **ON** if the temperature is less than the **RELAY 5** setting which is modified by the hysteresis value and hysteresis mode.

2) **SET POINT** - This is the **RELAY 5** control set point.

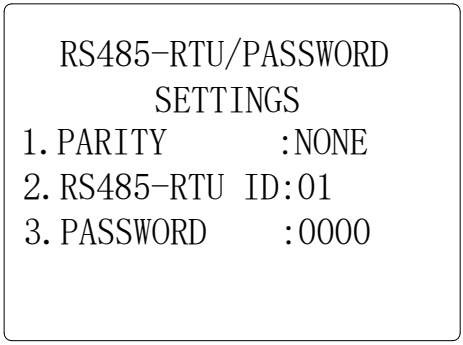
   [**Note**: The user can set the **SET POINT** from 0.0 to 199.9 °C, but be reminded that the range of the temperature is –10.0 to 120 °C.]

3) **HYSTERESIS** - This is the hysteresis mode for temperature relay. The user can choose between "**CENTER**" or "**EDGE**".

4) **HYSTERESIS** -This is the actual value of the hysteresis. The user can change this value from 0.1 to 19.9 °C.

9. **RS485-RTU/password settings page**

a. Screen illustration



1) **PARITY** – This option would let the user choose if the current RS-485 type is **"EVEN", "NONE"** or **"ODD".**

2) **RS485-RTU ID** – This is the unique ID/Address for the unit. If the user is connecting multiple model 6309PDTF or other Jenco models for logging purposes then this ID/Address must be unique for each connected unit. This ID/Address is the same address that must be used by the PC program to communicate with this unit.

3) **PASSWORD** - The meter allows the user to set a four digit password. At the RS485-RTU/password settings page, press **"MODE"** key. The number starts to blink. Use **"UP"** or **"DOWN"** key to select the desired digit. Press **"ENTER"** key to save password.

   [**Important note:** The password must be entered at password check page to change settings.

   The user is responsible for remembering the password number, otherwise the user would not be able to calibrate or change all the settings.]

CONTROLLING THE RELAYS

A. Isolation Voltage

The maximum isolation voltage of the relay output contacts is 1500 VDC. The voltage differential between the relay output contacts and the load should not exceed 1500 VDC.

B. Output Load

The current through the relay output contacts should not exceed 5 Amp at 115 VAC and 2.5 Amp at 230 VAC in order not to cause permanent damage to the relay contacts. This rating is specified for **resistive** loads only.

C. Relay Action, Relay Setpoint, Hysteresis Mode & Hysteresis Value

If the relay control type is set to HI and the hysteresis mode is **CENTER**, the relay will turn **ON** at [(RELAY SETPOINT) + (0.5 * hysteresis value)], and will turn **OFF** at [(RELAY SETPOINT) - (0.5 * hysteresis value)].

If the relay control type is set to HI and the hysteresis mode is **EDGE**, the relay will turn **ON** at (RELAY SETPOINT), and will turn OFF at [(RELAY SETPOINT - (hysteresis value)].

If the relay control type is set to LO and the hysteresis mode is **CENTER**, the relay will turn **OFF** at [(RELAY SETPOINT) + (0.5 * hysteresis value)], and will turn **ON** at [(RELAY SETPOINT) - (0.5 * hysteresis value)].

If the relay type is set to LO and the hysteresis mode is **EDGE**, the relay will turn **OFF** at [(RELAY SETPOINT) + (hysteresis value)], and will turn **ON** at (RELAY SETPOINT).

Relay Action	Hysteresis mode	Effective RELAY-**ON** Set point	Effective RELAY-**OFF** Set point
HIGH	CENTER	S.P.+ ½(H.V.)	S.P. -½ (H.V.)
HIGH	EDGE	S.P.	S.P. - H.V.
LOW	CENTER	S.P.-½ (H.V.)	S.P.+½ (H.V.)
LOW	EDGE	S.P	S.P.+ H.V.

