OPERATION MANUAL

JENCO MODEL 6309 POT MICROCOMPUTER BASED pH /ORP/ Temperature CONTROLLER

JENCO ELECTRONICS,LTD.

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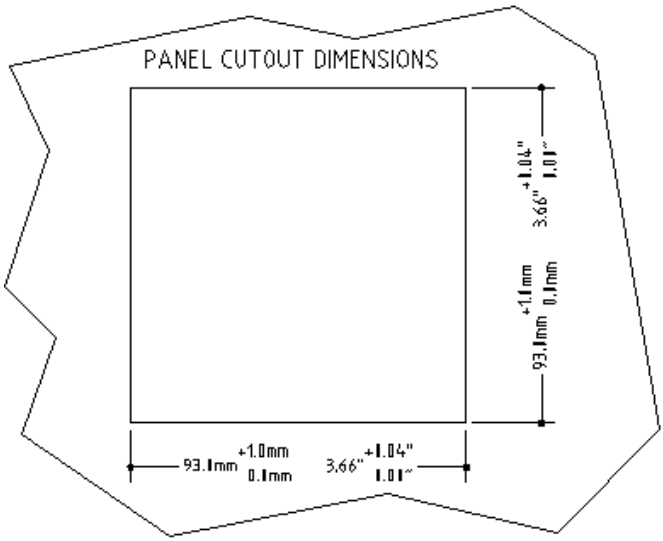
I. INITIAL INSPECTION and ASSEMBLY

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.

II. GENERAL INTRODUCTION

The Jenco Model 6309 **POT** (**p**H, **O**RP and **T**emperature) 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 6309 POT microprocessor performs a self-diagnostic routine every time you turn on the unit providing you with basic information on the stability of the instrument.

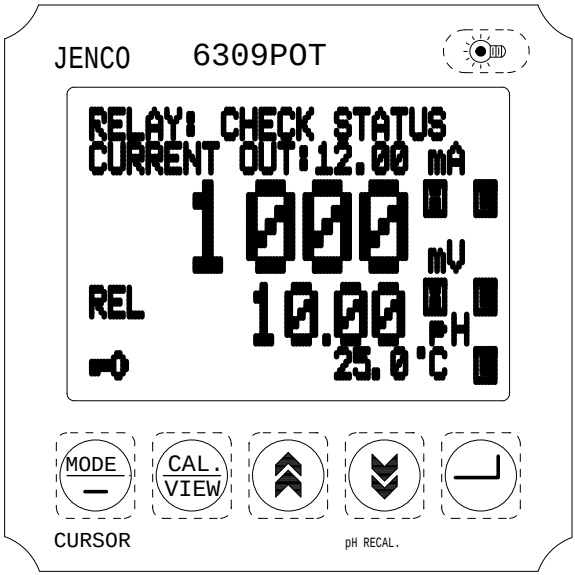
The system simultaneously displays pH, ORP, Temperature, relay status and current output in one LCD graphic screen.

The model 6309 POT is equipped with 5 relays (2 programmable high or low relay for pH, 2 programmable high or low relay for ORP and one programmable high or low relay for temperature); all relays are hysteresis driven and configurable to **CENTER** or **EDGE** mode. The system also has a **isolated 4-20mA** analog output, offset and span configurable for the pH or ORP display.

The model 6309 POT comes with a **RS485** interface that can easily let the user log all data (from multiple model 6308 or 6309) with an IBM© PC/AT compatible computer. For advanced users, the model 6309 POT may also be remotely controlled from main display mode to all calibration/setting modes.

III. USING THE JENCO MODEL 6309 POT

A. **FRONT PANEL**



1. The [**MODE/-**] **MODE or CURSOR** key.

   1a. In **Normal** mode this key will change the ORP display to ORP **ABS**(olute) or ORP **REL**(ative).

   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 two seconds will move you back to the previous parameter.

2. The [**CAL / VIEW**] key.

   2a. Pressing this key for about two seconds, during main 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 TEMP. CONTROL SETTING will place the display back to the MAIN 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 or pH RECALIBRATE** key.

4a.During Calibration/Setting mode this key will **decrement** the blinking digit of the active parameter.

