MICROPROCESSOR-BASED WATER
TREATMENT CONTROLLER

MCT300 SERIES

MODELS MCT310, MCT320, & MCT330

INSTALLATION
OPERATION
MAINTENANCE
INSTRUCTION

$5.00 USA

72-303-00 898

FACTORY SERVICE POLICY

Your controller is a state of the art microprocessor based unit with on-board diagnostics. If you are experiencing a problem with your controller, first consult the troubleshooting guide in your operation and maintenance manual. If the problem is not covered or cannot be solved, please contact our Technical Services Department for further assistance.

Trained technicians are available to diagnose your problem and arrange a solution. Solutions may include purchase of replacement parts or returning unit to the factory for inspection and repair. All returns require a Return Authorization number to be issued by the manufacturer. Parts purchased to correct a warranty issue may be credited after an examination of original parts by the manufacturer. Warranty parts returned as defective which test good will be sent back freight collect. No credit will be issued on any replacement electronic parts.

Any modifications or out-of-warranty repairs will be subject to bench fees and costs associated with replacement parts.

WARRANTY

The manufacturer warrants control systems of its manufacture to be free of defects in material or workmanship. Liability under this policy extends for 24 months from date of shipment. The manufacturer's liability is limited to repair or replacement of any failed equipment or part which is proven defective in material or workmanship upon manufacturer's examination. This warranty does not include removal or installation costs and in no event shall the manufacturer's liability exceed the selling price of such equipment or part.

The manufacturer disclaims all liability for damage to its products through improper installation, maintenance, use, or attempts to operate such products beyond their functional capacity, intentionally or otherwise, or any unauthorized repair. The manufacturer is not responsible for consequential or other damages, injuries, or expense incurred through the use of its products.

The above warranty is in lieu of any other warranty, whether expressed or implied. The manufacturer makes no warranty of fitness or merchantability. No agent of ours is authorized to provide any warranty other than the above.

Note: Conductivity, pH, and ORP sensors are not covered under the warranty. These items carry their own manufacturer’s warranty.

FCC WARNING

This equipment generates and uses radio frequency energy. If not installed and used properly, in strict accordance with the manufacturer’s instructions, it may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be required to take whatever measures necessary to correct the interference.

Contents

1. INTRODUCTION

These microprocessor based controllers have been designed to control and monitor a wide range of parameters, both analog and digital.

This instruction manual covers the Standard Series of controllers listed in Table 1 along with their standard features. All standard features are covered in this manual and most options have instructions where applicable.

IMPORTANT! While using this manual, if you see instructions for a feature that does not display on your controller, check the following:

- Consult Table 1 to see if that feature is available for your controller either as standard or option.
- Refer to the model number of your controller found on the enclosure of the unit. The letters after the model number are the options installed.
- After the above steps, if feature does not display, reinitialize the unit. If that fails, consult the factory.

For your convenience, there is an abbreviated instruction and software "MENU MAP" laminated card supplied with all manuals to be kept with the controller. This card is not a substitute for this instruction manual. It is supplied as a quick reference only and should be used in conjunction with the instruction manual.

DESCRIPTION

The Conductivity and Conductivity/pH controllers are designed to monitor and control Total Dissolved Solids (TDS) in open recirculating cooling systems, in terms of electrical conductivity measured in micro Siemens (µS/cm). A set point of the desired conductivity limit is entered into the controller through the front keypad. As this maximum limit is exceeded, a blowdown valve is opened. The system water with higher levels of TDS is blown down resulting in fresh make-up water being added, reducing the concentration of TDS in the cooling system.

The pH and Conductivity/pH controllers monitor and control pH by adding acid (or caustic) based on a set point entered into the controller through the front keypad. The set point has a built in limit timer that acts as a fail safe to prevent system overfeed. The design also includes a High/Low Conductivity/pH Alarm. The alarms can be operated in one of two modes: Track Set Point, in which an alarm offset is entered and the alarms automatically adjust themselves around the set point or Independently Set, which allows you to independently set both the High and Low Alarms.

The design also incorporates a Selectable Inhibitor Feed Timer which allows the user to choose 1 of 4 timer modes on which to base the addition of inhibitor.

1. "LIMIT TIMER" The Inhibitor Timer is actuated simultaneously with blowdown. The timer limits feed time during any single blowdown cycle, preventing overfeed.
2. "PERCENT TIMER" The Inhibitor Timer runs continuously for an adjustable time cycle, with output being activated for an adjustable percent of the time cycle.
3. "PERCENT POST BLOWDOWN" This mode keeps track of the total blowdown time and activates the Inhibitor Timer when the blowdown deactivates, for a percent of total blowdown time set.
4. "PULSE TIMER" With Accumulator and Totalizer. The controller accepts pulses from a contact head water meter located in the make-up line and/or blowdown line of the cooling system, to activate the Inhibitor Timer for an adjustable amount of time based on the amount of pulses received.

A mounted flow assembly with quick release sensor, flow switch and sample cock is provided with two of the Standard controllers, refer to Table 1, for the ease and convenience of installation and to facilitate periodic maintenance and sampling. The flow switch disables the outputs of the controller when flow is discontinued in the flow assembly.

A self charging capacitor is used to maintain time and history for up to two weeks. The EEPROM protects operating parameters during power outages. Hand/Off/Auto keys are provided on the keypad for immediate control of pumps, solenoid valves, etc., without scrolling through menus.

These controllers also allow the user to choose a rising or falling set point. The controller accepts options such as ORP, make-up conductivity, biocide timers, and/or communications.

TABLE 1

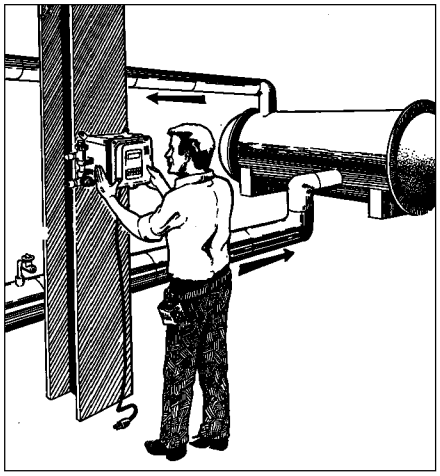
STANDARD FEATURES

Conductivity	pH	Conductivity/pH
Conductivity	pH Control	Conductivity
Hi/Lo Alarm Indicator	Hi/Lo Alarm Indicator	pH Control
Alarm Relay	Alarm Relay	Hi/Lo Alarm (pH)
Selectable Timer	Limit Timer (pH)	Hi/Lo Alarm (cond)
	Flow Assembly	Selectable Timer
		Limit Timer (pH)
		Flow Assembly

!!WARNING!!
CONTROLLER COULD BE DAMAGED AND VOID WARRANTY!

Avoid locations where the controller would be subjected to extreme cold or heat [less than 0ºF (-17.8ºC) or greater than 125ºF (52ºC)], direct sunlight, vibration, vapors, liquid spills or EMI (electromagnetic interference; i.e., strong radio transmission and electric motors).

2. INSTALLATION



LOCATION

Select a mounting location convenient to grounded electrical and plumbing connections. Mount the controller on a wall or other verticle surface with adequate lighting. Position so operator has access to the unit and a clear view of front panel display. Refer to Diagram 1, pg. 28, Standard Enclosure Dimensional Data and Mounting Hole Template for mounting details of our standard enclosures. Avoid locations where the controller would be subjected to extreme cold or heat. Note Warning at left. Installation should comply with national, state, and local codes.

NOTE: NOT ALL EQUIPMENT SHOWN IS PROVIDED WITH THE CONTROLLER AND IS FOR REFERENCE ONLY.

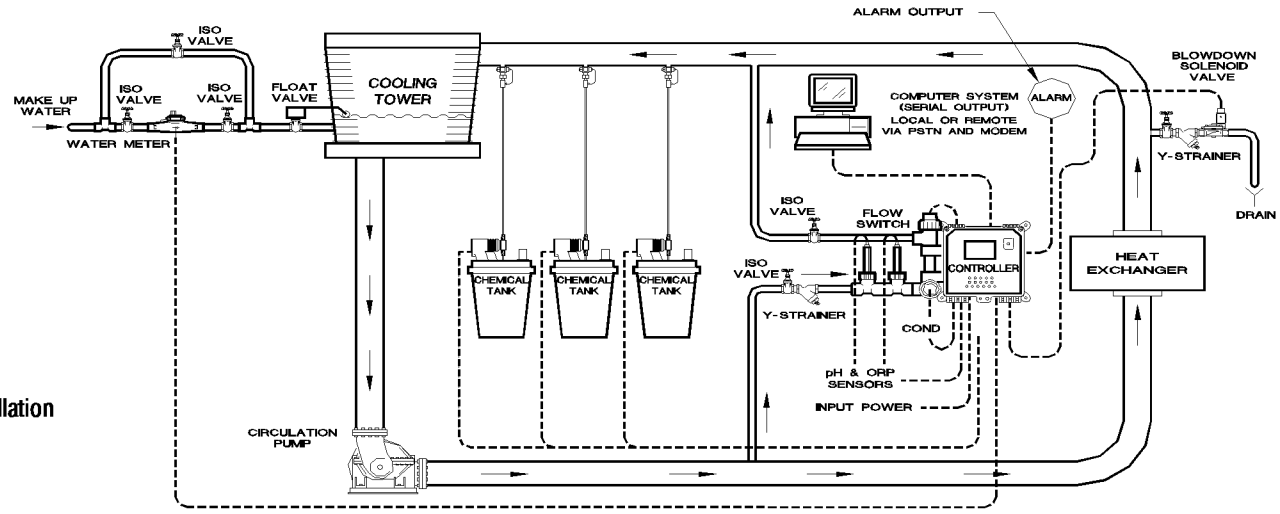


FIGURE 1
Typical Installation

NOTE:

The standard flow assembly, if provided with this controller, is constructed of durable glass filled polypropylene (GFPPL). Standard connection to flow line is 3/4" NPT. A PVC thread to slip adapter is provided so that a PVC weld joint, if preferred, can be made.

INSTALLATION NOTES

1. Install sensors or sample stream flow assembly at some point before chemical injection points, where chemical and water are thoroughly mixed. Refer to Figure 1.

2. Measuring surfaces of the sensors must be continuously immersed in system water.

3. The difference between inlet and outlet pressure must be sufficient to provide a flow rate of 1 GPM (3.8 l/m).

4. Install strainer on the upstream side of the flow assembly to collect debris that might affect controller operation. Install unions on both inlet and outlet.

5. Install hand valves on each side of the flow assembly for easy isolation and removal of sensors and strainer screens (see Fig.1).

6. Direction of flow should be from the bottom to the top of the flow assembly (see Fig. 2).

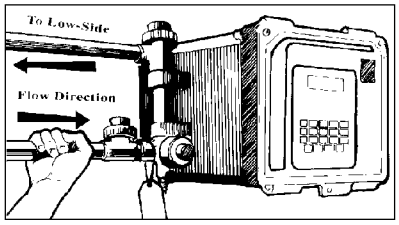


FIGURE 2
Hand tighten all NPT connections until snug plus 1/2 turn.

Note that a pressure differential must exist between the High and Low side for proper flow.

7. A manual valve should be installed in the blowdown line on the system side of the solenoid valve. This will be used for isolating and throttling (controlling the flow rate of blowdown) blowdown assembly if blowdown is incorporated.

8. Most solenoid valves require a pressure differential of 7 to 15 psi to close. If this is not available, install zero pressure solenoid valve, if blowdown is incorporated.

9. Always install a strainer upstream of the solenoid valve to collect debris that may clog solenoid valve if blowdown is incorporated.

10. For proper operation and accuracy, install water meters horizontally with meter face up if Pulse Timer mode is used.

11. If chemicals are to be injected into a sample line (not recommended) always use a back check valve to prevent chemicals from backing up around the sensor.

12. If a flow assembly or sample stream assembly is present, never install blowdown valve off these lines. System will not achieve proper blowdown and accuracy of controller readings may be affected.

13. Install sensors as shown in Figures 3-7 at right. After installation of sensors, open isolation valves to check for leaks.

NOTE:

A horizontal length equivalent to at least 12 pipe diameters must preceed the water meter inlet and a horizontal pipe length of 6 diameters must follow it. All piping in this area must be of the same diameter.

!!WARNING!!

Care should be exercised when removing the protective cover from the pH sensor. Save for future storage. Care should also be taken to prevent the glass bulb from hitting the tee or other piping. Never expose the sensor to air with power on for more than 45 seconds. Never allow the sensor to dry out. Use supplied rubber boot filled with proper storage solution. See Section 10. pg. 49 Maintenance for more information.

SENSOR INSTALLATION

Controller should be per installation diagram (see Figure 1). Make sure all fittings and connections are secure:

1. Remove power from the controller.

2. Close isolation hand valves located before and after the flow assembly.

3. Open the sample port on flow assembly to make sure no flow is present in the flow assembly.

4. Remove coupling nut(s) from sensor housings on flow assembly. Then remove threaded insert(s) by gently pulling straight out (Figure 3). Insert is held in place by rubber "O" ring.

5. Apply six wraps of teflon tape to threads of sensors (Figure 4).

6. Slip coupling ring over sensor, then hand tighten threaded insert on the teflon wrapped threads of sensor. (Figure 5)

7. If your controller is equipped with a pH or ORP sensor, remove the liquid filled protective cover from the sensor tip. IMPORTANT! Do not allow the sensor's tip to dry out, see Warning at left! (Figure 6)

8. Gently install sensor into sensor housing on flow assembly. Make sure sensor is firmly seated in housing. (Figure 7)

9. Slip coupling ring down onto housing threads and hand tighten.

10. Make sure sample port on flow assembly is closed and apply pressure and flow by opening hand valves slowly to avoid water hammer.

