

# **OPERATION MANUAL**

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**JENCO MODEL 6309PDT MICROCOMPUTER  
BASED pH/ DO/ Temperature CONTROLLER**

**JENCO** ELECTRONICS, LTD.

MANUFACTURER OF PRECISION INSTRUMENTS

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# I. GENERAL INTRODUCTION

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

The model 6309PDT 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 you use. The microprocessor also performs a self-diagnostic routine every time you turn on the unit providing you with basic information about the stability of the instrument.

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

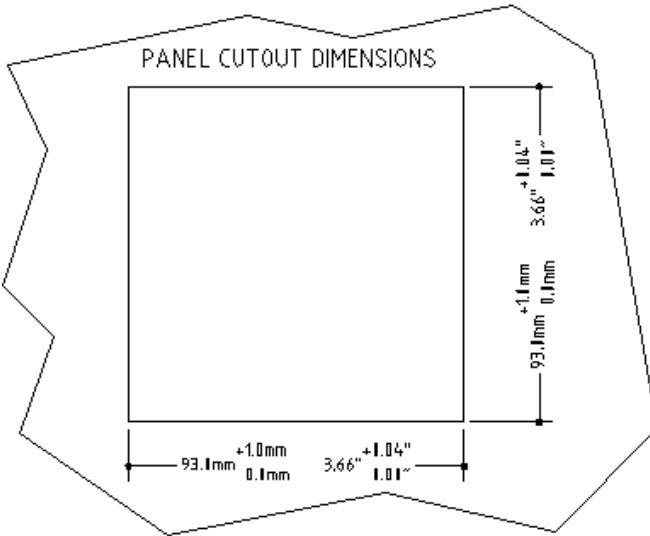
The model 6309 PDT is equipped with 5 relays (2 programmable High/Low action relays for pH, 2 programmable High/Low relays for DO and 1 programmable High/Low relay for Temperature); all relays are hysteresis driven and configurable to **CENTER** or **EDGE** mode. The system also has an **isolated 4-20mA** analog output, offset and span configurable for the pH or DO display.

The model 6309 PDT comes with a RS485 interface which can easily let the user log all data (from multiple model 6309 or 6308) with an IBM® PC/AT compatible computer.

## II. INITIAL INSPECTION and ASSEMBLY

Carefully unpack the instrument 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.

### 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.

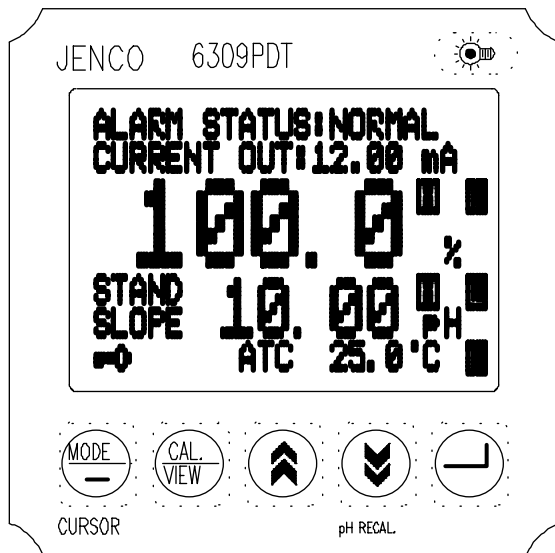
#### **Cleaning the instrument:**

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 instrument only.
4. Wipe-dry the instrument before powering again.

### III. USING THE JENCO MODEL 6309 PDT

#### A. FRONT PANEL



1. The [MODE/CURSOR] key.

1a. In **Normal** display mode this key will change the DO display to DO % or DO ppm.

1b. In **Calibration/Setting** mode this key will move to the next digit of the current active parameter.

1c. In **Calibration/Setting** mode, pressing this key for 2 seconds will move you back to the previous parameter.

2. The [CAL / VIEW] key.

2a. Pressing this key for about 2 seconds, during normal display mode will switch to Calibration/Setting mode.

2b. During Calibration/Setting mode 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. The [ ▲ ] UP key.

During Calibration/Setting mode this key will **increment** the current blinking digit of the active parameter.

4. The [ ▼ / pH Recal.] DOWN key.

4a. During Calibration/Setting mode this key will **decrement**

the current blinking digit of the active parameter.

- 4b. During pH calibration, you can press this key to recalibrate the stand or slope buffer again.

5. The [↵] **ENTER** key.

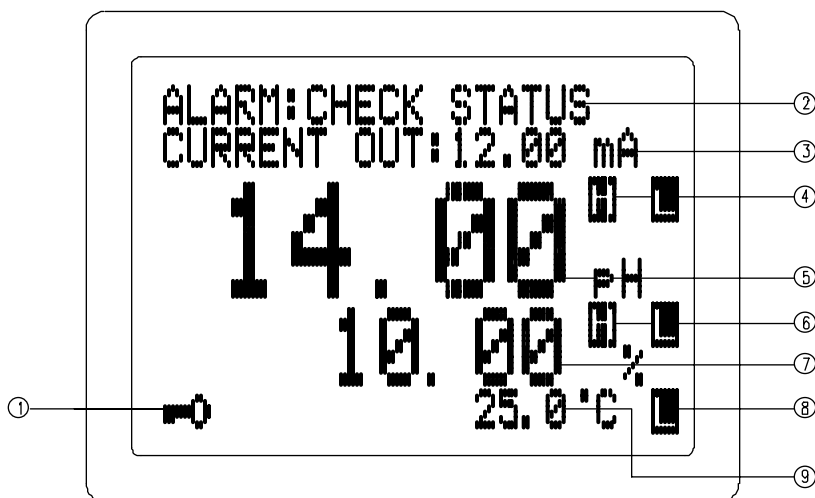
During Calibration/Setting mode, this key will save the current modified parameter and move to the next parameter.