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

5. The [↵] **ENTER** key.

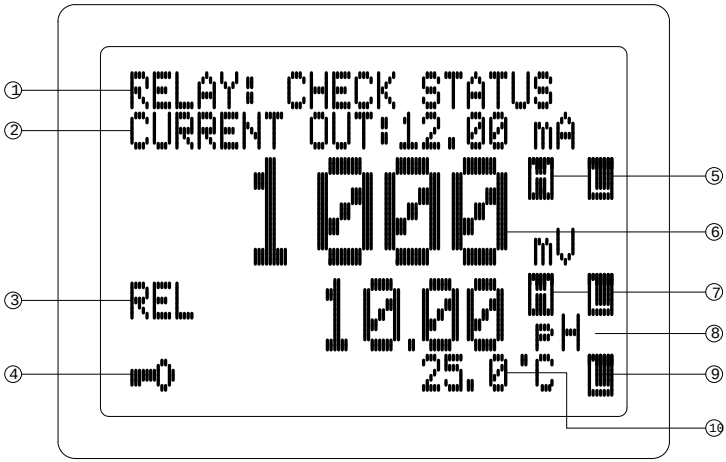
During Calibration/Setting mode, this key will save the current modified parameter and move the cursor to the next parameter.

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 after two minutes.

B. MAIN DISPLAY MODE



1. **RELAY** - this will show the status of the relays. At Power-ON a "**DISABLED**" message will be displayed for about 3 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.

2. **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 three seconds before returning to normal operation.

3. **REL** or **ABS** – this text will indicate if the present ORP reading is **ABS**olute or **REL**ative value.

4. annunciator - This will be displayed if Calibration/Setting pages are **password locked**, meaning the user **will not be able to** change the calibration/setting values unless the correct 4 digit number has been entered.

5. **H** , **L** annunciators - 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 ORP. The leftmost character will indicate RELAY2 if the display is pH or RELAY 4 If the display is ORP. If the display is ORP the annunciators will only indicate the unit selected at the **RELAY/mA** option in the **ORP CALIBRATION** .

6. **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 pH or ORP reading only to be shown here by changing the **Transmitter Output (pH LINEAR, pH ANTILOG or ORP LINEAR)** option.

7. **H** , **L** annunciators - one or both of these annunciators will be displayed if the left side reading (MEDIUM FONT DISPLAY)

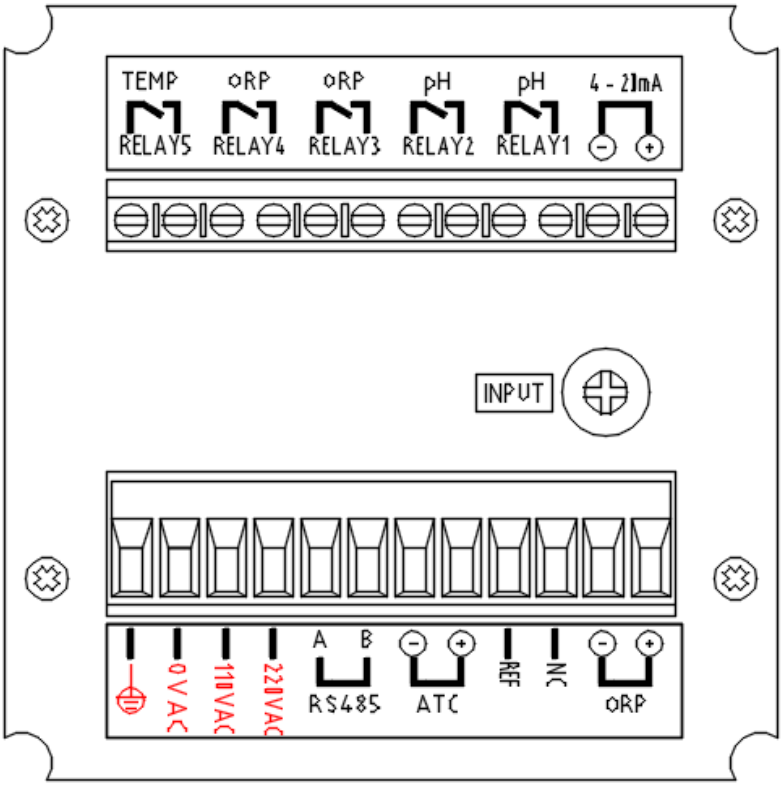
triggered the respective relay settings. The rightmost character will indicate RELAY 1 if the display is pH or RELAY 3 if the display is ORP. The leftmost character will indicate RELAY2 if the display is pH or RELAY 4 If the display is ORP. If the display is ORP the annunciators will only indicate the unit selected at the **RELAY/mA** option in the **ORP CALIBRATION** .