Refer to Diagrams 2, 2a, 3, and 3a, pgs. 29-31, for information and specifications for sensors supplied with your system.

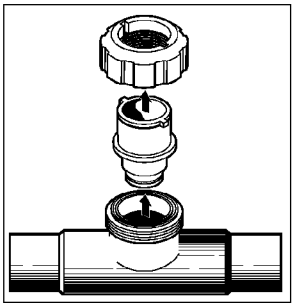


FIGURE 3

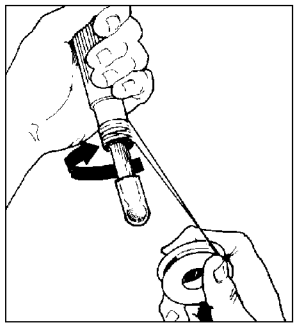


FIGURE 4

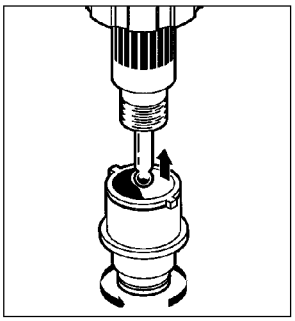


FIGURE 5

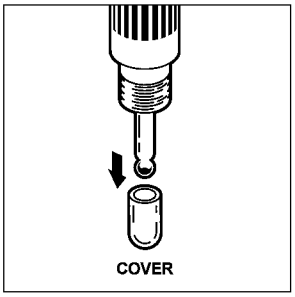


FIGURE 6
IMPORTANT! Do not allow the sensor's tip to dry out.

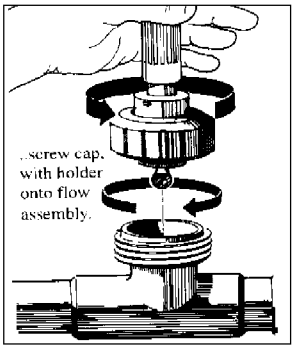


FIGURE 7

ACCESSORIES (not included)

The following accessories are suggested to complete installation.

1. Two manual gate valves, one on each side of the sensor or flow assembly if controller incorporates a flow switch, to isolate the sensor or flow assembly for installation and routine maintenance.
2. One needle valve, for isolating and throttling blowdown assembly if controller incorporates a blowdown valve.
3. Three manual gate valves, for isolating, by-passing and maintenance of water meter, if controller incorporates a water meter (optional).
4. Solenoid valve, if system incorporates blowdown.
5. Two Y-strainers, one before solenoid valve and the other before flow assembly.
6. Chemical metering pumps as required.
7. Contact head water meter, if controller incorporates a pulse timer (optional).
8. External alarm, if controller incorporates alarm relay. (See Figure 1, pg. 5)

!!WARNING!!

Unit must be wired in accordance with all applicable electrical codes.

ELECTRICAL WIRING

!!WARNING!!

Line voltage is present on the power supply located behind the Safety/EMI cover behind the front panel. Line voltage is also present on the relay board located in the bottom of enclosure, even when power is off.

POWER MUST BE DISCONNECTED WHILE CONNECTIONS ARE BEING MADE!

The controller electronic circuitry is fuse protected (refer to Diagram 10, pg. 40). In addition, each output relay is individually protected by replaceable plug-in 5 amp fuses on the relay board (refer to Diagram 4, 4a, pg. 32, 33). Use of a surge protector is strongly recommended! The device should satisfy the following minimum requirements:

Response Time:	< 1 ns
Energy Dissipation:	400 Joules
EMI/RFI Noise Attenuation:	5-35 dB

The controller should be connected to its own 15 amp power branch (i.e., its own wiring, circuit breaker, etc.) It must be properly grounded.

Prewired units are supplied with 6 foot (1.8 m), 18 AWG (1.2 mm) 3 wire grounded power cords and clearly marked 18 AWG (1.2 mm) 3 wire grounded receptacle cords for all controlled line voltage outputs.

Conduit units are factory predrilled with easily accessible connections for hard wiring. See Diagram 4, 4a, pg. 32, 33, Relay Board, for input and output power connections. **Use only 16 (1.5 mm) or 18 AWG (1.2 mm) wire for conduit power and load connections.**

Use 22 AWG (.76 mm) shielded wire for water meter, remote sensors, etc. Use wire provided with supplied sensors. These signal wires must be run separate from AC power lines.

NOTE: Liquid tight fittings are provided for all signal leads.

When connections are required by the end user, follow the instructions below. All electrical diagrams, circuit boards, etc., are located in Section 6, pages 28-40.

!!WARNING!!

When power is supplied to the unit, Line Voltage is present on the relay board located in the bottom of the enclosure, even with the power switch off.

OPEN ENCLOSURE

- Loosen thumb screw on dust cover and lift up.
- Loosen the 2 captive screws from upper control panel, gently swing the panel down on its hinges.

Note: The screws are retained and will not fall out.

FLOW SWITCH OR INTERLOCK

It is recommended that a flow switch or auxiliary dry contact from the control panel be used to make outputs inoperative when cooling tower is shut down. This connection is provided for on all units with or without mounted flow assembly. If a flow switch is not ordered with a unit, this function will be inoperative. To use the interlock feature, connect a flow switch or auxiliary dry contact from another device. See Diagram 4, 4a, pg. 32, 33, Relay Board, for flow switch or interlock connection location (connections are position 11 and position 12 FLOW

NOTE:

For proper rejection of AC line voltage spikes, sensor EMI noise rejection and personal safety, the case ground (SAFETY GROUND) must be properly installed. If there is ANY doubt, consult a qualified electrician.

SWITCH). To activate this function, turn the power switch off. Turn switch S1-"2" on. This switch is located on the mother board (refer to Diagram 7, pg. 36). Wait 15 seconds, and turn power back on.

SENSOR CONNECTIONS

Units supplied with polypropylene flow assemblies come from the factory with all sensors pre-connected. Refer to Diagram 5, 6, pg. 34, 35, Daughter Boards, for location of sensor connections. Use of non-factory provided sensors will void the warranty.

WATER METER (FOR PULSE TIMER)

Electrical wiring is required for water meters. Each individual timer is supplied with its own individual water meter input connection.

The Controller can be configured for up to three water meter inputs that can drive up to three selectable timers. A one water meter system could also drive up to three selectable timers. For a system where one water meter is required to drive more than one selectable timer, the water meter inputs must be jumpered to the second or third water meter input. Refer to Diagram 4, 4a, pg. 32, 33, Relay Board.

For **one water meter with two selectable timers, or one water meter with three selectable timers,** connect wire jumpers. Refer to Diagram 4, 4a, pg. 32, 33, Relay Board.

ALARM DRY CONTACT

Alarm dry contacts (rated @ 500 mA) are provided when Option K has been ordered for user connection. Refer to Diagram 4, 4a, pg. 32, 33, Relay Board.

RECEPTACLES

The Controller offers a unique prewired package. Each cord is clearly marked and readily accessible for connecting external electrical devices to be controlled. Refer to Section 15, pg. 63, for relay assignment information.

!!WARNING!!

When power is supplied to the unit, line voltage is present on the Relay Board located in the bottom of the enclosure even with the Logic Power switch off.

NOTE:

When Initializing or Re-Initializing your controller, all of the system settings will be overwritten by original factory default settings. The controller must be reconfigured to your specifications.

3. Start Up Instructions

READ THE FOLLOWING BEFORE PROCEEDING ANY FURTHER!!

INITIALIZATION

Note: If unit has been disconnected from power for a long time period (more than 2 weeks), when powered up the display may indicate charging with a percent value. When adequately charged, the display will AUTO SCROLL to **MAIN MENU**.

This unit requires initialization upon start-up. Before applying power, insure that devices being controlled are not in a position to cause harm or damage if activated upon initial start-up. With the controller now installed in a convenient location, INITIALIZE the Controller. Supply power to the controller and turn the Logic Power switch on. The power LED indicator light will be illuminated. When controller is powered up, the **MAIN MENU** (shown right) will be displayed.:

1. Use the ARROW keys to move the prompt to **SYSTEM CONFIGURE** and press ENTER.

2. Use the ARROW keys to move the prompt to **FACTORY REINIT** and press ENTER.

3. The Factory Re-Init Warning will be displayed. Continue to scroll down to the end of the warning and then press ENTER. Press the ENTER key to execute Factory Re-initialization. The unit will revert to AUTO SCROLL. Press the HOME key repeatedly to return to the **MAIN MENU**. NOTE: You may need to adjust the contrast after completing factory reinit!

FRONT PANEL

Take a moment to review Figure 8, to become familiar with the controller front panel.

```
      MAIN MENU
  AUTO SCROLL ON
  DISPLAY DATA
  CALIBRATE SENSORS
  SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
▶ SYSTEM CONFIGURE
```

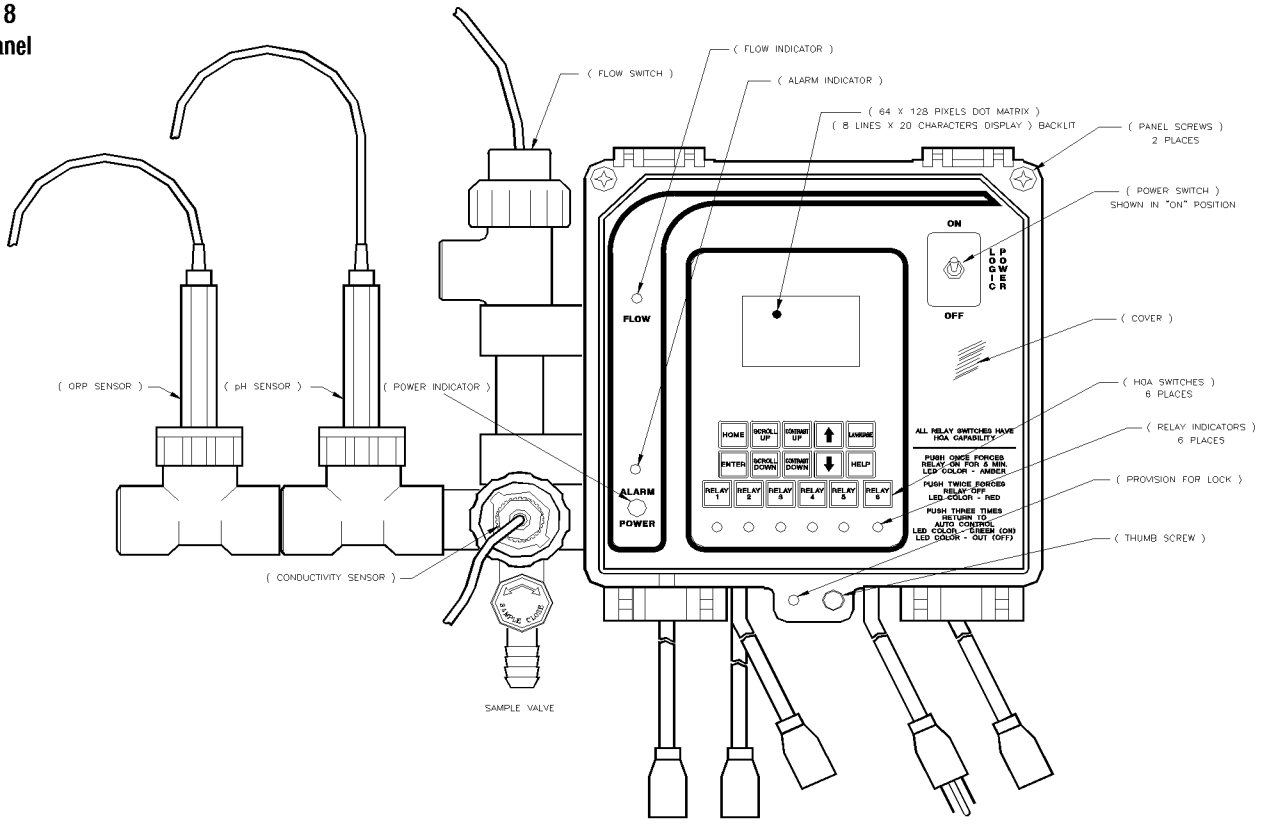
```
    SYSTEM CONFIGURE
▶ DAY WK DATE TIME
  SECURITY
  HI LO ALARM
  DISPLAY DAMPENER
  CONTROL SET POINT
  ALARM RELAY SELECT
  PRESS <HELP>
```

Press SCROLL DOWN to reveal rest of System Configure Menu. Actual screens displayed may vary according to options available.
FACTORY REINIT is present on all controllers.

```
    SYSTEM CONFIGURE
  SCALE/RANGE SYS COND
  SCALE/RANGE MAKE UP
  INHIBITOR TIMER 1
  TOTALIZER              0
▶ FACTORY REINIT

  PRESS <HELP>
```

```
    FACTORY REINIT
      WARNING
  FACTORY REINIT WILL
  OVERWRITE ALL OF THE
  PREVIOUS PROGRAMMING

  ENTER KEY TO CONTINUE
  HOME KEY TO EXIT
```

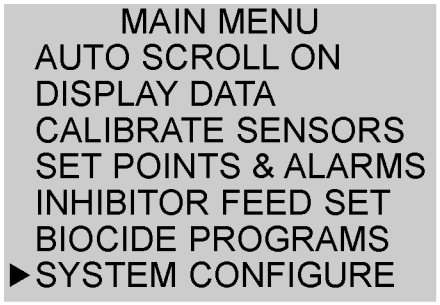
FIGURE 8
Front Panel



TIP:

For help with menu locations, please refer to the "Menu Map" supplied with your controller.

MENU STRUCTURE



The Controller menu structure and hardware are designed to be user friendly. This Main Menu structure diagram shows the first level of all sub-menus in the controllers. Not all sub-menus shown here may be present with your controller. The laminated "MENU MAP" supplied with the controller reflects your specific system with options.