6. The [☀] **LIGHT** key.

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**.

## B. NORMAL MODE DISPLAY



1.  annunciator - 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. **ALARM** - this will show the status of the relays. At Power-ON a "DISABLED" message will be displayed for about 3 sec. 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 3 sec. 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 3 sec. before going to normal operation. After exiting the Calibration /Setting pages a “**FROZEN**” message will be displayed for about 3 sec. before returning to normal operation.

4. **H , L** annunciators - one or both of these annunciators will be displayed if the left side reading triggered the respective HI ALARM setting and/or the LO ALARM setting.

5. **LARGE FONT DISPLAY** - this reading uses the biggest font and the reading here is the only one that will affect the analog output. You can select the DO or pH reading only to be shown here by changing the **Transmitter Output** option.

6. **H , L** annunciators - one or both of these annunciators will be displayed if the left side reading triggered the respective HI ALARM setting and/or the LO ALARM setting.

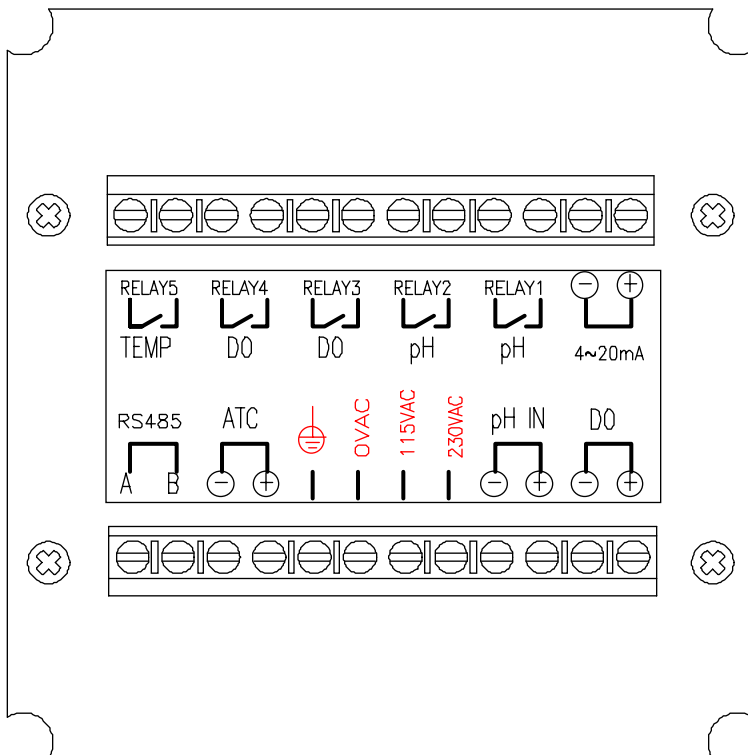
7. **MEDIUM FONT DISPLAY**- this is the secondary reading and no analog output is supplied.

8. **H, L** annunciators - one of these annunciators will be displayed if the temperature reading triggered the temperature alarm setting. The temperature alarm setting can only be configured to HI or LO.

9. **Temperature** - the current temperature of the solution.

## **C. REAR CONNECTORS**

Before wiring the probes, relays, analog output, RS485 and power cord be sure that you are connecting to the right terminal (and the unit is turned OFF) as shown below. Remember that the unit is ON once the user plugs in the power cord to an AC power supply.



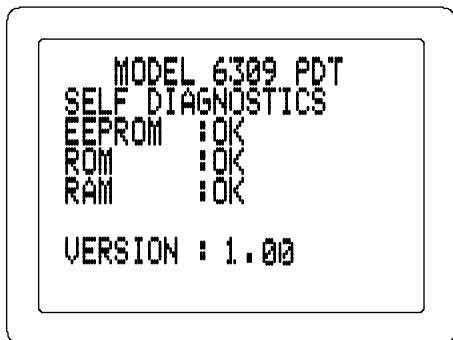
1. Connect the AC line to the rear of the instrument. The model 6309 PDT can be used with 115 or 230VAC 50/60 Hz. Power consumption is 6 watts. Make sure the **EARTH** connector is connected to the earth lead of the AC power line.
2. Connect the proper load to the output relays. **Make sure that the load does not exceed the relay rating, 5 Amp at 115VAC and 2.5 Amp at 230 VAC.**
3. Set the proper load to the 4-20mA-output connector. Make sure that the load impedance is less than 500 Ohms.
4. A **+5VDC** and **-5VDC** (max 20mA for each) output to provide excitation voltage for pH pre-amplifier only.