H.V.= Hysteresis value (Dead Band)
S.P. = Relay Set point

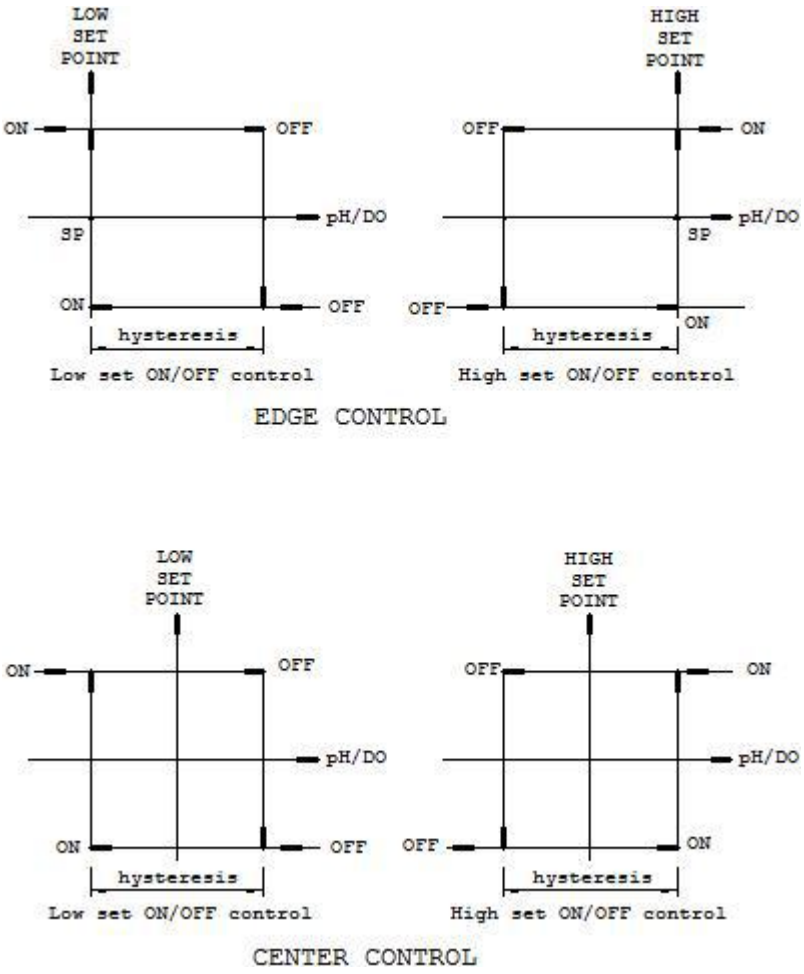


Figure 4

[**Note :** Setting any hysteresis value to zero may cause jitter and possibly damage the relay(s).]

D. pH Relays

There are two independent relay channels for pH display, which have **independen**t set point and HIGH or LOW control type (see Figure 4.). The hysteresis mode (center or edge, see Figure 4.) and hysteresis value will be used by **both** pH relays.

The action of the pH relays is dependent on set point, relay control type (HIGH or LOW), hysteresis mode (Center or Edge), hysteresis value and the current pH display (See figure 4.)

[**Note:** The user can set the **RELAY 1** and **RELAY 2** from 0.00 to 19.99 pH, **but be reminded that the range of pH is –2.00 to 16.00 pH.**]

E. DO Relays

There are two independent relay channels for the DO display that have **independent** set points and control types (see figure 4). The hysteresis mode (center or edge) and hysteresis value will be used by **both** DO relays.

The action of the DO relays is dependent on set point, relay control type (HIGH or LOW), hysteresis mode (Center or Edge), hysteresis value and the current DO display. (See figure 4).

[**Note:** The user can set the **RELAY 3** and **RELAY 4** from 0.0 to 599.9% or 0.00 to 69.99 ppm, **but be reminded that the range of DO is 0.00 to 500.0% or 0.00 to 60.00 ppm only.**]

F. Temperature Relay

One relay channel is available for temperature display which has independent set point and HIGH or LOW action (see figure 4) setting, hysteresis mode (center or edge) and hysteresis value.

The action of the temperature relay is dependent on set point, relay action type (HIGH or LOW), hysteresis mode (Center or Edge), hysteresis value and the current Temperature display.

[**Note**: The user can set the SET POINT from 0.0 to 199.9 °C, **but be reminded that the range of the temperature is –10.0 to 120 °C.**]

4 - 20 mA OUTPUT

A. Isolation Voltage

The maximum isolation voltage of the 4-20 mA output is 500 VDC. The voltage differential between the 4-20 mA output and the load should not exceed 500 VDC.

B. Output Load

The maximum load is 500 Ω. Output current inaccuracies may occur for load impedance in excess 500 Ω.