Auto Scroll Displays Date, Time, Week Number, Software Version, and present sensor readings. It also shows System Alarms and source if alarm is activated. Note: After three minutes of no keypad activity, the controller will start to Auto Scroll automatically.

Display Data This menu displays system parameters only. No settings or adjustments are made through this menu. Present System Conductivity, system pH, and ORP conditions are displayed along with configured rising or falling set points and alarms.

Calibrate Sensor(s) This menu is for analog input sensor calibration, such as conductivity, make-up conductivity, pH, and ORP. In this menu, the user is prompted to choose either 2 or 3 point calibration. After a choice is made, the user is prompted to enter values of LO, MID (if 3 point is chosen) and HI calibration solution.

Set Points and Alarms In this menu, the user is prompted to enter settings pertaining to alarms and set points that control the system operation.

Inhibitor Feed Set In this menu, the user is prompted to enter settings pertaining to the inhibitor feed mode chosen in the System Configure menu.

Biocide Programs In this menu the user is prompted to enter all settings pertaining to the biocide program timer.

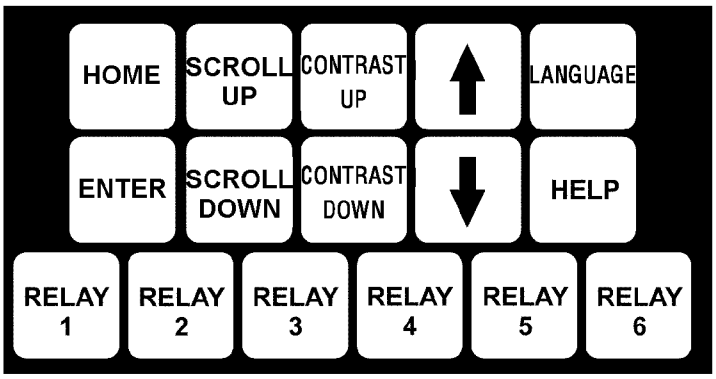
NOTE:

After five minutes of no keypad activity, the controller will display date, time, and system conductivity.

System Configure This is generally the first selection made at start up. In this menu, the user is prompted to configure system functions and options to your specific application. System Configure can include such things as time of day, date, security code, track set point or independent set of high/low alarm, display dampener, rising or falling set points, operating scale, the selection of the inhibitor feed mode, water meter pulse totalizer, analog output selection, and factory reinitialization.

KEY PAD OPERATION

The Key Pad is easy to use and will guide you through all the sub menus and functions of the controller.



TIP:

When using the Arrow Keys, press once to change numbers by one unit. Hold down either Arrow Key to change numbers more rapidly.

Feel free to try out these keys as you read about them. You will not hurt the controller and the values will need to be reprogrammed later anyway.

Home Press this key to return to previously displayed menu.

Scroll Up/Scroll Down Some menus contain more choices than can be displayed at once. Press either key to reveal other items on menu displayed. If no other choices are present, nothing will happen when pressing Scroll Keys. The Menu Map supplied with your controller will show you which menus need to be scrolled to show additional choices.

Contrast Up/Contrast Down Press these keys to control contrast of viewing screen.

Arrows These keys are used to move the triangular cursor or "prompt" as it is referred to in this manual (see Main Menu screen at top of page.) The Arrow Keys are also used to change the numbers associated with the various settings you will be entering. Use "down" arrow to select lower numbers and the "up" arrow to select higher numbers.

Enter This key has three functions:

FIRST, after moving the prompt with the Arrow Keys to a menu choice, press the Enter Key to display the sub menu of the choice you selected..

SECOND, within the sub menu, after moving the prompt with the Arrow Keys to the selection of your choice, pressing the Enter Key will activate the selection (the prompt and the value to be changed will begin to flash).

THIRD, after selecting the value needed with the Arrow Keys, press the Enter Key to "lock-in" the value. The prompt and value selected will quit flashing. Or, if other values are present within the selection chosen, the prompt and the next value in line will begin flashing.

!!WARNING!!

NEVER leave a screen with choices still "flashing"! Controller accuracy may be affected, and/or controller may not operate properly.
If you forget, simply return to that menu and complete your programming.

Help When pressed, this key will display simple instructions for the operation of the Enter, Home, Arrows, and Scroll keys.

Relays (1-6) These Hand/Off/Auto (HOA) keys allow immediate control of pumps, solenoid valves, etc. affected by the controller without scrolling through the menus. Press a Relay Key once to force relay on for 5 minutes (an amber light will appear below that key). Press the Relay Key again to force the relay off (a red light will appear below that key, relay will be forced off until key is pressed again). Press the Relay Key a third time to return the relay to auto control (green light will indicate that relay is on, no light indicates that relay is not activated).

SAMPLE PROGRAMMING

The following is a detailed example of how to program your controller. Once you have mastered this exercise, you will be ready to set up the controller to your specifications.

IMPORTANT! Please note that in all programming instructions, *keypad instructions* are presented as all capitals—"ENTER," items as they *appear in the display* are presented as all capitals and bold face—"**DISPLAY DATA**."

For this exercise, you will set "**DAY, WEEK, DATE, and TIME**."

```
        MAIN MENU
  AUTO SCROLL ON
  DISPLAY DATA
  CALIBRATE SENSORS
  SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
▶ SYSTEM CONFIGURE
```

1. If not already displayed, press HOME until **MAIN MENU** is displayed. Then use ARROW keys to move prompt to **SYSTEM CONFIGURE.**

Press ENTER to display **SYSTEM CONFIGURE** menu.

```
  SYSTEM CONFIGURE
▶ DAY WK DATE TIME
  SECURITY
  HI LO ALARM
  DISPLAY DAMPNER
  CONTROL SET POINT
  ALARM RELAY SELECT
  PRESS <HELP>
```

2. Move prompt with ARROW keys to **DAY WK DATE TIME**.

Press ENTER to display **DAY WK DATE TIME** menu.

```
  DAY  WK  DATE  TIME

  ENTER WEEK DAY
▶          2ND WK    TUE
  ENTER
  DATE            00/00/1995
  TIME              00:00
  PRESS <HELP>
```

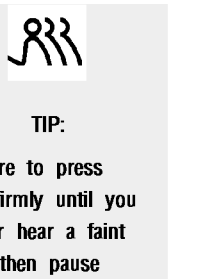
3. Move Prompt with ARROW keys to line below **ENTER WEEK DAY**. (**WEEK** will not appear if your controller does not have a Biocide Option.)

Press ENTER.

(Continued on next page)

TIP:

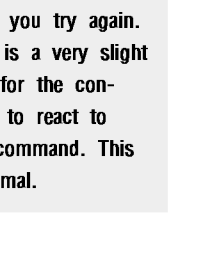
Be sure to press keys firmly until you feel or hear a faint click, then pause before you try again. There is a very slight delay for the controller to react to your command. This is normal.



4. Prompt and **WK** will flash. Use the ARROW keys to display **1ST, 2ND, 3RD,** or **4TH WK** (week).

Press ENTER.

NOTE: Week (**WK**) setting is available only if Biocide Options are installed.



5. Prompt and Day of the week will flash. Use the ARROW keys to select current day of the week.

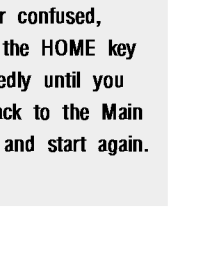
Press ENTER.

TIP:

If at any time, while programming your controller, you get lost or confused, press the HOME key repeatedly until you get back to the Main Menu and start again.

6. Move Prompt with the ARROW keys to **DATE** and press ENTER. Prompt and Month will flash. Select current Month with ARROW keys.

Press ENTER to complete



7. Prompt and Date will flash. Select current date with ARROW keys.

Press ENTER.

8. Prompt and Year will flash. Select current year with ARROW keys.

Press ENTER.

9. Move Prompt with the ARROW keys to **TIME**. Press Enter. Prompt and Hour will flash. Select current hour (24 hour clock) with the ARROW keys.

Press ENTER.

10. Prompt and Minutes will flash. Select current minutes with the ARROW keys.

Press ENTER. Nothing should be flashing and that completes **DAY WK DATE TIME** programming.

Congratulations, you've done it! All menu programming functions operate in this manner. Feel free to repeat this exercise as often as you like until you are comfortable with the programming proce-

4. CONTROLLER SET UP

!!WARNING!!

When power is supplied to the unit, line voltage is present on the Relay Board located in the bottom of the enclosure even with the Logic Power switch off.

NOTE:

When Initializing or Re-Initializing your controller, all of the system settings will overwritten by original factory default settings. The controller must be re-configured to your specifications.

TIP:

For help with menu locations, please refer to the "Menu Map" supplied with your controller.

GENERAL INFORMATION

Before applying power, insure that devices being controlled are not in a position to cause harm or damage if activated upon initial start-up. With the controller now installed in a convenient location, INITIALIZE Controller (see initialization procedure, pg. 9). Supply power to the controller and turn power switch on. The power LED indicator light will be illuminated. When controller is powered up, the **MAIN MENU** (shown right) will be displayed.

If display contrast requires adjustment, use the CONTRAST UP or CONTRAST DOWN keys on the control panel key pad to adjust screen for best viewing.

The default values for all Control features have been factory set, but you will want to fine tune the controller to meet your specific application.

SYSTEM CONFIGURE

Configure the controller functions using the ARROW keys to move the Prompt to **SYSTEM CONFIGURE** on the main menu (shown at right). Press ENTER and the selections to be configured will be displayed. If a security code has been entered, press ENTER and enter code as prompted..

A) Set DATE/DAY/TIME:

1. Please refer to Section 3 (pg. 11) Sample Programming.
2. When completed, press HOME once to return to **SYSTEM CONFIGURE** menu.

B) Set SECURITY Access Code:

The Controller can be configured to have a Security Access Code. One must know this code to access the System Configure menu. **Note: System Configure Security provides security for the System Configure Menu only.**

1. Use the ARROW keys to move the prompt to **SECURITY** and press ENTER. **SECURITY DISABLED** will appear. (If a security code has been entered, "SECURITY 0000" will be displayed. Press ENTER, prompt will flash. Enter security code using ARROW keys. Press ENTER, System Configure menu items will be displayed.)

   To set a security code, press ENTER. Press the UP ARROW key to display the desired code and press ENTER. After a security code has been entered, the operator must know the code to access the System Configure menu items.

2. To disable the code after it has been entered, you must first know the code. Use the ARROW keys to move the Prompt to **SYSTEM CONFIGURE** on the main menu. Press ENTER.

3. **ENTER SECURITY CODE** menu will be displayed. Press ENTER, prompt will flash, use the ARROW keys to enter the security code. Press ENTER, display will return to **SYSTEM CONFIGURE** menu with prompt next to **SECURITY**.

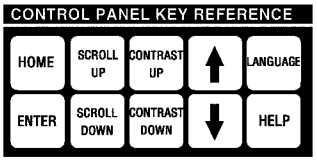
4. Press ENTER to return to **ENTER SECURITY CODE** menu. Press ENTER, prompt will flash. Press and hold DOWN ARROW key until display shows **DISABLED** and press enter.

5. Press HOME once to return to **SYSTEM CONFIGURE** menu.

```
      MAIN MENU
▶ AUTO SCROLL ON
  DISPLAY DATA
  CALIBRATE SENSORS
  SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
  SYSTEM CONFIGURE
```

```
      MAIN MENU
  AUTO SCROLL ON
  DISPLAY DATA
  CALIBRATE SENSORS
  SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
▶ SYSTEM CONFIGURE
```

CONTROL PANEL KEY REFERENCE




```
    SYSTEM CONFIGURE
▶ DAY WK DATE TIME
  SECURITY
  HI LO ALARM
  DISPLAY DAMPENER
  CONTROL SET POINT
  ALARM RELAY SELECT
  PRESS <HELP>
```

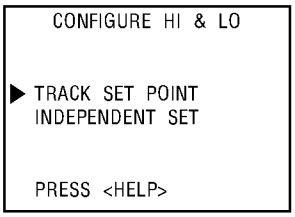
```
    ENTER SECURITY CODE


▶ SECURITY    DISABLED


  PRESS <HELP>
```

C) Set HI/LO ALARM:
You have the choice to select "Track Set Point" or "Independent Set Point." Selecting "Track Set Point" will cause the Hi and Low alarms to "Track" the setpoint by a given offset. In this case you specify only an offset. The Hi alarm point is calculated by adding the offset to the setpoint. The Low alarm point is calculated by subtracting it.
Selecting "Independent Set Point" allows you to set the Hi and Low alarm values independently.

1. Use the ARROW keys to move the prompt to **HI LO ALARM** and press ENTER. The prompt indicates the present alarm mode, either **TRACK SET POINT** or **INDEPENDENT SET** of high and low alarms.

2. Use the ARROW keys to move the prompt to the desired alarm mode. Press ENTER and the prompt will blink, reminding you to ENTER your choice.

3. Press HOME to return to the **SYSTEM CONFIGURE** menu.

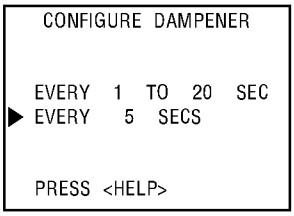


D) Set DISPLAY DAMPENER:
This setting determines the number of samples that are averaged together and the number of seconds before a new reading is displayed. This reduces the typical fluctuation of digital displays.

1. Use the ARROW keys to move the prompt to **DISPLAY DAMPENER**, press ENTER. The display dampener last set or the factory setting will be displayed.

2. Press ENTER and the display will prompt you to set sensitivity or display dampening with the ARROW keys, **1** being the most sensitive and **20** being the least, press ENTER.