## CAUTION:

MAKE SURE YOU CONNECT THE AC POWER CORD TO THE CORRECT AC TERMINALS. CONNECTING INCORRECTLY MAY DAMAGE THE UNIT PERMANENTLY.

### D. TURNING ON/OFF THE INSTRUMENT

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 **VIII. ERROR DISPLAYS AND TROUBLESHOOTING**).

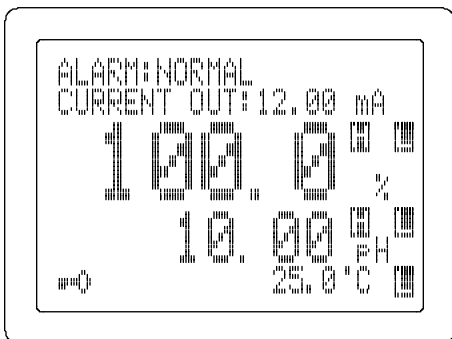
If the message persists then you might need to call your

distributor. (See **XII. WARRANTY**).

After the self-diagnostic is complete the temperature will be displayed on the lowest part of the screen and you are ready to make DO or pH measurements. Just immerse the probes halfway to the liquid. If possible do not allow the probes to touch any solid object in the solution. There should be no air bubbles around the probes either. Shaking or moving the probes vigorously before recording any measurement will dislodge any bubbles formed in the probes.

## IV. MODEL 6309 PDT MODES

### A. NORMAL MODE



Turning ON the unit will always display in normal mode.

The position of pH and DO display can be switched depending on the selected analog output on the MAIN SETTINGS of the Calibration/Setting mode.

(See CALIBRATION/SETTING mode)

This instrument is designed to provide 4 distinct measurements:

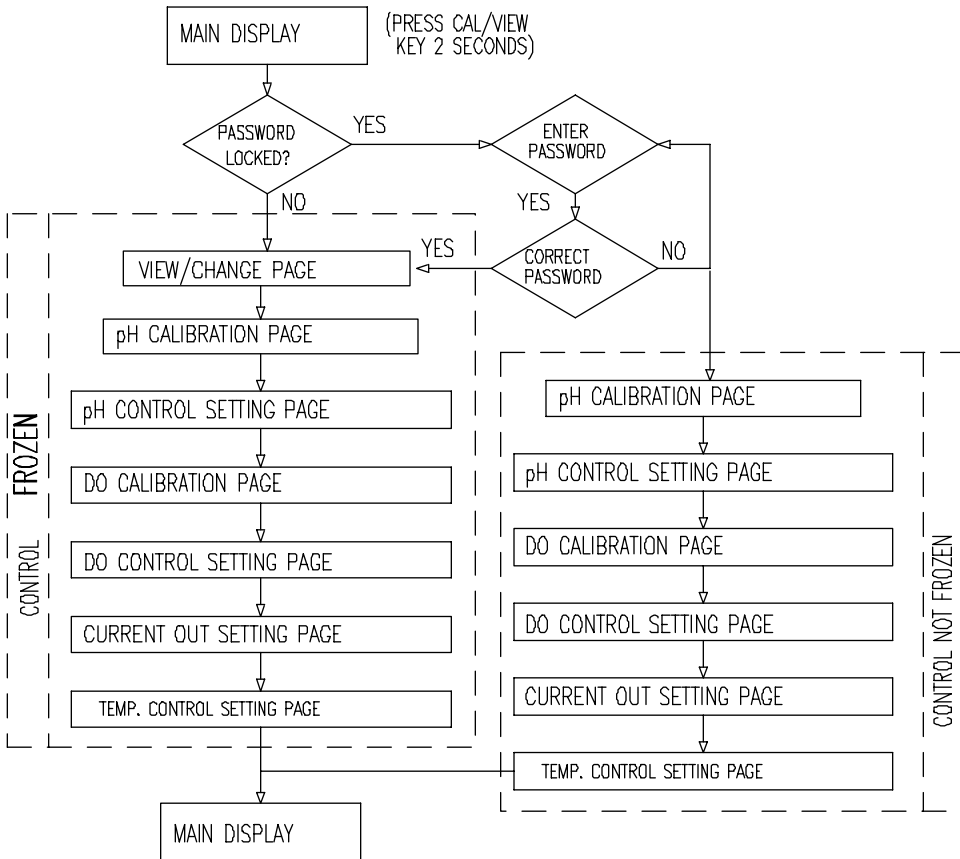
1. **Temperature** - current temperature of the solution, which is always displayed
2. **pH** - the degree of acidity or alkalinity of the solution (with automatic temperature compensation).
3. **Dissolved Oxygen %** - a measurement of oxygen in percent saturation.
4. **Dissolved Oxygen ppm** - a measurement of oxygen in ppm.

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

### B. CALIBRATION/SETTING MODE

Pressing the [CAL/VIEW] key for about 2 sec. during normal mode will bring-up the first page of 7 pages of the **Calibration/Setting** mode. Pressing [CAL/VIEW] key will switch to the next page until the last page, where pressing [CAL/VIEW] again will return the user to normal mode.