C. pH Linear Output

The analog output will produce a linear analog output if the user selects this option (see figure 5). The analog output will be dependent on the pH_4 mA setting, pH_20 mA setting and the current pH display.

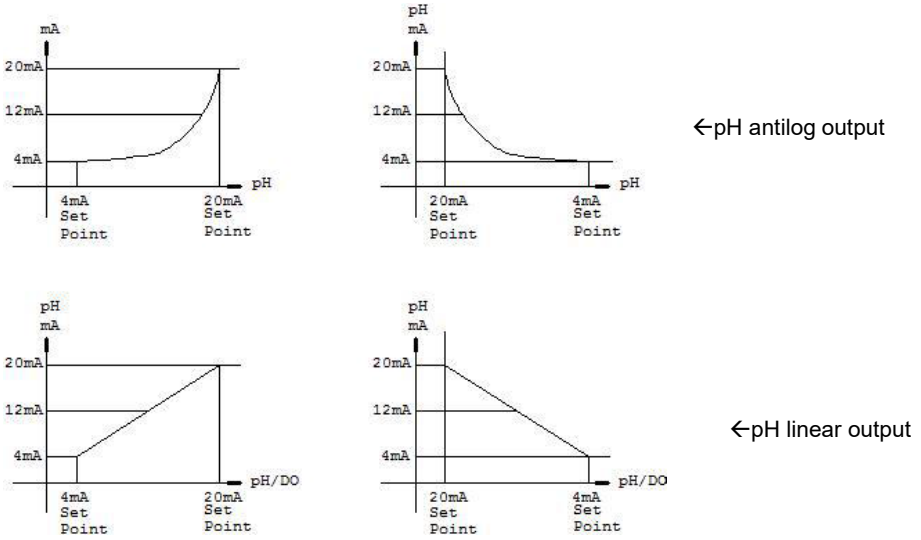


Figure 5

The pH linear analog output is based on the following equation:
$mA_{(pH)}$ = 4 mA + (16 mA) * ($D_{(pH)}$ - pH (4)) / (pH (20) - pH (4))

Where:
$mA_{(pH)}$ = analog output
$D_{(pH)}$ = current pH display
pH(4) = pH user setting for 4 mA
pH(20) = pH user setting for 20 mA.

[**Note:** The user can set the 4 mA and 20 mA OUT from 0.00 to 19.99 pH, but be reminded that the range of pH is –2.00 to 16.00 pH.

The absolute difference of the 4 mA and 20 mA settings must be greater or equal to **0.10 pH** or else the analog output will be disabled.]

D. DO Linear Output

The analog output will produce a linear analog output if the user selects this option. The analog output will be dependent on the DO 4 mA setting, DO 20 mA setting and the current DO display.

The DO linear analog output is based on the following equation:
$mA_{(DO)}$ = 4 mA+(16 mA) * ($D_{(DO)}$ - DO (4)) / (DO (20) - DO (4))

Where:
$mA_{(DO)}$ = analog output
$D_{(DO)}$ = current DO display
DO(4) = DO user setting for 4 mA
DO(20) = DO user setting for 20 mA.

[**Note:** The user can set the 4 mA and 20 mA OUT from 0.0 to 599.9% or 0.00 to 69.99 ppm, **but be reminded that the range of DO is 0.00 to 500.0% or 0.00 to 60.00 ppm only.**

The absolute difference of the 4 mA and 20 mA settings must be greater or equal to 1.0% or 0.10 ppm or else the analog output will be disabled.]

E. pH Antilog Output

The analog output will produce an antilog analog output if the user selects this option (see **figure 5**). The analog output will be dependent on the **pH 4 mA setting**, **pH 20 mA setting** and the **current pH display**.

The pH antilog analog output is based on the following equation:
$mA_{(pH)}$ = 4 mA + (16 mA) * ($10^{D(pH)}$ - $10^{pH(4)}$) / ($10^{pH(20)}$ - $10^{pH(4)}$)

Where:
$mA_{(pH)}$ = analog output
$D_{(pH)}$ = current pH display
pH(4) = pH user setting for 4 mA
pH(2) = pH user setting for 20 mA.

[**Note:** The user can set the 4 mA and 20 mA OUT to 0.00 to 19.99 pH **but be reminded that the range of pH is –2.00 to 16.00 pH.**

The absolute difference of the 4 mA and 20 mA settings must be greater or equal to 0.10 pH or else the analog output will be disabled.]