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

9. **H** or **L** annunciator - one of these annunciators will be displayed if the temperature reading triggered the temperature relay setting. Only one RELAY is available for the temperature.
10. **Temperature** - the current temperature of the solution where the temperature probe is immersed.

C. REAR CONNECTORS

Before connecting the probes, relays, analog output, RS485 and power cord be sure that you are inserting to the right terminal 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 POT 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 2.5Amp at 230 VAC**.
5. Set the proper load to the 4-20mA-output connector. Make sure that the load impedance is less than 500 Ohms.

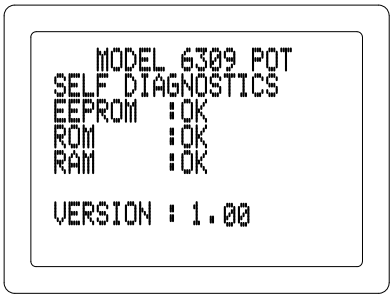
CAUTION:

1. MAKE SURE THAT THE POWER IS UNPLUGGED BEFORE WIRING YOUR PROBES, RELAY ETC.

2. 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 or plugging the unit will turn OFF or turn ON the unit respectively.



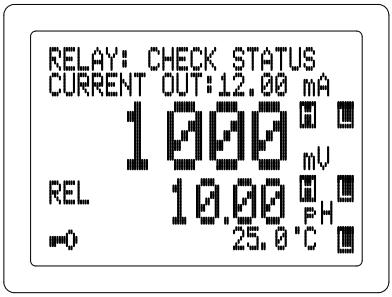
After the unit is turned on, it will perform some basic self diagnostics and will display “OK” or “BAD”. If you received any “BAD” messages turn OFF the unit and turn it ON again. (See **VIII. ERROR DISPLAYS AND TROUBLESHOOTING**).

If the message persists then you might need to call your distributor. (See **XI. 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 pH/ORP/Temperature measurements. Just immerse the probes half way 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 POT MODES

A. **NORMAL MODE**



Turning ON the unit will always display main display mode.
This instrument is designed to provide four 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. ORP-ABS - a measurement of absolute ORP mV.
4. ORP-REL - a measurement of relative ORP mV. The **OFFSET** value at the **ORP CALIBRATION** will be added to the ORP absolute value to display the ORP relative value.

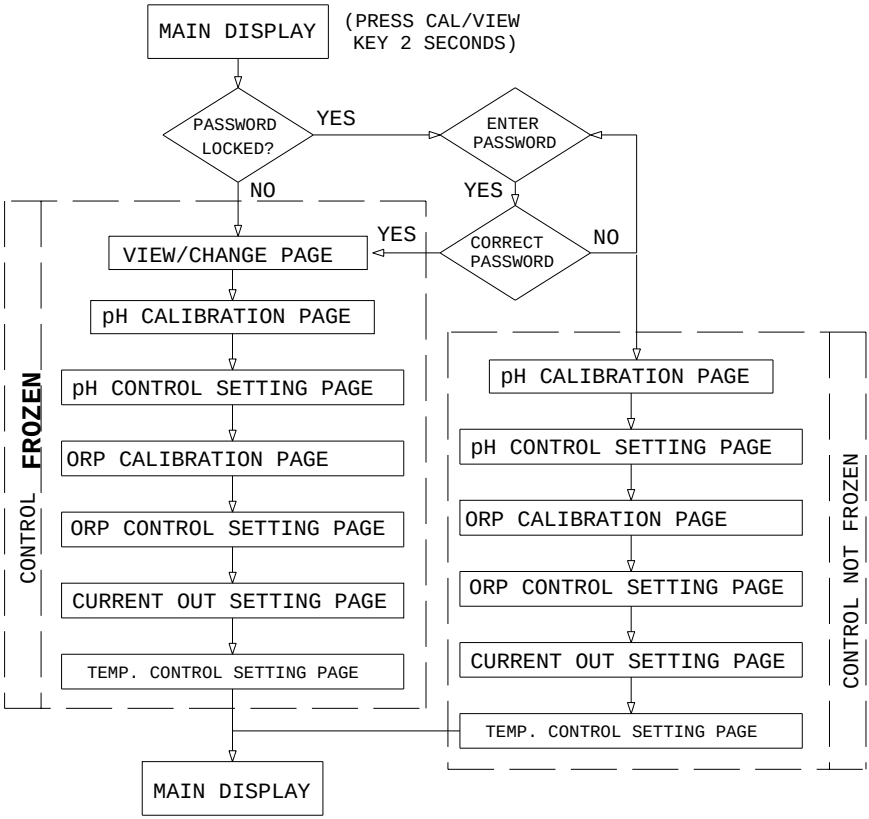
You can select which ORP unit to display by pressing the [**MODE/-**] key.