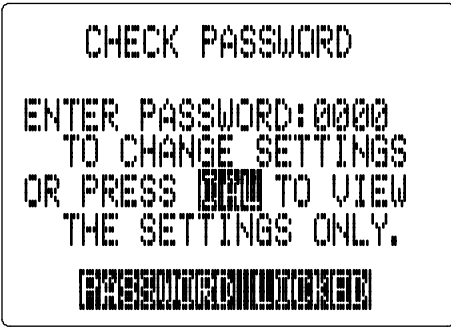
Below is a simple flowchart showing the path of the [CAL/VIEW]



key:

You can change any blinking words or digit by pressing the [ ▲ ] or [ ▼ ] keys. For options in digit format you need to press the [ **MODE/CURSOR** ] key to move to the next digit. If you are satisfied with the selection you made you need to press the [ ↵ ] **ENTER** key to save the changes and move to the next option. If you **don't** need to change the current blinking option just press the [ ↵ ] **ENTER** key to move to the next selection.

a. **CHECK PASSWORD** page



You will only see this page if the unit is password locked. To change any settings or calibration you need to unlock the system to remove the “**PASSWORD LOCKED**” message. You need to enter the correct 4-digit number on the “**ENTER PASSWORD**” input. You 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.

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

- b. **USER SETTING** page -You will only see this page if the unit is not password locked. This page is just a warning, telling you that all relays are frozen, and that you can calibrate and change the settings.

```

USER SETTING

!! WARNING !!
RELAYS & ANALOG OUT
ARE NOW FROZEN!

PRESS [ENTER] TO PROCEED
  
```

**NOTE:**

**FROZEN** MEANS ALL THE RELAYS AND THE ANALOG OUT WILL MAINTAIN THEIR LAST STATUS UNTIL THE USER RETURNS TO NORMAL DISPLAY MODE.

- c. **pH CALIBRATION** page

```

pH CALIBRATION
ATC TEMP: 25.0 °C
1. BUFFER 1: 7.00 PH
2. BUFFER 2: 4.00 PH
3. STAND: 7.00 PH WAIT
4. SLOPE: 4.00 PH WAIT
EFFICIENCY: 100.0%
* SAVING *
  
```

**ATC TEMP.** - the current temperature of the solution.

1. **BUFFER 1** - in this option you can select which buffer to use for the standardization calibration. You can choose 7.00 pH or 6.86 pH by using the [▲] and [▼] keys and pressing the [↵] key to save your choice.

2. **BUFFER 2** - after you selected the buffer 1 this option will let you select the second buffer to use to calibrate the slope. You can choose 4.00 pH, 4.01 pH, 9.18 pH or 10.01 pH by using [▲] and [▼] keys and pressing the [↵] to save your choice.

3. **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 you made on **BUFFER 1**).

A flashing [↵] icon will be displayed to indicate that pressing the [↵] **ENTER** key will start the calibration for the offset. Clean and immerse the pH probe into the standard buffer 1 solution. Press

the [↵] ENTER key. The “STAND” will display the pH value of the current buffer corresponding to the buffer 1 temperature (See **IX. pH Buffers**) and a flashing “WAIT” will appear. If the offset mV of the solution is greater or less than  $\pm 100$  mV (for buffer 7.00) or 108.3 mV / -91.7 mV (for buffer 6.86) then an “OVER” or “UNDER” error display will occur, you can clean the probe and change the buffer or you can press [CAL] key to exit the calibration. If during stabilization period and the reading change by more than 0.01 pH in 10 seconds then this wait time will restart (In this case: a. you can change the buffer. b. just abort by pressing the [CAL] key. or c. wait it out until the electrode stabilizes). If no error occurs the unit will wait for the reading to stabilize, if the solution is stable for about 10 seconds. It will halt the updating of the display. Once the display is halted changing the input or temperature will not change the “STAND” pH display. If there are no problems a flashing “SAVE” will be displayed. Pressing the [↵] ENTER key will save the new OFFSET of the pH probe or pressing the [▼] down key will recalibrate the BUFFER 1 again. The “EFFICIENCY” of probe will be 100% since the SLOPE will **default to Ideal** if only the OFFSET is calibrated.

4. **SLOPE** - The pointer will move to this option if you successfully calibrated the STAND. A flashing [↵] icon will be displayed to signify that pressing the [↵] ENTER key will start the calibration for the SLOPE. Clean and immerse the pH probe into the standard buffer solution (4.00, 4.01, 9.18 or 10.01 depending the choice you made for **BUFFER 2**). Press the [↵] ENTER key. The “SLOPE” will display the pH value of the current buffer corresponding to the buffer 2 temperature and a flashing “WAIT” will appear. If the mV input is not within the  $\pm 30\%$  of the ideal mV slope of this buffer then an error display will occur. You can clean the probe and change the buffer or you can press [CAL/VIEW] key to exit the calibration. If during stabilization period and the reading change by more than 0.01 pH in 10 seconds then this wait time will restart (In this case: a. you can change the buffer. b. just abort by pressing the [CAL/VIEW] key. or c. wait it out until the electrode stabilizes).