Note: Does not affect control.



NOTE:

Pressing "Scroll Up or Down" will show more of the menu if additional selection choices are available in that menu.

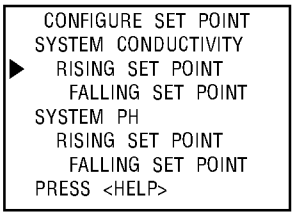
E) Set CONTROL SET POINT:
This setting gives you the option to configure either a rising or falling set point for Conductivity, pH, and ORP (if equipped) values. A rising set point means that relays are activated above the set point, falling set point means that relays are activated below the set point. Depending on which model of the controller you have, your choice of control set point will be available for System Conductivity, System pH, and/or System ORP. All configure in the same manner as described below.

1. Use the ARROW keys to move the prompt to **CONTROL SET POINT**. Press ENTER.

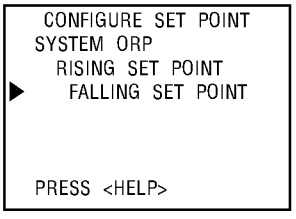
2. When the Configure Set Point screen appears, the position of the prompt will indicate the present control set point mode, **RISING** or **FALLING**. Use the ARROW keys to move the prompt to the desired control set point mode. Press ENTER and the prompt will flash. Press ENTER again to enter your choice.

3. Use the ARROW keys to move the prompt to configure other set points.

4. Press HOME to return to **SYSTEM CONFIGURE**.



Press SCROLL DOWN to reveal rest of Configure Set Point Menu. ORP Set Point options will appear if this option is present.



NOTE:

When an alarm relay is activated for a certain condition ("✓" next to selection), a signal is sent to an externally connected alarm, computer, or some other monitoring device. A deactivated alarm condition (no "✓" next to selection) means that no alarm signal will be sent to an external device.
In either instance, the alarm LED on the face of the controller will still light up if an alarm condition exists.

F) Set ALARM RELAY SELECT, ALARM DRY CONTACT
This setting lets you choose which system condition will activate an external alarm relay.

1. Use the ARROW keys to move the prompt to **ALARM RELAY SELECT** and press ENTER. When Alarm Relay Select menu appears, a "✓" indicates which system condition will activate the alarm relay. Use the ARROW keys to move the prompt to the system condition you want to activate/deactivate the alarm relay.

2. Press ENTER. Press ENTER again and a "✓" will appear or disappear next to your selection depending on what was showing at that system condition.

3. Press HOME to return to **SYSTEM CONFIGURE**.

The alarm dry contact provides provides an alarm dry contact which can be interfaced with a computer or energy management system. Make electrical connections for the alarm dry contact on terminal strip as follows (refer to Diagram 4, 4a, Relay Board, pg. 32, 33, for connections) :

Connection 1 Relay Common A1
Connection 2 N.O. A2
Connection 3 Relay Common B1
Connection 4 N.O. B2

```
   ALARM RELAY SELECT
▶ ✓HIGH ALARM SYS COND
  ✓HIGH ALARM SYS PH
  ✓HIGH ALARM SYS ORP
  ✓LOW ALARM SYS COND
  ✓LOW ALARM SYS PH
  ✓HIGH ALARM SYS ORP
  PRESS <HELP>
```

Press SCROLL DOWN to reveal rest of Alarm Relay Select Menu.

```
   ALARM RELAY SELECT
  ✓LIMIT TIME SYS PH
  ✓LIMIT TIME SYS ORP
    NO FLOW
     INH TIME ALARM


  PRESS <HELP>
```

G) Set SCALE/RANGE:
This selection lets you choose the conductivity range you wish your controller to monitor.

1. SCROLL DOWN in **SYSTEM CONFIGURE** menu to reveal **SCALE/RANGE** selection.

2. Press ENTER and the prompt will indicate the present scale. Use the ARROW keys to move the prompt to the desired scale.

3. Press ENTER and the prompt will blink, reminding you to press ENTER again to make the selection. A message will appear, reminding you to change switch on daughter board, display will freeze for seconds.

4. Press HOME to return to **SYSTEM CONFIGURE** menu.

```
      CONFIGURE SCALE

  500    US/CM    SWITCH 1
  2000   US/CM    SWITCH 2
▶ 5000   US/CM    SWITCH 3
  10000  US/CM    SWITCH 4
  20000  US/CM    SWITCH 5
  PRESS <HELP>
```

!!WARNING!!

If the Scale-Range is changed (present scale will display in the "Main Menu, Display Data" menu when you press the Home key), the keypad becomes inoperative for 15 seconds. A reminder will appear that a switch on the daughter board must be changed also! See table at right for proper switch configuration.

Scale/Range Table (refer to Diagram 5, Conductivity Daughter Board, pg. 34)

	S2-"5"	S2-"4"	S2-"3"	S2-"2"	S2-"1"
0-500					•
0-2,000				•	
0-5,000			•		
0-10,000		•			
0-20,000	•				

• = Closed (or On)

Your Controller comes from the factory pre-configured to monitor conductivity in the range of 0-5,000 µS/cm. The ranges listed in the Scale/Range Table can be selected by the setting of the five dip switches located just left of the sensor input on the conductivity daughter board. Refer to Diagram 5, pg. 34.

Note: Assure that only one scale switch is in the closed position. The corresponding range must also be selected from the keypad under the **SYSTEM CONFIGURE** menu.

If your controller is equipped with the make-up conductivity option, a "scale/range make-up" item will also appear under the "input scale" menu.

```
    SYSTEM CONFIGURE
  SCALE/RANGE SYS COND
▶ SCALE/RANGE MAKE UP
  INHIBITOR  TIMER  1
  TOTALIZER          0
  FACTORY  REINIT

  PRESS <HELP>
```

NOTE:

TOTALIZER keeps track of water meter pulses. Totalizer will count even if the system is not in pulse timer feed mode and a water meter with a contact head is connected. See configure menu.

NOTE:

Pulse count may also be read in the INHIBITOR FEED SET main menu if system is configured for pulse timer.

!!WARNING!!
CONTROLLER COULD BE DAMAGED AND VOID WARRANTY!

Analog outputs are self powered. Do not try to externally loop power.
Externally powered outputs will damage your controller!

H) Set SELECTABLE INHIBITOR TIMER

This selection lets you choose the method desired to control the operating duration of the inhibitor feed pump when activated by system blowdown.

1. Use the ARROW keys to move the prompt to **INHIBITOR TIMER** in System Configure menu.
2. Press ENTER and the prompt will indicate the present inhibitor feed mode. Use the ARROW keys to move the prompt to desired feed mode.
3. Press ENTER and the prompt will flash, reminding you to press ENTER again to make the selection.
4. Press HOME to return to **SYSTEM CONFIGURE** menu.

```
   SYSTEM CONFIGURE
  SCALE/RANGE

▶ INHIBITOR TIMER
  TOTALIZER          0
  ANALOG OUTPUT  1   CAL
  ANALOG OUTPUT  2   CAL
              PRESS <HELP>
```

```
   CONFIG  INH  FEED

▶ LIMIT TIMER
  PERCENT TIMER
  PULSE TIMER
  PERCENT POST BLOWDWN

  PRESS <HELP>
```

I) Set TOTALIZER

The Totalizer displays the accumulated number of pulses received from a contact head equipped water meter. This selection lets you reset or enter a count value.

1. Use the ARROW keys to move the prompt to **TOTALIZER**.
2. To reset the totalizer, press ENTER. Use the ARROW keys to set the reset to zero or to the desired count and press ENTER. Press HOME to return to **SYSTEM CONFIGURE** menu. Use the ARROW keys in the main menu to access other primary menu categories.

```
   SYSTEM CONFIGURE
  SCALE/RANGE

  INHIBITOR TIMER
▶ TOTALIZE           0
  ANALOG OUTPUT 1 CAL
  ANALOG OUTPUT 2 CAL
  PRESS <HELP>
```

J) Set ANALOG OUTPUT

Analog outputs are designed for interfacing with recorders, pumps and computers.

The programmable option is an Isolated Proportional 4-20 mA output, designed to interface with an analog recorder, metering pump or computer. The output is 4-20 mA over a programmable range. For example, if the analog input was pH, the output could be programmed to be 4 mA at 6.7 pH, the “LO RANGE” set point, and 20 mA at 8.2 pH, the “HI RANGE” set point”.

Analog outputs require calibration upon initial start up. Calibration is recommended after changing scales or after factory reinitialization. For accurate calibration of the analog output, a milliamp meter is required.

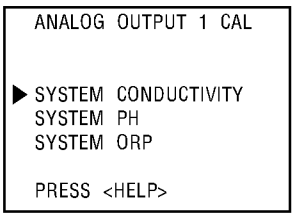
Calibration

Note: LO = 4 mA
HI = 20 mA

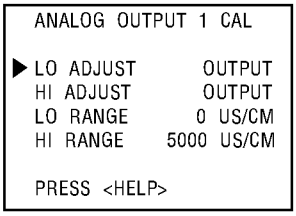
1. Remove signal wires if installed and connect a milliamp meter to output connections on daughter board. Observe proper polarity (+/-). Refer to Diagram 8, pg. 37, for connections. **Note:** The Diagram reflects a dual or 2 channel board. Depending on your controller model, there may be connections for only one output.
2. Use the ARROW keys to move the prompt to **ANALOG OUTPUT 1 CAL** (you will need to scroll in System Configure menu to get to these selections). If more than one analog output is present, use the ARROW keys to move the prompt to the analog output to be programmed. Refer to menu screen, shown right.

```
   SYSTEM CONFIGURE
  SCALE/RANGE

  INHIBITOR TIMER
  TOTALIZER            0
▶ ANALOG OUTPUT 1 CAL
  ANALOG OUTPUT 2 CAL
  PRESS <HELP>
```

3. Press ENTER and the analog output (**SYSTEM CONDUCTIVITY, PH, OR ORP**) to be controlled or monitored will be displayed. Use ARROW keys to move the prompt to the analog output to be tagged and programmed. Press ENTER, the prompt will flash.

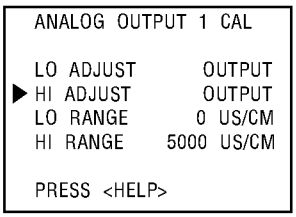


4. Press ENTER and SCROLL DOWN to **LO ADJUST OUTPUT**. Press ENTER and while the prompt is blinking, use the keys to adjust the "LO" mA reading on the externally connected milliamp meter. Press ENTER to enter the "LO" calibration adjustment.

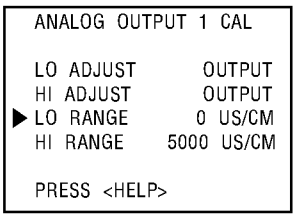


5. Use the ARROW keys to move the prompt to **HI ADJUST OUTPUT**. Press ENTER and while the prompt is blinking use the ARROW keys to adjust the "HI" mA reading on the externally connected milliamp meter. Press ENTER to enter the "HI" calibration adjustment.

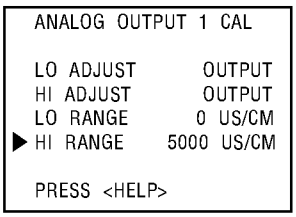
If the controller is equipped with the programmable option continue with steps 6 and 7. If not, continue with step 8 below.



6. Use the ARROW keys to move the prompt to **LO RANGE**(unit of measure for analog low range set point will be displayed). Press ENTER, prompt will flash. Use the ARROW keys to set **LO RANGE** as prompted. Press ENTER to enter **LO RANGE** set point.



7. Use ARROW the keys to move the prompt to **HI RANGE** (unit of measure for analog high range set point will be displayed). Press ENTER prompt will flash. Use the ARROW keys to set **HI RANGE** as prompted. Press ENTER to enter **HI RANGE** set point.



8. Press HOME to return to **SYSTEM CONFIGURE** menu. If more than one programmable option is present, use the ARROW keys to move the prompt to analog output not previously programmed and repeat steps 2 through 5. If no other analog outputs are present, continue with step 9.

9. Press HOME to return to **SYSTEM CONFIGURE** menu. Press HOME again to return to **MAIN MENU**.

10. Remove milliamp meter and connect analog recorder, metering pump or computer. Be sure to maintain proper polarity when connecting external devices!

SET POINTS AND ALARMS

NOTE:

When configuring Inhibitor Feed Timer in System Configure menu, you may select only one of four (4) possible feed modes.

Rising or Falling Set Point

The setting at which the controller activates an output, such as a solenoid valve when the conductivity set point is exceeded or an acid pump when pH exceeds the desired limit, or a chemical pump if the ORP set point is exceeded (depending on the model number of your controller).

1. Use the ARROW keys to move the prompt in **MAIN MENU** to **SET POINTS & ALARMS**. Press ENTER and the **SET POINTS & ALARMS** menu will be displayed.

```
        MAIN MENU
  AUTO SCROLL ON
  DISPLAY DATA
  CALIBRATE SENSORS
▶ SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
  SYSTEM CONFIGURE
```

2. Use the ARROW keys to move the prompt to **SYSTEM CONDUCTIVITY**. Press ENTER, **SYSTEM CONDUCTIVITY** menu will appear.

```
  SET POINTS & ALARMS
▶ SYSTEM CONDUCTIVITY
  SYSTEM PH
  SYSTEM ORP


  PRESS <HELP>
```

3. Use ARROW keys to move prompt to **R SET PT____US/CM** (the factory setting or the last set point entered) will be displayed. Press ENTER, prompt will flash. Use the ARROW keys to set the desired set point. Press ENTER to enter your value.

```
  SYSTEM CONDUCTIVITY
▶ R SET PT      1500 US/CM
  SPT DIFF       100 US/CM
  HI ALARM      1700 US/CM
  LO ALARM      1300 US/CM
  AL OFFSET      200 US/CM

  PRESS <HELP>
```

TIP:

For help with menu locations, please refer to the "Menu Map" supplied with your controller.