ORP (Absolute or Relative), pH and Temperature are always simultaneously displayed in the graphic LCD screen in normal mode.

B**. CALIBRATION/SETTING MODE**

Pressing the [**CAL/VIEW**] key for about two seconds during main display mode will bring-up the first page of seven 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 main display mode.

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



How to use the keys

1. At MAIN DISPLAY you need to press and hold the [CAL/VIEW] key for two seconds to change the display to VIEW SETTING PAGE or if the instrument is password locked the display will be PASSWORD CHECK page.

2. At MAIN DISPLAY pressing the [MODE/-] key will toggle between **ABS**olute ORP and **REL**ative ORP.

3. You can change any blinking options or digit by pressing the [▲] or [▼] keys.

4. For options in digit format you need to press the [MODE/-] key to move the cursor to the next digit .

5. 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.

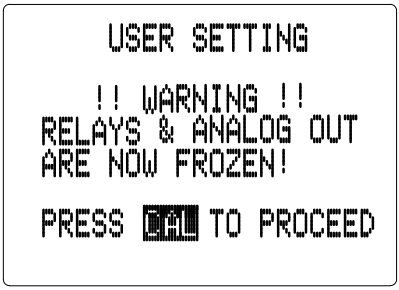
6. If you don't need to change the current blinking option just press the [↵] **ENTER** key to move to the next selection.

7. You also can press and hold [MODE/-] key for two seconds and will move back the cursor to the previous option.

a. **CHECK PASSWORD**

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 four 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 and analog output.
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**.

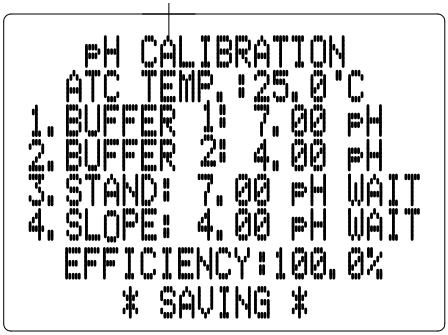
b. **USER SETTING**



You will only see this page if the unit is not password locked. This page is just a **WARNING**, informing that all relays and analog output are frozen, and that you can calibrate and change the settings.

NOTE: FROZEN MEANS ALL THE RELAYS AND THE ANALOG OUT WILL MAINTAIN THEIR LAST STATE UNTIL THE USER RETURNS TO MAIN DISPLAY MODE.

c. **pH CALIBRATION**



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 [▼/**pH-Recal**.] 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 [▼/**pH-Recal**.] 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** . (See Step by step pH Calibration.)

4. 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 you made on **BUFFER 2**. (See Step by step pH Calibration.)

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) x 100%

We recommend that you use a new electrode, if the electrode efficiency is lower than 80%.

Step by step pH calibration

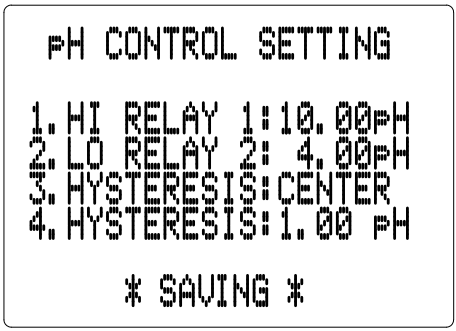
1. Press the [CAL/VIEW] key to go to pH Calibration page. If the unit is password locked, remove the password lock first.
2. Select buffer 1 (7.00 or 6.86), by using the [▲] or [▼/**pH-Recal**.] keys, then press the [↵] key to save your selection.
3. Select buffer 2 (4.00,4.01,9.18 or 10.01), by using the [▲] or [▼/**pH-Recal**.] keys, then press the [↵] key to save your 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 [↵] key. A "**WAIT**" message will blink indicating that the instrument is waiting for a stable reading. The display will be locked to the buffer value corresponding to the temperature of buffer 1 (See **IX. pH Buffers**). When a stable reading is reached, the unit will blink a "**SAVE**" message.
7. Press the [↵] key to save the STAND calibration and prepare to do a SLOPE calibration or press the [▼/**pH-Recal**.] key to ***recalibrate*** buffer 1 and repeat from step 6.