If no error occurs the unit will wait for the reading to stabilize, if the solution is stable for about 10 seconds it will halt the updating of the display. Once the display is halted changing the input or temperature will not change the "SLOPE" pH display. If there are no problems a flashing "SAVE" will be displayed. Pressing the [↵] ENTER key will save the new SLOPE of the pH probe and the new "EFFICIENCY" of probe will be displayed or pressing the [▼] down key will recalibrate the **BUFFER 2** again.

**EFFICIENCY** -After saving the SLOPE a new efficiency will be displayed around 4 seconds and then will move to the next page. (Efficiency = (new slope/ ideal slope)\* 100%)  
We recommend that you use a new electrode, if the electrode efficiency is lower than 80%.

### c. pH CONTROL SETTING

```
PH CONTROL SETTING
1. HI RELAY 1: 10.00=H
2. LO RELAY 2: 4.00=H
3. HYSTERESIS: CENTER
4. HYSTERESIS: 1.00 =H
* SAVING *
```

1. ?? **RELAY1** - The control type for this relay is changeable, you can choose "HI"-type or "LO" type. (In HI-type the relay will turn ON if the pH is greater than the RELAY1 set point, in LO-type the relay will turn ON if the pH is less than the RELAY1 set point, which is modified by the hysteresis value and hysteresis

mode.)(See chapter V. CONTROLLING THE RELAYS .) Use [▲] and [▼] to change the RELAY1 type then press [↵] to save. After you select the RELAY1 type you can now select the RELAY1 set point. Use [▲] and [▼] keys to change the blinking digit; use the [MODE] key to select another digit and the [↵] key to save the new set point.

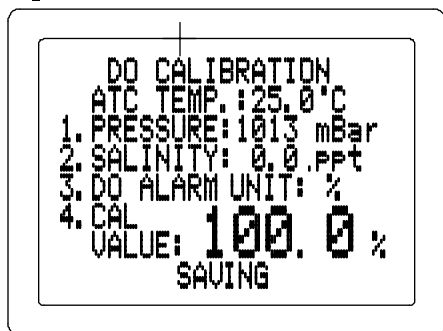
2. ?? **RELAY2** - The control type for this relay is changeable, you can choose "HI"-type or "LO" type. (In HI-type the relay will turn ON if the pH is greater than the RELAY2 set point, in LO-type the relay

will turn ON if the pH is less than the RELAY2 set point, which is modified by the hysteresis value and hysteresis mode.)(See chapter V. **CONTROLLING THE RELAYS** .) Use [▲] and [▼] to change the RELAY2 type then press [↵] to save. After you select the RELAY2 type you can now select the RELAY2 set point. Use [▲] and [▼] keys to change the blinking digit; use the [MODE] key to select another digit and the [↵] key to save the new set point.

3. **HYSTERESIS (mode)** -this is the hysteresis mode for pH RELAY1 and pH RELAY2. You can choose “CENTER” or “EDGE”. (See chapter V. **CONTROLLING THE RELAYS**.)

4. **HYSTERESIS (value)** - this is the actual value of the hysteresis. You can change this value from 0.00 pH to 3.99 pH. . ( See chapter V. **CONTROLLING THE RELAYS** .)

#### d. DO CALIBRATION



**ATC TEMP.** - The current temperature of the solution.

1. **PRESSURE** - user changeable Pressure. The acceptable range is from 600 to 1100 mBar for DO computations.

2. **SALINITY** - user changeable Salinity. The acceptable range is from 0 to 49.9 ppt for DO computations.

3. **DO ALARM UNIT** - this is the

unit which the DO **RELAY3** and DO **RELAY4** will be based upon. The DO RELAY3 and DO RELAY4 values for % and **ppm** are saved in different memory (EEPROM) location.

4. **CAL VALUE**: this is the DO calibration option. If you move 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 normal mode. To accurately calibrate the model 6309 PDT you will need the following information:

i. The approximate pressure (in mbar) of the region (See **X.DO CALIBRATION VALUES**) in which you plan to take your dissolved oxygen measurements.

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

## CALIBRATION PROCEDURES

a. Place 5-6 drops of distilled water into the sponge inside the calibration bottle. Turn the bottle over and allow any excess water to drain out of the bottle. The wet sponge creates a 100% water saturated-air environment for the probe, which is ideal for calibration, transport and storage of the Model 6309 PDT **DO** probe.

b. Screw in the bottle into probe allowing at least 5 mm space between the probe and the sponge.

c. Wait around 30 minutes for the dissolved oxygen and temperature readings to stabilize.

Pressing the [ ↵ ] **ENTER** key will start the calibration.

d. If you are 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.

e. If you are calibrating in **ppm** then the current reading in ppm will be displayed. If you press the [ ↵ ] **ENTER** key, the unit will

capture the current value and then you can change the value by using the [MODE] , [ ^ ] UP and [ v ] DOWN keys. If you are satisfied with the ppm setting, you need to 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.