Set Point Differential

Also referred to as dead band or hysteresis. The offset applied to a set point to prevent chattering of an output relay around a set point.

4. Use the ARROW keys to move the prompt to **SPT DIFF____US/CM** (the factory setting or the last set point differential entered will be displayed. Press ENTER, prompt will flash. Use the ARROW keys to set the desired set point differential. Press ENTER to enter your value.

```
  SYSTEM CONDUCTIVITY
  R SET PT      1500 US/CM
▶ SPT DIFF       100 US/CM
  HI ALARM      1700 US/CM
  LO ALARM      1300 US/CM
  AL OFFSET      200 US/CM

  PRESS <HELP>
```

High or Low Alarm Settings

Every analog input has a high/low alarm indicator. The alarms can be configured one of two ways. The controller is factory configured to track the set point. An alarm offset is entered which sets the alarm point above and below the set point of the controller. Example: With an "AL OFFSET" of 200, if the set point is 1200, the high alarm would be at 1400 and the low alarm at 1000. The high/low alarms can also be configured with independent set points for the "High Alarm" and the "Low Alarm". This is accomplished in "HI LO ALARM" under the "SYSTEM CONFIGURE" menu. Refer to the Menu Map for INDEPENDENT SET of display screens.

NOTE:

Set "Track" or "Independent" Set point in the System Configure menu. See C), pg. 14.

5. Use the keys to move the prompt to **AL OFFSET** (AL OFFSET is displayed if HI LO ALARM has been configured to "Track Set Point" under system configuration. If so, skip steps 6 & 7. If HI LO ALARM was configured for "Independent Set", skip step 5 and proceed with steps 6 & 7).
The factory setting or the last alarm offset entered will be displayed. Press ENTER, prompt will flash. Use the ARROW keys to set desired alarm offset. Press ENTER to enter your value.

```
  SYSTEM CONDUCTIVITY
  R SET PT      1500 US/CM
  SPT DIFF       100 US/CM
  HI ALARM      1700 US/CM
  LO ALARM      1300 US/CM
▶ AL OFFSET      200 US/CM

  PRESS <HELP>
```

6. Use the ARROW keys to move the prompt to **HI ALARM**. The factory setting or the last high alarm entered will be displayed. Press ENTER, prompt will flash. Use the ARROW keys to set desired Hi Alarm setting. Press ENTER to enter your value.

TIP:

TO RESET LIMIT TIMER:

1) Cycle power.

2) Satisfy the condition by manually feeding, etc.

7. Use the ARROW keys to move the prompt to **LO ALARM**. The factory setting or the last high alarm entered will be displayed. Press ENTER, prompt will flash. Use the ARROW keys to set desired Lo Alarm setting. Press ENTER to enter your value.

8. Press HOME key to return to SET POINTS & ALARMS menu. Repeat steps 2 through 7 to configure set points and alarms for system pH and ORP.

9. Use ARROW keys to move prompt to **SYSTEM PH** in **SET POINTS & ALARMS** menu, press ENTER.

10. **SYSTEM PH** menu appears. Press SCROLL DOWN to reveal **LIM TIMER** and **RUN TIME**.

11. **LIM TIMER __:__ H:M** and the factory setting or the last time entered will be displayed. Press ENTER, prompt and value for hours will flash. Use the ARROW keys to set the desired limit hours. Press ENTER after entering hours, minutes will flash. Use the ARROW keys to set the desired limit minutes. Press ENTER.

12. **RUN TIME __:__ H:M** will be displayed below. This is the elapsed run time. Press HOME to return to "SET POINTS & ALARMS menu. Repeat steps 9 through 11 to configure Limit Timer for System ORP.

```
SET POINTS & ALARMS
SYSTEM CONDUCTIVITY
▶ SYSTEM PH
SYSTEM ORP


PRESS <HELP>
```

```
SYSTEM PH
▶ R SET PT        7.40 PH
SPT DIFF          0.20 PH
HI ALARM          9.40 PH
LO ALARM          5.40 PH
AL OFFSET         2.00 PH

PRESS <HELP>
```

Limit Timer (pH and Conductivity/pH Controller)
Also referred to as lockout timer or feed limit timer. Displayed only if the analog input, pH or ORP is available on your controller. This limits the amount of time output is activated. The timer is adjustable in one minute increments up to 24 hours; factory set for 1 hour, 30 minutes.

10. SCROLL DOWN to **LIMIT TIMER 1 (or 2)**. The factory setting or the last time entered will be displayed flashing. Use the ARROW keys to set the desired limit time, press ENTER.

11. Press HOME repeatedly to return to **MAIN MENU-DISPLAY DATA.**

```
SYSTEM PH

▶ LIM TIMER    01 : 30 H:M
RUN TIME       00 : 00 H:M


PRESS <HELP>
```

NOTICE:

When configuring Inhibitor Feed Timer in System Configure menu, you may select only one of the modes present.

SELECTABLE INHIBITOR FEED TIMER

The inhibitor feed timer for this controller is selectable; the user can choose one of four modes on which to base the addition of inhibitor. The selection of timer modes is made in the **SYSTEM CONFIGURE** menu. Only the mode selected in System Configure will be displayed in the **INHIBITOR FEED SET** menu. Refer to the following timer mode instructions for the mode you selected in the SYSTEM CONFIGURE menu.

Limit Timer
Also referred to as lockout timer. The chemical feed pump is actuated based on conductivity simultaneously with blowdown. The timer limits the length of time the pump can be activated during any single blowdown cycle, preventing overfeed that could occur if the blowdown line were clogged. The timer is adjustable in one minute increments up to 23 hours and 59 minutes with an elapsed-time display.

```
MAIN MENU
AUTO SCROLL ON
DISPLAY DATA
CALIBRATE SENSORS
SET POINTS & ALARMS
▶ INHIBITOR FEED SET
BIOCIDE PROGRAMS
SYSTEM CONFIGURE
```

1. Use the keys to move the prompt through the **MAIN MENU** to **INHIBITOR FEED SET**. Press ENTER, **INHIBITOR FEED SET** menu will be displayed with prompt next to **INHIBITOR TIMER**.

```
INHIBITOR FEED SET
▶ INHIBITOR TIMER


PRESS <HELP>
```

!!WARNING!!

Setting the Limit Timer time to 00:00 disables the Limit Timer.

2. Press ENTER, **ENTER LIMIT TIME** will be displayed with prompt next to **RUN TIME**. Press ENTER and use the ARROW keys to set the desired limit time (**RUN TIME __:__ H:M**) as prompted, press ENTER.

3. Press HOME key repeatedly to return to **MAIN MENU**.

INHIBITOR FEED SET
ENTER LIMIT TIME

▶ RUN TIME 10:00 H:M
ELAPSED 00:00 H:M

PRESS <HELP>

TIP:

For help with menu locations, please refer to the "Menu Map" supplied with your controller.

Percent Timer

Also referred to as a cycle timer. The timer runs continuously on an adjustable time cycle, such as ten minutes, with the output being activated for an adjustable percentage of the time cycle. The timer is adjustable in one percent increments up to 100 percent and the cycle time is adjustable from one to 120 minutes.

1. Use the keys to move the prompt through the **MAIN MENU** to **INHIBITOR FEED SET**. Press ENTER, **INHIBITOR FEED SET** menu will be displayed with prompt next to **INHIBITOR TIMER**.

MAIN MENU
AUTO SCROLL ON
DISPLAY DATA
CALIBRATE SENSORS
SET POINTS & ALARMS
▶ INHIBITOR FEED SET
BIOCIDE PROGRAMS
SYSTEM CONFIGURE

2. Press ENTER, **ENTER PERCENT TIMER** will be displayed with prompt next to **PERCENT**. Press ENTER and use the ARROW keys to set the desired percent of on-time, **PERCENT ____%**, as prompted, press ENTER.

INHIBITOR FEED SET
▶ INHIBITOR TIMER

PRESS <HELP>

3. Use the ARROW keys to move the prompt to **PERCENT MINUTES**. Press ENTER and use the ARROW keys to set the desired cycle time as prompted, press ENTER.

INHIBITOR TIMER
ENTER PERCENT TIMER

▶ PERCENT 0%
PERCENT MINUTES 10

PRESS <HELP>

4. Press HOME key repeatedly to return to **MAIN MENU**.

Post Blowdown Percent Timer

This timer is adjustable in 1 percent increments up to 100 percent of the blowdown time. The timer keeps track of the total blowdown time and activates the chemical feed for the percent of total blowdown time set. The chemical feed occurs after blowdown is complete.

1. Use the ARROW keys to move the prompt through the **MAIN MENU** to **INHIBITOR FEED SET**. Press ENTER, **INHIBITOR FEED SET** menu will be displayed with prompt next to **INHIBITOR TIMER**.

MAIN MENU
AUTO SCROLL ON
DISPLAY DATA
CALIBRATE SENSORS
SET POINTS & ALARMS
▶ INHIBITOR FEED SET
BIOCIDE PROGRAMS
SYSTEM CONFIGURE

INHIBITOR FEED SET
▶ INHIBITOR TIMER

PRESS <HELP>

2. Press ENTER, **ENTER POST BLEED %** will be displayed with prompt next to **BLEED**. Press ENTER and use the ARROW keys to set the desired percent of on-time as prompted, press ENTER.

INHIBITOR TIMER
ENTER POST BLEED %

▶ BLEED % 0%

PRESS <HELP>

3. Press HOME key repeatedly to return to **MAIN MENU**.

!!WARNING!!

If PULSE SET is entered to zero (0), pulse timer will run continuously.

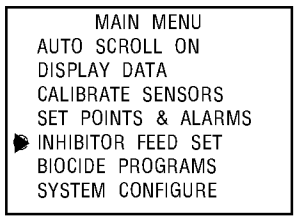
Pulse Timer/Accumulator

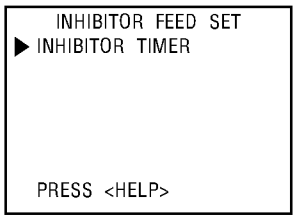
Also referred to as water meter or reset timer. The timer accepts pulses from a water meter to actuate a chemical feed pump. The timer has an adjustable feed time (RUN TIME) in 1 second increments up to 250 minutes and 59 seconds with an elapsed-time display. It has a built-in accumulator (PULSE SET) that can count pulses up to 255 before activating the output with an elapsed pulse counter (PULSE CNT). Also incorporated into the timer is a pulse totalizer (TOTALIZER _____) that keeps an ongoing count of the number of pulses received by the timer. This pulse totalizer can be reset to zero or any other number; this is accomplished in the SYSTEM CONFIGURE menu.

NOTE:

The pulse counter will only store one (1) overlapping pulse, if received while pumping.

1. Use the keys to move the prompt through the **MAIN MENU** to **INHIBITOR FEED SET**. Press ENTER, **INHIBITOR FEED SET** menu will be displayed with prompt next to **INHIBITOR TIMER**.





NOTE:

The pulse will reset itself when it reaches 65,535.

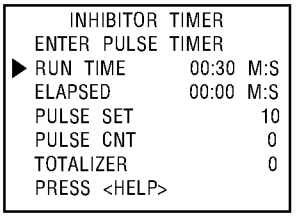
2. Press ENTER, **ENTER PULSE TIMER** will be displayed with prompt next to **RUN TIME**. Press ENTER and use the ARROW keys to set the desired **RUN TIME ___:___ M:S** as prompted, press ENTER. The elapsed run-time (**ELAPSED ___:___ M:S**) is displayed on the next line.

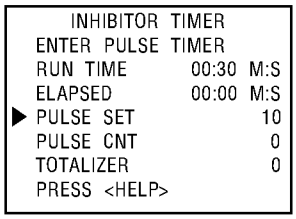
3. Use the ARROW keys to move the prompt to **PULSE SET**. Press ENTER and use the ARROW keys to set the desired number of pulses required to activate the timer, press ENTER.

4. The present number of pulses (**PULSE CNT __**) received is displayed on the next line.

5. The total number of pulses received from the water meter (**TOTALIZER**) is displayed on the next line. This can be reset from the **SYSTEM CONFIGURE** menu.

6. Press HOME key repeatedly to return to **MAIN MENU**.





NOTE:

If Biocide programs are not set or if set to 'no wk' after being programmed, they will not activate.

BIOCIDE PROGRAMMING

Controller biocide programs are on a 28 day cycle. Each biocide has four individual programs with a wide range of day and week setting combinations. The biocide program timers incorporate bleed lock-out with pre-bleed on those controllers incorporating conductivity control.

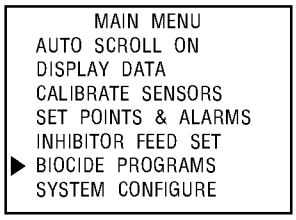
All controllers with Biocide Options will show BIOCIDE PROGRAMS on the main menu. In this menu, the user is prompted to enter all settings pertaining to the biocide program timer.

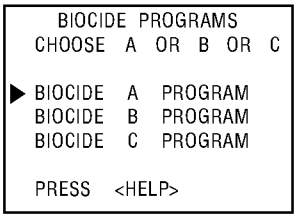
Program Start Time

The four programs have individual program start times. If system incorporates a conductivity control, pre-bleed would activate the biocide program at this time. If not, biocide feed would activate at this time.

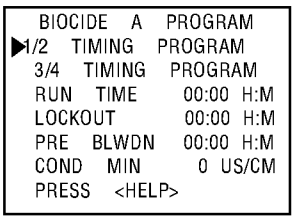
1. Use the ARROW keys to move the prompt through the **MAIN MENU** to **BIOCIDE PROGRAMS**. Press ENTER.