If "**OVER**" or "**UNDER**" (See **VIII. ERROR DISPLAYS AND TROUBLESHOOTING**) is displayed or a blinking "**SAVE**" does not show after more than few minutes then something is wrong with your buffer 1 or electrode. Be sure your 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 [↵] key. A "**WAIT**" message will blink indicating that the instrument is waiting for a stable reading. The display will be locked to the buffer value corresponding to the temperature of buffer 2 (See **IX. pH Buffers**). When a stable reading is reached, the unit will blink a "**SAVE**" message.
10. Press the [↵] key to save the SLOPE calibration or press the [⮟/**pH-Recal**.] key to ***recalibrate*** buffer 2 and repeat from step 8.

If "**OVER**" or "**UNDER**" (See **VIII. ERROR DISPLAYS AND TROUBLESHOOTING**) 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 your buffer 2 is correct or change a new electrode and repeat from step 4.
11. Set-up your Relay, mA OUT and Temperature control.
12. The unit is ready for measurement and control.

d. **pH CONTROL SETTING**



1. **RELAY1** - The control action for this relay is changeable, you can choose "**HI**"-action or "**LO**" action. (In HI-action the relay will turn **ON** if the pH is greater than the RELAY1 set point, in LO-action 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. <u>CONTROLLING THE RELAYS</u>** .) Use [⮝] and [⮟/**pH-Recal**.] to change the RELAY1 action then press [↵] to save. After you select the RELAY1 action you can now select the RELAY1 set point. Use [⮝] and [⮟/**pH-Recal**.] keys to change

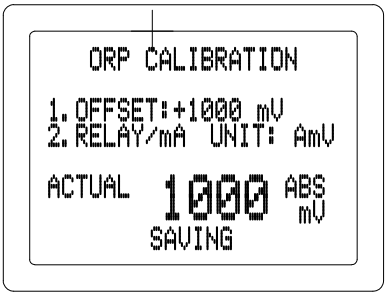
the blinking digit; use the [**MODE/-**] key to select another digit and the [↵] key to save the new set point.

2.RELAY2 - The control action for this relay is changeable, you can choose "**HI**"-action or "**LO**" action. (In HI-action the relay will turn **ON** if the pH is greater than the RELAY2 set point, in LO-action 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 [▼/**pH-Recal**.] to change the RELAY2 action then press [↵] to save. After you select the RELAY2 action you can now select the RELAY2 set point. Use [▲] and [▼/**pH-Recal**.] 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 0.01 pH *(Don't set to 0.00 pH)* to 3.99 pH (See **V. CONTROLLING THE RELAYS.)**

e. **ORP CALIBRATION**



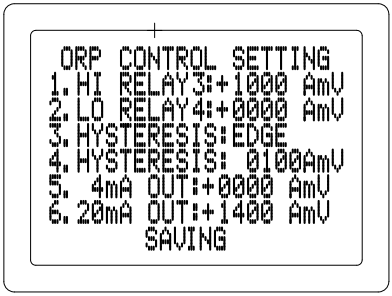
1. OFFSET - The value here will be subtracted to the absolute ORP reading to display the relative ORP reading.

RmV = AmV - OFFSET

2. RELAY/mA UNIT – this is the unit that the ORP **RELAY3** and ORP **RELAY4** will be based upon. The ORP Relay 3 and ORP Relay 4 values for **ABS** and **REL** are saved in different eeprom location.