RS485 INTERFACE OPERATION

A. Introduction

This meter is using the standard RS485 MODBUS RTU protocol. Please read the "protocol.doc" in the accompanying disk to help programming an application that will communicate with the meter. There is also a simple demo program that the user can install to see the protocol in action.

B. Preparing The Meter

The meter's RS485 MODBUS (RTU) interface requires 2 ordinary (preferably awg 24) unshielded twisted pair wires connected in a daisy-chain configuration.

ERROR DISPLAYS AND TROUBLESHOOTING

LCD display	ATC display	DISPLAY unit	Possible cause(s) [Action(s)]
"OVER"	"OVER"	pH	a. Temperature > 120.0 °C. [Bring buffer/solution to a lower temperature.] [Replace temperature probe.] b. No temperature sensor. [Use a temperature probe.]
"UNDR"	T>50.0 °C or "OVER"	a. % or ppm -DO b. % or ppm -DO cal	Temperature > 50.0 °C. [Bring solution to a lower temperature.]
"OVER"	"UNDR"	a. pH b. % or ppm-DO	Temperature < -10.0 °C. [Bring ,buffer/solution to a higher temperature.]
"OVER"	-10.0 to 120.0 °C	pH	pH>16.00 . [Recalibrate.]
"OVER"	0.0 to 60.0 °C	pH-Cal	pH>16.00. [Use a new buffer solution.] [Replace the electrode.]
"OVER"	0.0 to 60.0 °C	a.pH-Cal-STAND buffer 7.00pH b.pH-Cal-STAND buffer 6.86 pH c.pH-Cal-SLOPE	a. mV>100 mV or mV<-100 mV b. mV>108.3 mV or mV < -91.7 mV c. Slope mV>ideal slope by 30% or mV < ideal slope by – 30% [Use a new buffer solution.] [Replace electrode.]
"UNDR"	0.0 to 60.0 °C	a.pH-Cal-STAND b.pH-Cal-SLOPE	a. Offset @ 7.00 pH: mV<-100 mV Offset @ 6.86 pH:mV< -91.7 mV b. New Slope<ideal slope by 30% [Use a new buffer solution.] [Replace electrode.]
"UNDR"	-10.0 to 120.0 °C	pH	pH<-2.00 [Recalibrate.]
EEPROM:BAD		During power-on	Unit has failed its EEPROM test. [Turn meter OFF and back to ON again.] [Return for service. (See Warranty)]
ROM: BAD		During power-on	Unit has failed its ROM test. [Turn meter OFF and back to ON again.] [Return for service. (See Warranty)]
RAM: BAD		During power-on	Unit has failed its RAM test. [Turn meter OFF and back to ON again.] [Return for service. (See Warranty)]
"UNDR"	0.0 to 60.0 °C	a.pH-Cal-STAND b.pH-Cal-SLOPE	a. Offset @ 7.00pH: mV<-100 mV Offset @ 6.86pH:mV< -91.7 mV b. New Slope<ideal slope by 30% [Use a new buffer solution.] [Replace electrode.]

pH BUFFERS

The temperature characteristics of pH calibration buffers 4.00, 4.01, 6.86, 7.00, 9.18 and 10.01 pH are stored inside the meter. The buffers used to calibrate the meter must exhibit the same temperature characteristics as the stored values.

TABLE 1.

°C	4.00	6.86	9.18	4.01	7.00	10.01
0	4.01	6.98	9.46	4.01	7.11	10.32
5	4.00	6.95	9.39	4.01	7.08	10.25
10	4.00	6.92	9.33	4.00	7.06	10.18
15	4.00	6.90	9.28	4.00	7.03	10.12
20	4.00	6.88	9.23	4.00	7.01	10.06
25	4.00	6.86	9.18	4.01	7.00	10.01
30	4.01	6.85	9.14	4.01	6.98	9.97
35	4.02	6.84	9.10	4.02	6.98	9.93
40	4.03	6.84	9.07	4.03	6.97	9.89
45	4.04	6.83	9.04	4.04	6.97	9.86
50	4.06	6.83	9.02	4.06	6.97	9.83
55	4.07	6.83	8.99	4.08	6.97	9.80
60	4.09	6.84	8.97	4.10	6.98	9.78

[**Note:** The actual reading of the meter can differ from the values shown by ±0.01 pH.]