2. **BIOCIDE A PROGRAM** will be displayed if any biocide program option, or if dual or triple biocide program options are present, **BIOCIDE B PROGRAM** and/or **BIOCIDE C PROGRAM** will also be displayed. Using the ARROW keys, move the prompt to the program you wish to set. Press ENTER and the biocide program chosen will appear.

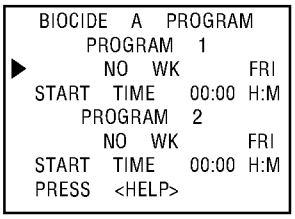




3. Use the ARROW keys to move the prompt to **1/2 TIMING PROGRAM** (for program 1 and 2) or **3/4 TIMING PROGRAM** (for program 3 and 4) to select individual program start times. Press ENTER.



4. The factory settings **NO WK** and **FRI** or the last settings programmed will be displayed. Press ENTER, **NO WK** and the prompt will flash.



BIOCIDE "WEEK" SETTINGS		BIOCIDE "DAY" SETTINGS	
NO WEEK	**4TH WEEK**	**SUN**	**THU**
1ST WEEK	**EVEN WEEK**	**MON**	**FRI**
2ND WEEK	**ODD WEEK**	**TUE**	**SAT**
3RD WEEK	**EVERY WEEK**	**WED**	**EVERY**

5. Use the ARROW keys to set the desired week, press ENTER. **FRI** (or last day programmed) and prompt will flash. Use the ARROW keys to set desired day and press ENTER.

NOTE:

Time settings are based on a 24 hour clock.
For example, 1:00 P.M. would be programmed as 13:00.

6. Use the ARROW keys to move the prompt to **START TIME 00:00 H:M**. Press ENTER. Prompt and hours will flash. Use the ARROW keys to set the desired start time hours (24 hour clock, see Note at left) press ENTER. Prompt and minutes will flash. Use the ARROW keys to set the desired start time minutes, press ENTER.

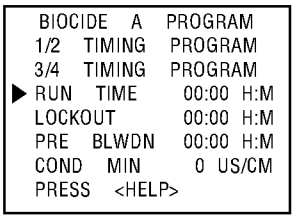
7. Use the ARROW keys to move the prompt to **PROGRAM 2**. Program week, day and start time by repeating steps 5 and 6. Press HOME to return to **BIOCIDE PROGRAM** menu.

8. Repeat steps 3 through 7 to set additional **3/4 TIMING PROGRAM** then continue with step 9.

Length Of Run/Feed Time

The length of time that biocide feed pump is to operate. Adjustable in one minute increments up to 23 hours 59 minutes. (Default 01:30.) The **RUN TIME** is common to all four Biocide Programs

9. Use the ARROW keys to move the prompt to **RUN TIME 00:00 H:M**. Press ENTER and use the ARROW keys to set desired run time as prompted, press ENTER.



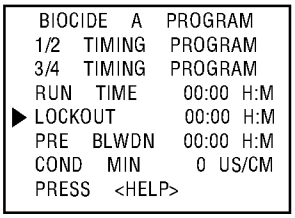
NOTE:

If conductivity is present, continue with step 10. If not, continue with step 13. These functions are only present if conductivity control is also incorporated.

Blowdown Lock-Out

The length of time blowdown is to be locked out is during and after biocide feed. The lock-out time starts when **Biocide Program Start Time** is activated. Adjustable in one minute increments up to 23 hours 59 minutes. (Default 00:00.) **LOCKOUT** is common to all four Biocide Programs

10. Use the ARROW keys to move the prompt to **LOCKOUT 00:00 H:M**. Press ENTER and use the ARROW keys to set desired bleed lockout time as prompted, press ENTER.



Pre-Blowdown

The pre-blowdown function of this controller allows for the user to pre-blowdown in advance of the blowdown lock-out. This reduces the possibility of scaling due to increased TDS levels. Pre-blowdown is programmed for a length of time that starts at the biocide program **START TIME 00:00 H:M** and continues for the length of time programmed or until the preset conductivity low limit, **COND MIN __ US/CM** has been reached. Adjustable in one minute increments. **PRE BLWDN** and **COND MIN** is common to all four Biocide Programs.

TIP:

See the Biocide Programming Work Sheet in Section 13, page 57 of this manual.

11. Use the ARROW keys to move the prompt to **PRE BLWDWN 00:00 H:M**. Press ENTER and use the ARROW keys to set the desired pre-blowdown time as prompted, press ENTER.

12. Use the ARROW keys to move the prompt to **COND MIN 0 US/CM**. Press ENTER and use the ARROW keys to set the desired minimum conductivity setting as prompted, press ENTER.

13. Press HOME to return to **BIOCIDE PROGRAMS** menu. Other biocide programs will be displayed also if present. Repeat steps 1 through 13 to set other Biocide Programs.

14. Press HOME key repeatedly to return to **MAIN MENU**.

TIP:

For help with menu locations, please refer to the "Main Map" supplied with your controller.

5. SENSOR CALIBRATION/INFORMATION

Important: Verify calibration before proceeding with final system start-up. Make sure sensors are clean (refer to Section 10, Maintenance, pg. 50) before proceeding with system calibration.

See Section 13. Additional Calibration Techniques

CONDUCTIVITY CALIBRATION

Conductivity Function Calibration Notes

!!WARNING!!

Two of the determining factors for the sensor cell constant are the volume of the solution and area of the sampling chamber. If any other container, such as a plastic cup, is used in place of a calibration kit (CALKIT) or on-line sample tee, the calibration will be inaccurate.

A Controller Calibration Kit, fig. 9 (CAL KIT, not included) is available to assist in proper calibration of conductivity sensors. The CAL KIT provides the same physical area for a sample chamber as your on-line sample stream assembly and three standard calibration solutions.

Conductivity Calibration, 2 point method
Sensors: Carbon-Graphite, Platinum Black

1. Condition the new Carbon-Graphite Sensor by soaking it in water for 5 minutes before proceeding with calibration. This step is required for new sensors or sensors that are not in service at the time of calibration. Clean sensor before calibration by first flushing with fresh water. Inspect to assure sensor is free of deposits.

2. Set **DISPLAY DAMPENER** to 1 sec. (Refer to System Configure Menu, pg. 14, paragraph **D)**.

3. Obtain a sample of system water and test the sample with a reliable, calibrated tester (see figs. 10 and 11.) Make note of reading.

4. Close isolation valves and relieve pressure on the system by opening the sample valve. Remove and place sensor into the sample container with distilled or deionized water for a value of zero (0) to enter as the "LOW" calibration point in the following procedure (see fig. 12). If deposits or fouling is present, clean sensor per instructions in Section 10, Maintenance, pg. 50.

```
BIOCIDE A   PROGRAM
1/2 TIMING  PROGRAM
3/4 TIMING  PROGRAM
RUN TIME     00:00 H:M
LOCKOUT      00:00 H:M
▶ PRE BLWDN  00:00 H:M
COND MIN      0 US/CM
PRESS <HELP>
```

```
BIOCIDE A   PROGRAM
1/2 TIMING  PROGRAM
3/4 TIMING  PROGRAM
RUN TIME     00:00 H:M
LOCKOUT      00:00 H:M
PRE BLWDN    00:00 H:M
▶ COND MIN    0 US/CM
PRESS <HELP>
```

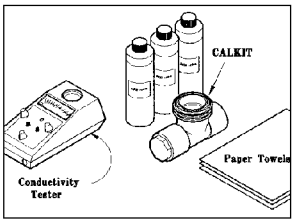


FIGURE 9
CALKIT shown with tester and paper towels.

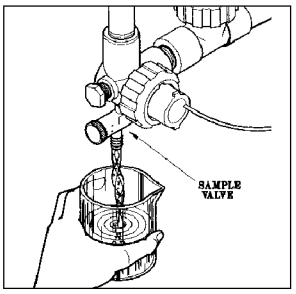


FIGURE 10
Securing a sample of cooling tower water.

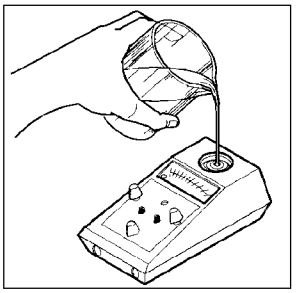


FIGURE 11
Pouring cooling tower sample water into tester.

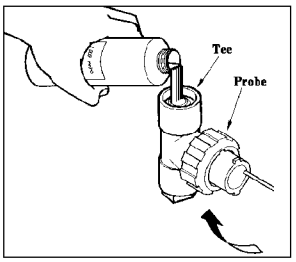


FIGURE 12
Conductivity sensor shown installed in CALKIT tee with deionized water being added.

5. Use the keys to move the prompt through the **MAIN MENU** to **CALIBRATE SENSORS**. Press ENTER.

```
        MAIN MENU
  AUTO SCROLL ON
  DISPLAY DATA
▶ CALIBRATE SENSORS
  SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
  SYSTEM CONFIGURE
```

6. **CALIBRATE SENSORS** menu will be displayed. Use the ARROW keys to move prompt next to **SYSTEM CONDUCTIVITY.** Press ENTER.

```
     CALIBRATE SENSORS
▶SYSTEM CONDUCTIVITY
  SYSTEM PH
  SYSTEM ORP


  PRESS  <HELP>
```

7. **SYSTEM CONDUCTIVITY** menu will be displayed. Using ARROW keys move prompt to **2 PT CAL**. Press ENTER.

```
     CALIBRATE SENSORS
  SYSTEM CONDUCTIVITY
  CHOOSE 2 OR 3 PT CAL
▶ 2  PT  CAL
  3  PT  CAL


  PRESS  <HELP>
```

NOTE:

Be sure to allow sensor to stabilize for at least 2 minutes each time its environment is changed before evaluating readings.

8. **2 PT SYS COND CAL** menu is displayed with prompt next to LOW. Press ENTER and prompt will flash. Use ARROW keys to input **0** and wait two minutes with unit flashing "0." Press ENTER, prompt will stop flashing.

```
 2  PT  SYS  COND  CAL
 ENTER CAL SOLUTION

▶ LOW              0 US/CM
  HIGH             0 US/CM


  PRESS  <HELP>
```

9. Reinstall conductivity sensor into flow assembly (see fig. 13), close sample valve, and open isolation valves.

10. SCROLL DOWN to display **SYS COND HI CAL.**. Use ARROW keys to enter the reading obtained by the Conductivity Tester in step 1 and wait two minutes with the entered reading (xxx) flashing. Press ENTER.

```
 2  PT  SYS  COND  CAL
 ENTER CAL SOLUTION

  LOW              0 US/CM
▶ HIGH             0 US/CM


  PRESS  <HELP>
```

Tip:

For best results, calibrate one point as close to the control set point as possible.

11. Press HOME repeatedly to return to **MAIN MENU-DISPLAY DATA**. Press ENTER to display data to verify calibration.

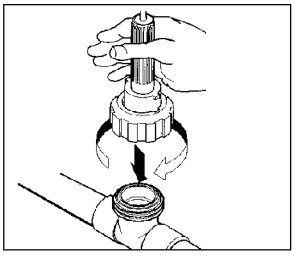


FIGURE 13
Reinstall sensor into flow assembly prior to calibrating, high setting.

Conductivity Calibration, 2 point method
Sensors: Stainless Steel

1. Set **DISPLAY DAMPENER** to 1 sec. (Refer to System Configure Menu, pg. 14, paragraph **D)**.

2. Obtain a sample of system water and test the sample with a reliable, calibrated tester (see figs. 10 and 11, pg. 23). Make a note of the reading.

3. Close isolation valves and relieve pressure on the system by opening the sample valve.

4. Remove sensor. If required, clean in accordance with instructions on page 50. Dry the stainless steel electrode surface for a value of zero (0) to enter as the "LOW" calibration point in the following steps.

5. Perform steps 5 - 11 of the **Conductivity Calibration, Carbon-Graphite Sensor.**

!!WARNING!!

Care should be exercised when removing the protective rubber boot from the sensor. Submerge the tip of the sensor in water to loosen the protective boot and remove. Save for future storage. Care should also be taken to prevent the glass bulb from hitting the tee or other piping. Never expose the sensor to air with power on for more than 45 seconds. Never allow sensor to dry out.

NOTE:

Be sure to allow sensor to stabilize for at least 2 minutes each time its environment is changed before evaluating readings.

pH CALIBRATION

pH Function Calibration Notes

1. The most common buffers are 4, 7 and 10, but any pH buffers will work if there is at least 3 pH units difference between solutions.

2. Always use two buffers that are most representative of the operating conditions. Example: if monitoring around 8 pH use a 4 buffer for the low point and 10 for the high point.

3. Between each sample, rinse sensor with de-ionized water then with next buffer to be sampled.

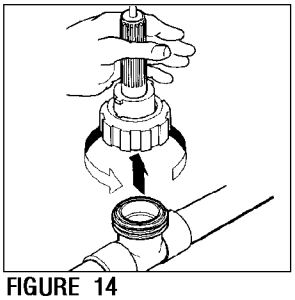


FIGURE 14
Removing pH sensor from flow assembly.

pH Calibration, 2 point method

1. Obtain a sample of system water and test the sample with a reliable, calibrated pH tester (see figs. 10 and 11, pg. 23). Make note of reading.

2. Close isolation valves and relieve pressure on the system by opening the sample valve. Remove sensor from flow assembly by unscrewing coupling ring. Pull sensor straight up with no side motion to prevent breakage (see fig. 14). Rinse and then inspect sensor. If deposits or fouling is present, clean sensor per instructions in Section 10, Maintenance, pg. 50.