Note: AmV = Absolutue mV, RmV = Relative mV

f. ORP CONTROL SETTING



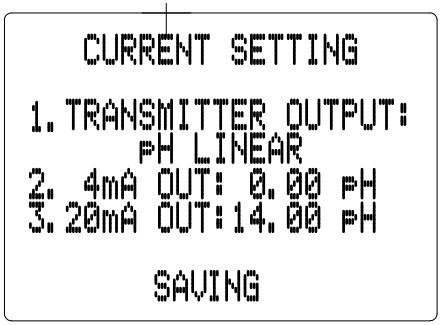
1.**RELAY3** - The control action for this relay is changeable, you can choose "**HI**"-action or "**LO**" action. (In HI-action the relay will turn **ON** if the ORP is greater than the RELAY3 set point, in LO-action the relay will turn **ON** if the ORP is less than the RELAY3 set point, which is modified by the hysteresis value and hysteresis mode.)(See chapter **V. CONTROLLING THE RELAYS** .) Use [⮝] and [⮟/**pH-Recal**.] to change the RELAY3 action then press [↵] to save. After you select the RELAY3 action you can now select the RELAY3 set point. Use [⮝] and [⮟/**pH-Recal**.] 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 action for this relay is changeable, you can choose "**HI**"-action or "**LO**" action. (In HI-action the relay will turn **ON** if the ORP is greater than the RELAY4 set point, in LO-action the relay will turn **ON** if the ORP 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 [⮟/**pH-Recal**.] to change the RELAY4 action then press [↵] to save. After you select the RELAY4 action you can now select the RELAY4 set point. Use [⮝] and [⮟/**pH-Recal**.] 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 ORP RELAY3 and ORP 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 1 *(Don't set to 0 mV)* to 999 AmV or RmV. **(See chapter V. CONTROLLING THE RELAYS .)**

g. **CURRENT SETTING**



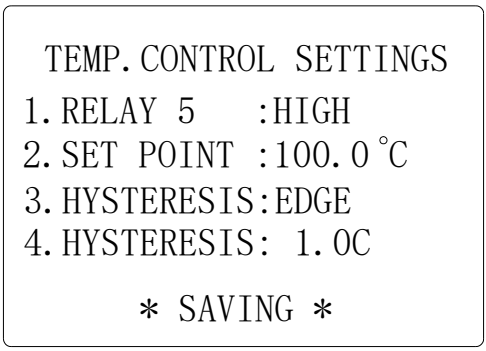
1. **TRANSMITTER OUTPUT** – This option would let you choose if the current output type is **pH LINEAR, pH ANTILOG or ORP LINEAR**. If the user chooses "ORP LINEAR", the ORP analog output will be based on the RELAY/mA UNIT.

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**.)
Example: For ORP LINEAR: If **4mA OUT** is set at 200AmV, **20mA OUT** is set at 1000AmV, the analog out at 400AmV=

ANALOG OUTPUT = 4mA + (16mA)/(**1000AmV-200AmV**)
=6mA

h. TEMP. CONTROL SETTINGS



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, RELAY5 will turn **ON** if the temperature is greater than the **RELAY5** setting, in LOW-type, the RELAY5 will turn **ON** if the temperature is less than the **RELAY5** setting, which is modified by the hysteresis value and hysteresis mode.

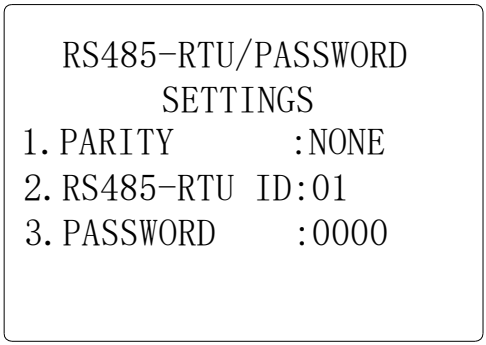
2. **SET POINT** - This is the **RELAY5** control set point.

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 temperatur relay. You can choose "**CENTER**" or "**EDGE**".

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

i. RS485-RTU/PASSWORD SETTINGS



1. **PARITY** –
This option would let you 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 you are 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** - This is your security code if the unit is locked (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 for remembering their password number, otherwise the user would not be able to calibrate or change all the settings.

V. 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.+ 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.)

S.P. = Relay Set point

H.V.= Hysteresis value (Dead Band)

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

If the relay action is set to **HI**GH and the hysteresis mode is **EDGE**, the relay will turn ON at [(RELAY SET POINT), and will turn OFF at (RELAY SET POINT) - (hysteresis value)].

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

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

CAUTION :
Setting any hysteresis value to zero may cause jitter and possibly damage the relay(s).