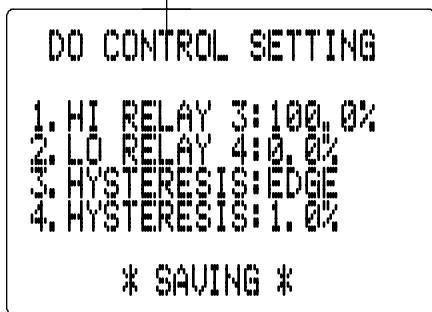
#### f. DO CONTROL SETTING

1. ?? RELAY3 - The control type for this relay is changeable, you can choose “HI”-type or “LO” type control. (In HI-type the relay will turn ON if the pH is greater than the RELAY3 set point, in LO-type the relay will turn ON if the pH is less than the RELAY3 set point, which is modified by the hysteresis value and hysteresis mode.)(See chapter V. CONTROLLING THE RELAYS .)

Use [ ^ ] and [ v ] to change the RELAY3 type then press [ ↵ ] to save. After you select the RELAY3 type you can now select the RELAY1 set point. Use [ ^ ] and [ v ] keys to change the blinking digit; use the [MODE] key to select another digit and the [ ↵ ] key to save the new set point.

2. ?? RELAY4 - The control type for this relay is changeable, you can choose “HI”-type or “LO” type control. (In HI-type the relay will turn ON if the pH is greater than the RELAY4 set point, in LO-type the relay will turn ON if the pH is less than the RELAY4 set point, which is modified by the hysteresis value and hysteresis mode.)(See

chapter V. CONTROLLING THE RELAYS .) Use [ ^ ] and [ v ] to change the RELAY4 type then press [ ↵ ] to save. After you select the RELAY4 type you can now select the RELAY4 set point. Use [ ^ ] and [ v ] keys to change the blinking digit; use the [MODE] key to select another digit and the



[ ↵ ] key to save the new set point.

**3. HYSTERESIS (mode)** -this is the hysteresis mode for DO RELAY3 and RELAY4. You can choose “CENTER” or “EDGE”. (See chapter V. CONTROLLING THE RELAYS.)

**4. HYSTERESIS (value)**- this is the actual value of the hysteresis. You can change this value from 0.0 % to 39.9 % or 0.00 ppm to 49.99 ppm. (See chapter V. CONTROLLING THE RELAYS .)

f. **CURRENT SETTING** page

**1. TRANSMITTER OUTPUT** - This option would let you choose if the current output type is **pH linear, pH logarithmic or DO LINEAR** (The DO mA output will be based on the DO ALARM UNIT whereas the DO Calibration is based on the NORMAL DO MODE UNIT).

### CURRENT SETTING

```
1. TRANSMITTER OUTPUT:  
   PH LINEAR  
2. 4mA OUT: 0.00 PH  
3. 20mA OUT: 14.00 PH  
  
SAVING
```

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

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

### g. TEMP. CONTROL SETTING

```
TEMP. CONTROL SETTING  
1. RELAY 5 : HIGH  
2. SET POINT : 100.0 °C  
3. HYSTERESIS : EDGE  
4. HYSTERESIS : 1.0 °C  
5. RS 485 ID : 00  
6. PASSWORD SET : 0000  
* SAVING *
```

1. **RELAY 5** - the temperature has only one relay to control you need to set what control type it will use, HIGH or LOW type. (In HIGH-type the relay will turn ON if the pH is greater than the RELAY5 set point, in LOW-type the relay will turn ON if the pH is less than the RELAY5 set point,

which is modified by the hysteresis value and hysteresis mode.)(See chapter V. **CONTROLLING THE RELAYS** .)

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

3. **HYSTERESIS (mode)** -this is the hysteresis mode for TEMPERATURE alarm. You can choose "CENTER" or "EDGE". (See chapter V. **CONTROLLING THE RELAYS**.)

4. **HYSTERESIS (value)**- this is the actual value of the hysteresis. You can change this value from 0.0 to 19. 9°C. (See chapter V. **CONTROLLING THE RELAYS**.)

5. **RS 485 ID** - this is the **unique** ID/ Address for the unit. If you are connecting multiple model 6308PDT 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.

6. **PASSWORD SET** - this is your security code if the unit is locked (password protected) the value here will not be available. You need to input the correct code in the PASSWORD CHECK page.

**CAUTION: The user is responsible in remembering their password number otherwise you would no be able to calibrate or change all the settings.**

## **IV. 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**

Relay Action	Hysteresis mode	Effective RELAY-ON Set point	Effective RELAY-OFF Set point
HIGH	CENTER	S.P.+ 1/2(H.V.)	S.P. -1/2 (H.V.)
HIGH	EDGE	S.P.	S.P. - H.V.
LOW	CENTER	S.P.-1/2 (H.V.)	S.P.+1/2 (H.V.)
LOW	EDGE	S.P	S.P.+ H.V.