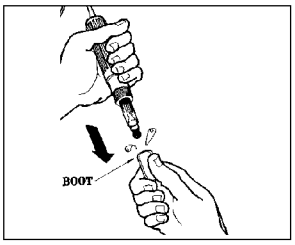


FIGURE 15
Removing protective, liquid filled, rubber boot from sensor tip.

3. (New sensors only) Wet tip of sensor and carefully remove the liquid filled, protective rubber boot from the sensor's tip (see fig. 15). Do not allow sensor's tip to dry out! Save boot for future use.

4. Rinse sensor in pH 4 solution (low cal), then place sensor into a clean container and pour enough pH 4 buffer solution to cover tip (approximately 1" depth) (see fig. 16).

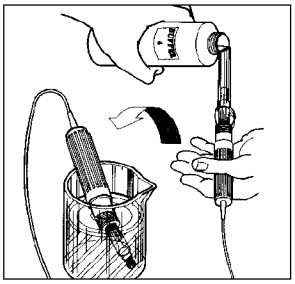


FIGURE 16
Adding pH buffer solution to sensor in a clean container for calibration.

5. Use the arrow keys to move the prompt through the **MAIN MENU** to **CALIBRATE SENSORS**. Press ENTER.

```
MAIN MENU
  AUTO SCROLL ON
  DISPLAY DATA
▶ CALIBRATE SENSORS
  SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
  SYSTEM CONFIGURE
```

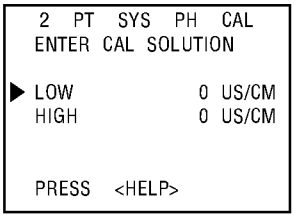
6. **CALIBRATE SENSORS** menu will be displayed.Use the ARROW keys to move prompt next to **SYSTEM PH.** Press ENTER.

```
  CALIBRATE SENSORS
  SYSTEM CONDUCTIVITY
▶ SYSTEM PH
  SYSTEM ORP


  PRESS <HELP>
```

7. **SYSTEM PH** menuwill be displayed. Using ARROW keys to move prompt to **2 PT CAL**. Press ENTER.

```
  CALIBRATE SENSORS
  SYSTEM PH
  CHOOSE 2 OR 3 PT CAL
▶ 2 PT CAL
  3 PT CAL


  PRESS <HELP>
```

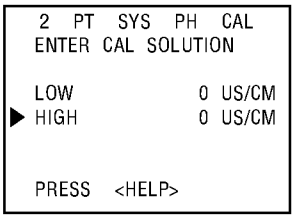
8. **2 PT SYS PH CAL** menu is displayed with prompt next to **LOW**. Press ENTER and prompt will flash. Use ARROW keys to enter **4.00 PH** and wait two minutes with the entered value flashing. Press ENTER, prompt will stop flashing.



!!WARNING!!

Sensor must be installed in flow assembly before calibrating High setting if a calkit is not used.

9. Use ARROW keys to move prompt to **HIGH**, press ENTER. Prompt will flash. Use ARROW keys to input **10.0 PH** and wait two minutes with the entered value flashing. Reinstall pH sensor into flow assembly (see fig. 17), close sample valve and open isolation valves. Press ENTER, prompt will stop flashing.



10. Press HOME repeatedly to return to **MAIN MENU-DISPLAY DATA**. Press ENTER to display data to verify calibration.

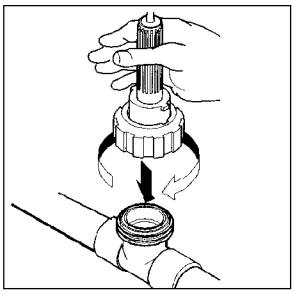


FIGURE 17
Reinstall sensor into flow assembly prior to verifying calibration.

ORP CALIBRATION

ORP Function Calibration Notes

1. The most common mV solutions are 100, 465, but any mV calibration solution will work.

TIP:

For help with menu locations, please refer to the "Menu Map" supplied with your controller.

2. Between each sample, rinse sensor with mV solution to be sampled.

3. If required, clean sensor before calibration by first flushing with fresh water. Inspect to assure sensor is free of deposits.

ORP Calibration, 2 point method

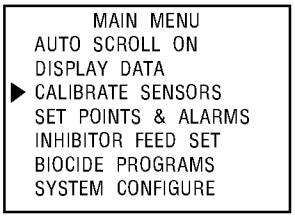
1. Close isolation valves and relieve pressure on the system by opening the sample valve. Remove sensor from flow assembly by unscrewing coupling ring. Pull sensor straight up with no side motion to prevent breakage (see fig. 14) Inspect sensor, if deposits or fouling is present, clean sensor per instructions in Section 10, Maintenance, pg. 50.

2. Rinse ORP sensor with 100 mV, low buffer solution, then place sensor in a clean container. Pour enough low buffer solution into the container to cover the sensor's tip (see fig. 16).

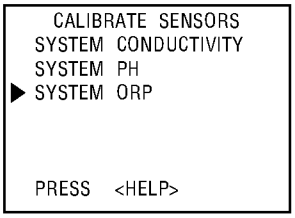
NOTE:

Be sure to allow sensor to stabilize for at least 2 minutes each time its environment is changed before evaluating readings.

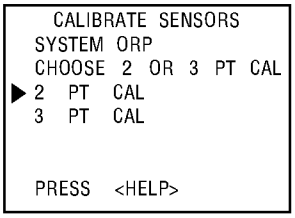
3. Use the ARROW keys to move the prompt through the **MAIN MENU** to **CALIBRATE SENSORS**. Press ENTER.



4. **CALIBRATE SENSORS** menu will be displayed. Use the ARROW keys to move prompt next to **SYSTEM ORP.** Press ENTER.



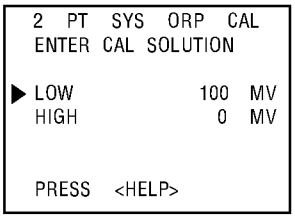
5. **SYSTEM ORP** menu will be displayed. Using ARROW keys move prompt to **2 PT CAL**. Press ENTER.



TIP:

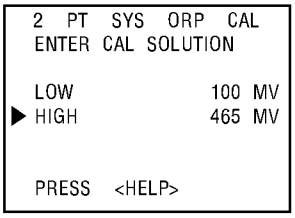
For help with menu locations, please refer to the "Menu Map" supplied with your controller.

6. **2 PT SYS ORP CAL** menu is displayed with prompt next to LOW. Press ENTER and prompt will flash. Use ARROW keys to input **100 MV**, the value of the low buffer solution and wait two minutes with the entered value flashing. Press ENTER, prompt will stop flashing.



7. Rinse ORP sensor with 465 mV, high buffer solution, then place sensor in a clean container. Pour enough high buffer solution into the container to cover the sensor's tip (see fig. 16).

8.Use ARROW keys to move prompt to **HIGH**. Press ENTER and prompt will flash. Use ARROW keys to enter **465 MV,** the value of the high buffer solution and wait two minutes with the entered value flashing. Press ENTER, prompt will stop flashing.



9. Reinstall ORP sensor into flow assembly (see fig. 17), close sample valve and open isolation valves.

10. Press HOME repeatedly to return to **MAIN MENU**. Enter **DISPLAY DATA** to verify calibration.

6. DIAGRAMS: INSTALLATION, COMPONENT, AND ELECTRICAL

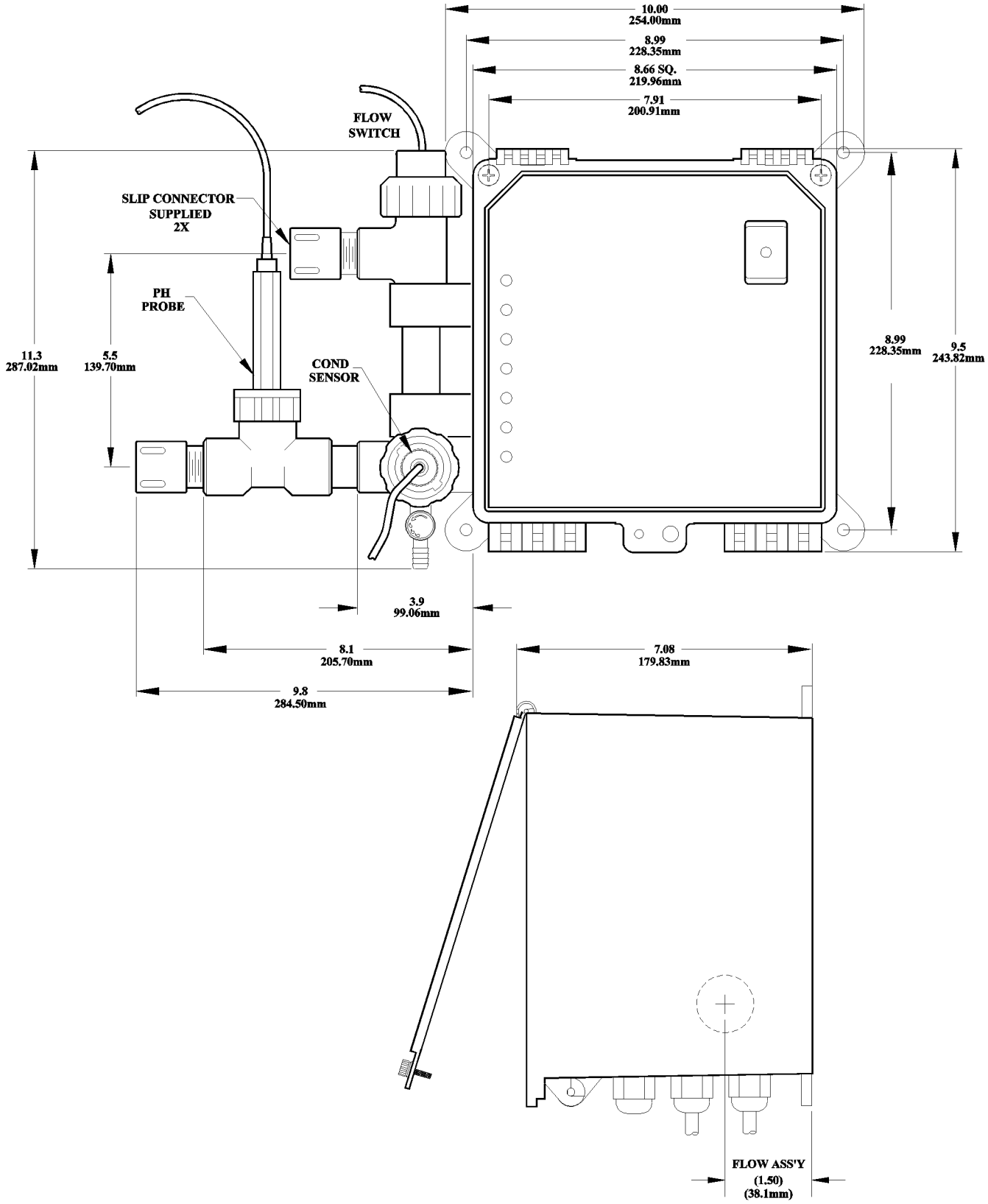
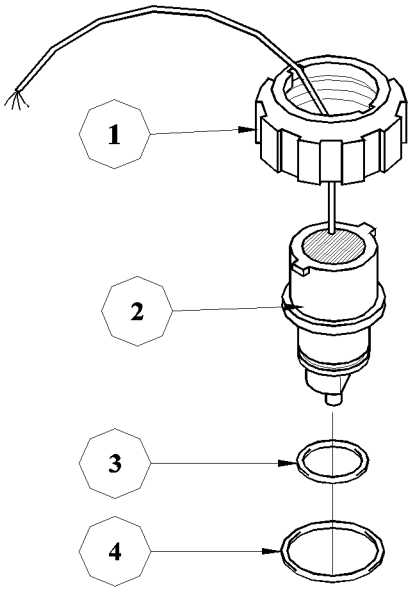


DIAGRAM 1 ENCLOSURE DIMENSIONAL DATA (shown with flow assembly)



STAINLESS STEEL SENSOR SPECIFICATIONS

Pressure Rating .....125 PSI (8.6 BAR)
Temperature Rating .....125° F (51.7° C)
Temperature Compensation .....45°F (7.2°C) to 105°F (40.6°C)
Construction .....Glass Filled Polypropylene Stainless Steel
Cell Constant 5

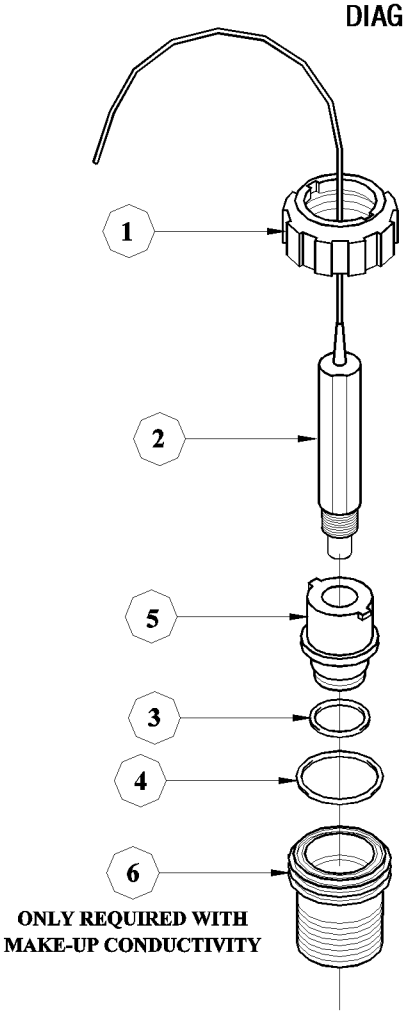
WIRE COLOR CODE

Red .....Sensor
Black .....Common of Sensor and Temperature Compensation
Clear .....Temperature Compensation
(Note: Clear Wire may be Green or White)
Bare .....Shield