D. pH RELAYS

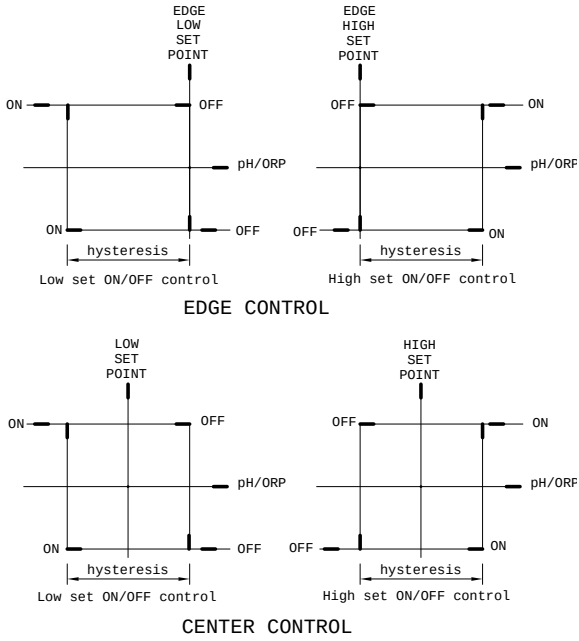


Figure 1

There are two independent relay channels for pH display which has **independen**t set point and control action (HIGH or LOW, 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 action (HIGH or LOW), hysteresis mode (Center or Edge), hysteresis Value and the current pH display (See figure 1.)

E. ORP RELAYS

There are two independent relay channels for the ORP display. (see **figure 1.**). The hysteresis mode (center or edge, see **figure 1.**) and hysteresis value will be used by all ORP relays.

The action of the ORP relays are dependent on set point, relay action (HIGH or LOW), hysteresis mode (Center or Edge) , hysteresis value and the current ORP display. (see **figure 1**).

F. TEMPERATURE RELAY

One relay channel is available for temperature display which has independent set point, action (see **figure 1**) setting (HIGH or LOW), hysteresis mode (center or edge) and hysteresis value.

The action of the Temperature relay is dependent on **set point**, **relay action** (HIGH or LOW), **hysteresis mode** (Center or Edge) , **hysteresis value** and the **current Temperature display**. (See **figure 1**).

VI. 4 - 20 mA ANALOG 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 . Output current inaccuracies may occur for load impedance in excess 500 .

C. pH LINEAR TRANSMITTER (mA) OUTPUT

The analog output will produce a linear analog output if the user selects this option (see figure 2). The analog output will be

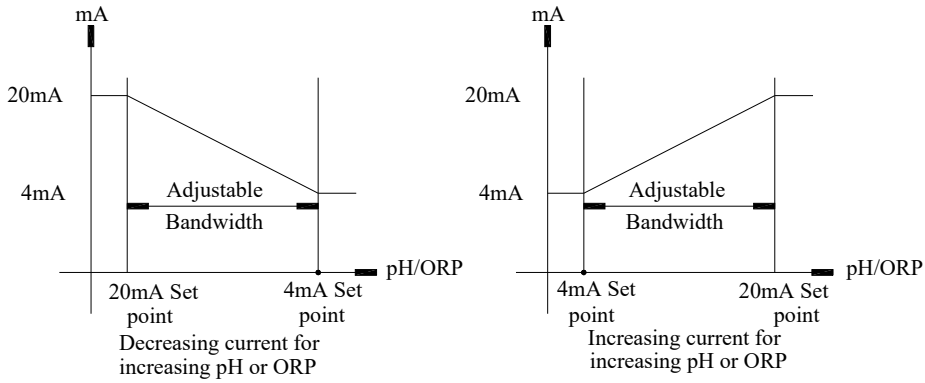


Figure 2

dependent on the pH_4 mA setting, pH_20 mA setting and the current pH display.
The pH LINEAR 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 user can set the 4mA and 20mA OUT from “0.00” to “16.99” pH**, but be reminded that the range of pH is “-2.00” to “16.00” pH only**.
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.

D. ORP LINEAR (mA) 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 **ORP_4 mA setting**, **ORP_20 mA setting** and the **current ORP (**ABS or REL**) display**.
The ORP LINEAR output is based on the following equation:

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

Where :

$mA_{(ORP)}$ = analog output
$D_{(ORP)}$ = current ORP (ABS or REL) display
ORP(4) = ORP(ABS or REL) user setting for 4 mA
ORP(20) = ORP (ABS or REL) user setting for 20 mA.