DO ALTITUDE/PRESSURE TABLE

TABLE 2 Calibration values for a range of pressures and altitudes.

Pressure mBar	Pressure mm-Hg	Altitude feet	Altitude meters	Calibration Value in %
1023	768	-276	-84	101
1013	**760**	**0**	**0**	**100**
1003	752	278	85	99
993	745	558	170	98
983	737	841	256	97
973	730	1126	343	96
963	722	1413	431	95
952	714	1703	519	94
942	707	1995	608	93
932	699	2290	698	92
922	692	2587	789	91
912	684	2887	880	90
902	676	3190	972	89
892	669	3469	1066	88
882	661	3804	1160	87
871	654	4115	1254	86
861	646	4430	1350	85
851	638	4747	1447	84
841	631	5067	1544	83
831	623	5391	1643	82
821	616	5717	1743	81
811	608	6047	1843	80
800	600	6381	1945	79
790	593	6717	2047	78
780	585	7058	2151	77
770	578	7401	2256	76
760	570	7749	2362	75
750	562	8100	2469	74
740	555	8455	2577	73
730	547	8815	2687	72
719	540	9178	2797	71
709	532	9545	2909	70
699	524	9917	3023	69
689	517	10293	3137	68

SPECIFICATIONS

pH

Range	Resolution	Accuracy
-2.00 to 16.00 pH	0.01 pH	±0.01 pH ± 1 LSD

DO

Display	Range	Accuracy	Resolution
Dissolved O_2 (ppm)	0.00 to 60.00 ppm	±0.2 % F.S.	0.01 ppm
Dissolved O_2% (air-sat)	0 to 500.0 %	±0.2% F.S.	0.1 %

Temperature

Range	Resolution	Accuracy
-10.0 to 120.0 °C	0.1 °C	±0.1 °C

pH

pH buffer recognition	pH 7.00, 4.00, 10.00 or pH 6.86, 4.01, 9.18
pH Temperature compensation	Auto -10.0 to 120.0 °C
pH Buffer Temperature range	0.0 to 60.0 °C
pH Electrode Offset recognition	100 mV at pH 7.00 +108.3 mV/-91.7 mV at pH 6.86
pH Electrode Slope recognition	30% at pH 4.00, 4.01, 9.18 & 10.01
Input impedance	$>10^{13}$
Calibration point sensing	Yes

DO

Salinity compensation	0.0 to 49.9 ppt (manual)
Pressure compensation	600 to 1100 mBar (manual)
Temperature compensation	-10.0 to 50.0 °C (automatic)

Temperature

Temperature sensor	22 KΩ at 25 °C

4-20mA Output

Input Select	DO or pH (user selectable)
Current output range	4 to 20 mA (isolated)
Current output scale	user programmable
Maximum load	500 Ω
Accuracy	± 0.02 mA
Isolation voltage	500 VDC

Controller

Relays	5 (high or low) programmable relays
Control type	ON/OFF control
Relay output	5 A at 115 VAC or 2.5 A at 220 VAC

Hysteresis mode	CENTER or EDGE
Hysteresis range	0.01pH – 3.99 pH, 0.1% - 99.9% & 0.01 ppm to 9.99 ppm

GENERAL

Keys	Audio feedback in all keys
Security protect	4 - digit password
Communication	RS485 (modbus)
Power:	115 VAC or 230 VAC 50/60 Hz
Power consumption	6 watts
Ambient temperature range	0.0 to 50.0 °C
Display:	128 x 64 graphic LCD w/ backlight
Case	IP65 ¼ DIN case, depth 148 mm
Weight	950 g

WARRANTY

JENCO warrants this product to be free from significant deviations in material and workmanship for a period of 1 year from date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse, within the year period, please return-freight-prepaid and the correction of the defect will be made free of charge. If you purchased the item from our **JENCO** distributors and it is under warranty, please contact them to notify us of the situation. **JENCO** Service Department alone will determine if the product problem is due to deviations or customer misuse.

Out-of-warranty products will be repaired on a charge basis.

RETURN OF ITEMS

Authorization must be obtained from one of our representatives before returning items for any reason. When applying for authorization, have the model and serial number handy, including data regarding the reason for return. For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss. **JENCO** will not be responsible for damage resulting from careless or insufficient packing. A fee will be charged on all authorized returns.

NOTE: JENCO reserves the right to make improvements in design, construction and appearance of our products without notice.

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