S.P. = Relay Set point

H.V.= Hysteresis value (Dead Band)

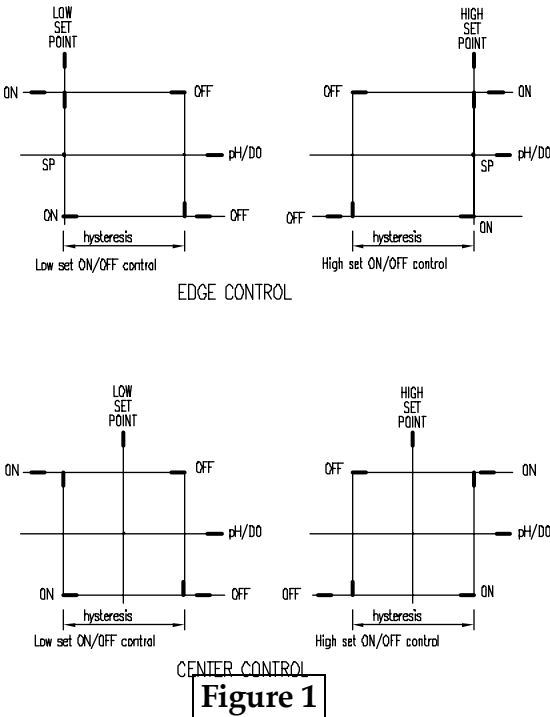
If the relay type is set to HI and the hysteresis mode is **CENTER**, the relay will turn **ON** at [(RELAY SETPOINT) + (0.5 \* hysteresis value)], and will turn **OFF** at [(RELAY SETPOINT) - (0.5 \* hysteresis value)].

If the relay 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 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).

## C. pH RELAYS



There are two independent Alarm channels for pH display which has **independent** set point and HIGH or LOW control type (see figure 1.). The hysteresis mode (center or edge, see figure 1.) 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 1.)

## D. DO RELAYS

There are two independent Alarm relays for the DO display that have **independent** set points and control types (see Figure 1) . The hysteresis mode (center or edge, see figure 1) 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 1).

## E. TEMPERATURE RELAY

One relay channel is available for temperature display which has independent set point and HIGH or LOW action (see figure 1) 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. (See figure 1).

## **VI. 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 500Ω. Output current inaccuracies may occur for load impedance in excess 500Ω.

### **C. pH LINEAR OUTPUT**

The analog output will produce a linear analog output if the user selects this option (see figure 2). The analog output will be dependent on the pH\_4 mA setting, pH\_20 mA setting and the current pH display.

The pH LINEAR analog output is based on the following equation:

$$mA_{(pH)} = 4mA + (16mA) * (D_{(pH)} - pH(4)) / (pH(20) - pH(4))$$

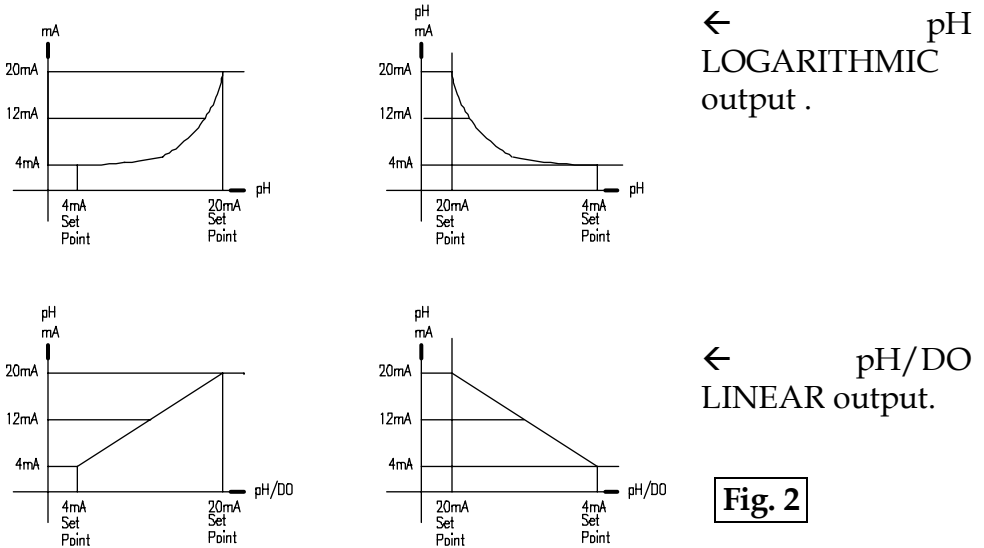
Where:

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

**Note:**

1. The range for 4mA and 20mA settings is 0.00 to 14.00 pH.

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



### C. 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:

$$mA_{(DO)} = 4mA + (16mA) * (D_{(DO)} - DO(4)) / (DO(20) - DO(4))$$

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:**

1. The range for 4mA and 20mA settings is 0.0 to 500.0% or 0.00 to 60.00 ppm.

3. The absolute difference of the 4mA 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 2**). 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:

$$mA_{(pH)} = 4mA + (16mA) * (10^{D(pH)} - 10^{pH(4)}) / (10^{pH(20)} - 10^{pH(4)})$$

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:**

1. The range for 4mA and 20mA settings is 0.00 to 14.00 pH.
2. The absolute difference of the 4mA and 20 mA settings must be greater or equal to 0.10pH or else the analog output will be disabled.

## VII. RS485 INTERFACE OPERATION

### A. INTRODUCTION

This section assumes you are familiar with the basics of data communication, the RS485 interface, a rudimentary knowledge and a copy of the more popular Windows®  9X computer languages

capable of using a PC RS485 card or RS232-RS485 converter (**third party vendor**) module.

A simple program must be written in order to send your command and receive data from the meter.

A sample source program in Visual Basic®  6.0 is included in the accompanying disk.