Note :
1. The user can set the 4mA and 20mA OUT from -9999 to 9999 AmV or -9999 to 9999 RmV, but **be reminded that the range of ORP in absolute mode is –2500 to +2500 AmV only**, while in relative ORP mode it's –6499 to +6499 RmV only.
2. The absolute difference of the 4mA and 20 mA settings must be greater or equal to 10 AmV or 10 RmV or else the analog output will be disabled.

E. pH ANTILOG (mA) OUTPUT

The analog output will produce an antilog analog output if the user selects this option (see **figure 3**). The analog output will be dependent on the **pH _4 mA setting**, **pH _20 mA setting** and the **current pH display**.

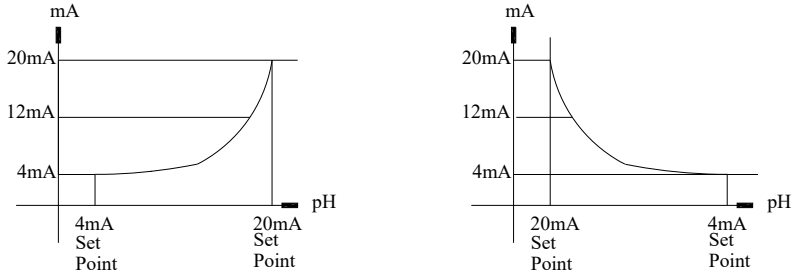


Figure 3

The pH ANTILOG output is based on the following equation:

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

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 user can set the 4mA and 20mA OUT from “0.00” to “19.99” pH, but **be reminded that the range of pH is –2.00 to 16.00 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 instrument is using the standard RS485 MODBUS RTU protoc ol. Please read the “protocol.doc” in the accompanying disk to help you program an application that will communicate with the instrume nt. There is also a simple demo program that you can install to see the
protocol in action.

B. PREPARING THE METER

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

VIII. ERROR DISPLAYS AND TROUBLESHOOTING

LCD display	Temperature 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.]
"OVER"	"UNDR"	pH	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.]
"OVER"	don't care	ORP (ABS or REL)	a. ORP ABS display > +2500 mV [Bring solution to a lower ORP reading]

LCD display	Temperature display	DISPLAY unit	Possible cause(s) [Action(s)]
"UNDR"	don't care	ORP (ABS or REL)	a. ORP ABS display < -2500 mV [Bring solution to a higher ORP reading]
don't care	"OVER"		a. Temperature > 120.0°C. [Bring solution to a lower temperature.] [Replace temperature probe.] b. No temperature sensor. [Use a temperature probe.]
don't care	"UNDER"		Temperature < -10.0°C. [Bring buffer/solution to a higher temperature.]
EEPROM: BAD		During power-on	Unit has failed its EEPROM test. [Turn instrument OFF and back to ON again.] [Return for service. (see Warranty)]
ROM: BAD		During power-on	Unit has failed its ROM test. [Turn instrument OFF and back to ON again.] [Return for service. (see Warranty)]
RAM: BAD		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.

°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 instrument can differ from the values shown by ±0.01 pH.

X. SPECIFICATIONS

pH

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

ORP

Display	Range	Accuracy	Resolution
ORP Absolute mV	-2500 to 2500 mV	±0.2 % of span	1 mV
ORP OFFSET	-3999 to 3999 mV	±0.2 % of span	1 mV

Temperature

Range	Resolution	Accuracy
-10.0 to 120.0 °C	0.1 °C	±0.1 °C ± 1 LSD

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 end point sensing	Yes

Temperature

Temperature sensor	Thermistor, 10.00k at 25°C

4-20 mA Analog Output

Current output range	4 to 20 mA (isolated)
Current output scale	user programmable
Maximum load	500
Accuracy	± 0.02mA
Isolation voltage	500VDC

Controller

Control type	(five) ON/OFF control
Relay output	5A at 115VAC or 2.5A at 220VAC Resistive load only

GENERAL

Keys	Audio feedback in all keys
Security protect	4-digit password
Communication	RS485
Power:	115VAC or 230VAC 50/60Hz
Fuse	0.315Amp/250Vfast acting glass tube
Ambient Temperature range	0.0 to 50.0 °C
Display:	128x64 graphic LCD w/ backlight
Case	IPT65 ¼ DIN case, depth 148mm
Weight	950 g

XI. WARRANTY

Jenco Instruments, Ltd. 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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