## **B. PREPARING THE METER**

This meter comes equipped with a 2-wire RS485 interface. Just connect each terminal to the respective RS485 terminal on your PC. (If the DEMO program is not working, try reversing the connections of the terminals.) After you have connected correctly the meter (or multiple meters with unique ID number) and turned on both the meter(s) and the computer, you are now ready to program a simple routine to read data from the instrument.

Read the file "6309PDT.TXT" in the accompanying disk to jump-start you in using the meter with your RS485 enabled PC

## **VIII. ERROR DISPLAYS AND TROUBLESHOOTING**

<b>LCD display</b>	<b>ATC display</b>	<b>DISPLAY unit</b>	<b>Possible cause(s) [Action(s)]</b>
"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	a. 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~ 120.0°C	pH	pH>16.00 . [Recalibrate.]

"OVER"	0.0 ~ 60.0°C	pH-Cal	pH>16.00. [Use a new buffer solution.] [Replace the electrode.]
"OVER"	0.0 ~ 60.0°C	a.pH-Cal-STAND buffer 7.00pH b.pH-Cal-STAND buffer 6.86 pH c. pH-Cal-SLOPE	a. mV>100mV or mV<-100mV  b. mV>108.3mV 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"	-10.0~ 120.0°C	pH	pH<-2.00 [Recalibrate.]
"UNDR"	0.0 ~ 60.0°C	a.pH-Cal-STAND  b.pH-Cal-SLOPE	a. Offset @ 7.00pH: mV<-100mV Offset@6.86pH:mV< -91.7 mV b. New Slope<ideal slope by 30% [Use a new buffer solution.] [Replace electrode.]
<b>LCD display</b>	<b>ATC display</b>	<b>DISPLAY unit</b>	<b>Possible cause(s) [Action(s)]</b>
<b>EEPROM: BAD</b>		During power-on	Unit has failed its EEPROM test. [Turn instrument OFF and back to ON again.] [Return for service. (See Warranty)]
<b>ROM: BAD</b>		During power-on	Unit has failed its ROM test. [Turn instrument OFF and back to ON again.] [Return for service. (See Warranty)]
<b>RAM: BAD</b>		During power-on	Unit has failed its RAM test. [Turn instrument OFF and back to ON again.] [Return for service. (See Warranty)]

## IX. pH BUFFERS

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

**TABLE 1.**

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

Note: The actual reading of the instrument can differ from the values shown by  $\pm 0.01$  pH.

## **X. DO CALIBRATION VALUES**

**TABLE 2**

Calibration values for a range of pressures and altitudes.

<b>Pressure mBar</b>	<b>Pressure mm-Hg</b>	<b>Altitude feet</b>	<b>Altitude meters</b>	<b>Calibration Value in %</b>
1023	768	-276	-84	101
<b>1013</b>	<b>760</b>	<b>0</b>	<b>0</b>	<b>100</b>
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

## XI. 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 <sub>2</sub> (ppm)	0.00 to 60.00 ppm (if DO% is OVER or UNDER then DOppm will be OVER or UNDER also)	±0.2 % of span	0.01 ppm
Dissolved O <sub>2</sub> % (air-sat)	0 to 500.0 %	±0.2 % of span	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<sup>13</sup>Ω

**Calibration point sensing**

Yes

## DO

**Salinity compensation**

0.0 to 40.0 ppt (manual)

**Pressure compensation**

640 to 1100 mBar (manual)

**Temperature compensation**

-10.0 to 50.0 °C (automatic)

## Temperature

**Temperature sensor**

Thermistor, 10.00kΩ at 25°C  
or 2252Ω at 25°C

## 4-20mA Output

<b>Input Select</b>	DO or pH (user selectable)
<b>Current output range</b>	4 to 20 mA (isolated)
<b>Current output scale</b>	user programmable
<b>Maximum load</b>	500 $\Omega$
<b>Accuracy</b>	$\pm 0.02\text{mA}$
<b>Isolation voltage</b>	500VDC

## Controller

<b>Control type</b>	Five relays with ON/OFF control
<b>Relay output</b>	5A at 115VAC or 2.5A at 230VAC

## GENERAL

<b>Keys</b>	Audio feedback in all keys
<b>Security protect</b>	4-digit password
<b>Communication</b>	RS485
<b>Power:</b>	115VAC or 230VAC 50/60Hz
<b>Ambient Temperature range</b>	0.0 to 50.0 $^{\circ}\text{C}$
<b>Display:</b>	128x64 graphic LCD w/ backlight
<b>Case</b>	IPT65 $\frac{1}{4}$ DIN case, depth 155mm
<b>Weight</b>	950 g

## **XII. WARRANTY**

Jenco Instruments, Ltd. Warrants this product to be free from defects in material and workmanship for a period of one year from date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse, within the one year period, please return-freight-prepaid and the correction of the defect will be made without 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 will determine whether the product problem is due to defects or customer misuse. Out-of-warranty products will be repaired on a fee basis.

## **RETURN OF ITEMS**

Authorization must be obtained from one of our representatives before returning items for any reason. When applying for authorization, please have the model and serial number handy, including all relevant information regarding the reasons 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 unauthorized returns.

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

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