MATERIALS

Item 1	Quantity 1	Part No. 06-008-00-E	Coupling Nut
Item 2	Quantity 1	Part No. 04-600-02	Conductivity Sensor Assembly
Item 3	Quantity 1	Part No. 03-005-02-E	Gasket, O-Ring 2-119
Item 4	Quantity 2	Part No. 03-005-04-E	Gasket, O-Ring 2-029

DIAGRAM 2 STAINLESS STEEL SENSOR



CARBON GRAPHITE SENSOR SPECIFICATIONS

Pressure Rating .....125 PSI (8.6 BAR)
Temperature Rating .....125° F (51.7° C)
Temperature Compensation .....45°F (7.2°C) to 105°F (40.6°C)
Construction .....Glass Filled Polypropylene Carbon Graphite
Thread Size.....3/4" (19.05mm) NPT
Cell Constant 1.0

WIRE COLOR CODE

Red .....Sensor
Black .....Common of Sensor and Temperature Compensation
Clear .....Temperature Compensation
(Note: Clear Wire may be Green or White)
Bare .....Shield

MATERIALS

Item 1	Quantity 1	Part No. 06-008-00-E	Coupling Nut
Item 2	Quantity 1	Part No. 04-035-00	Carbon Graphite Sensor Conductivity
Item 3	Quantity 1	Part No. 03-005-02-E	Gasket O-Ring #2-119
Item 4	Quantity 1	Part No. 03-005-04-E	Gasket O-Ring #2-029
Item 5	Quantity 1	Part No. 03-096-64-E	Sensor Holder
Item 6	Quantity 1	Part No. 03-096-60-E	Insertion Adaptor

DIAGRAM 2A CARBON GRAPHITE SENSOR

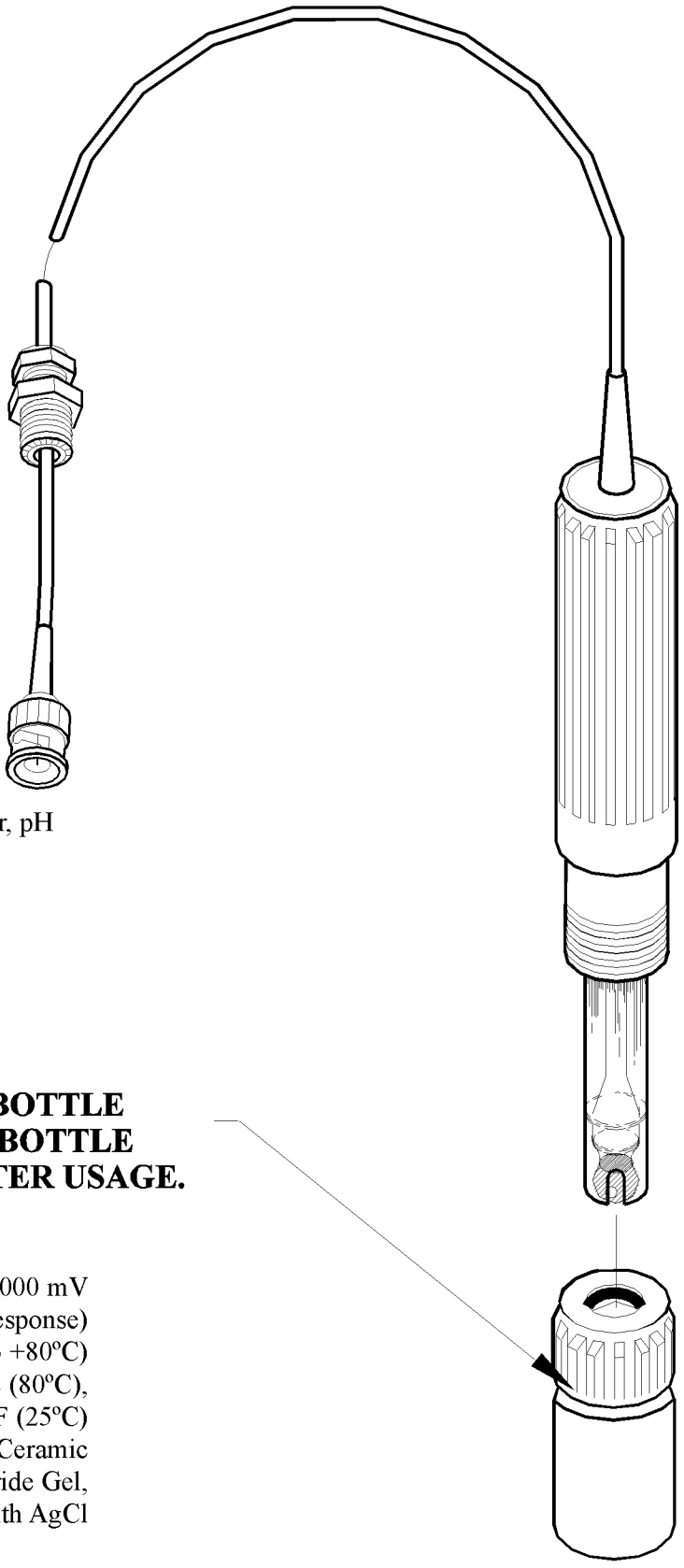
pH

SPECIFICATIONS

Double Junction
pH Range .....pH 0 to 14 (Na+ < 0.1 N)
Accuracy .....+/- 0.1 pH Unit
Response Time .....< 10 Sec. (95% Response)
Operating Temperature Range .....23 to +176° F
(-5 to +80° C)
Operating Pressure Range.....100 psi

MATERIALS

Item 1 Quantity 1 Part No. 04-040-00 Sensor, pH



IMPORTANT

REMOVE PROTECTIVE BOTTLE FOR OPERATION, KEEP BOTTLE IN SAFE PLACE FOR LATER USAGE.

ORP

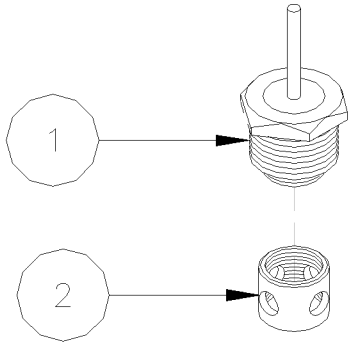
SPECIFICATIONS

ORP Range .....0-1000 mV
Response Time .....< 25 Sec. (95% Response)
Operating Temperature Range ...23 to +176ºF (-5 to +80ºC)
Operating Pressure Range.....50 psi @ 176ºC (80ºC),
100 psi @ 77ºF (25ºC)
Reference Type.....Annular Ceramic
Reference Sensor.....Polysaccharide Gel,
Outer Solution 4 M KCl sat'd with AgCl

MATERIALS

Item 1 Quantity 1 Part No. 04-045-00 Sensor, ORP

DIAGRAM 3 SENSORS

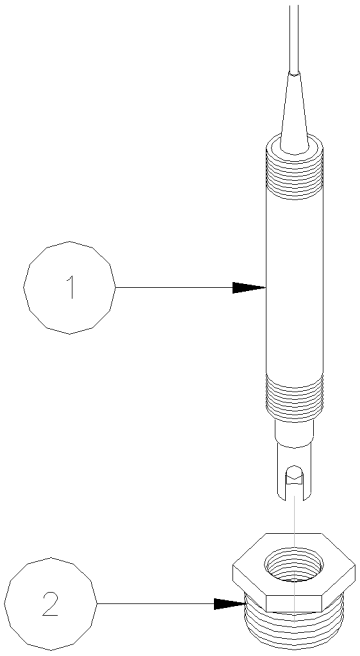


HI-PRESSURE CONDUCTIVITY SENSOR
SPECIFICATIONS

Pressure Rating .....250 PSI (17.3 BAR)
Temperature Rating .....32° F to 212° F (0° C to 100° C)
Temperature Compensation .....45°F to 105°F (7° C to 40°C)
Construction .....Stainless Steel with CPVS Insulator
Cell Constant.....1.5

MATERIALS

Item 1	Quantity 1	Part No. 04-600-30	Conductivity Sensor with end cap
Item 2	Quantity 1	Part No. 03-068-00	end cap only

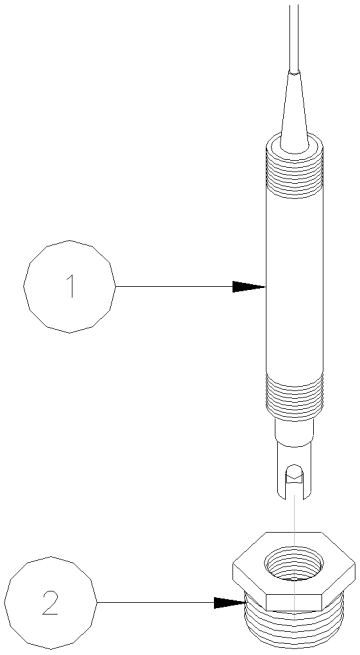


HI-PRESSURE pH SENSOR
SPECIFICATIONS

pH Range .....pH 0 to 14 (Na+ < 0.1N)
Accuracy .....± 0.1 pH Unit
Response Time .....< 10 sec. (95% response)
Operating Temperature .....23°F to 215°F (-5°C to 120°C)
Operating Pressure Rating .....250 psi (17.3 BAR)

MATERIALS

Item 1	Quantity 1	Part No. 04-048-00	pH Sensor
Item 2	Quantity 1	Part No. 03-135-14	Reducer Bushing



HI-PRESSURE ORP SENSOR
SPECIFICATIONS

ORP Range .....± 2000mV
Response Time .....< 25 sec. (95% response)
Operating Temperature .....23°F to 215°F (-5°C to 120°C)
Operating Pressure Rating .....250 psi (17.3 BAR)

MATERIALS

Item 1	Quantity 1	Part No. 04-045-05	ORP Sensor
Item 2	Quantity 1	Part No. 03-135-14	Reducer Bushing

DIAGRAM 3A HI-PRESSURE SENSORS

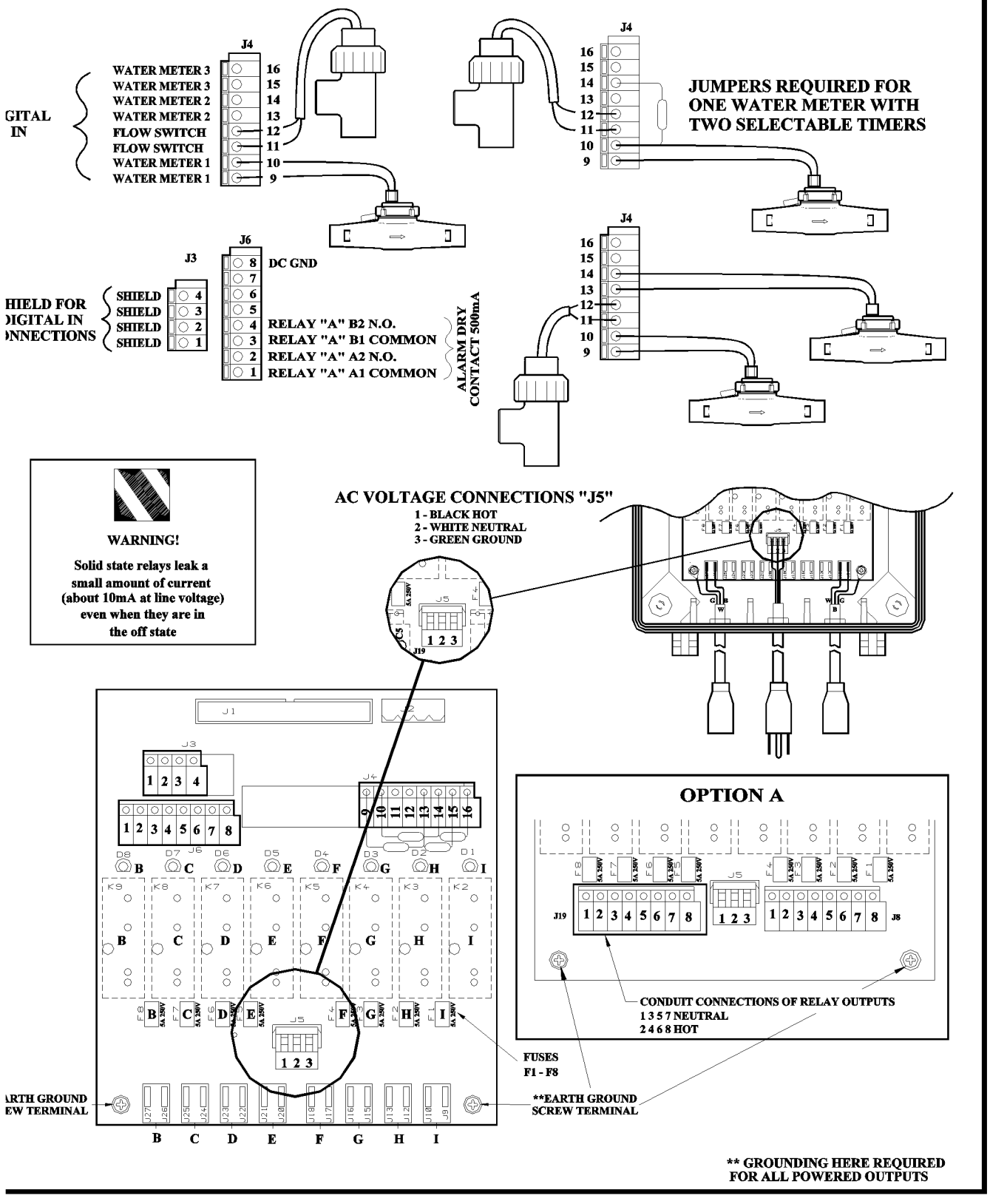
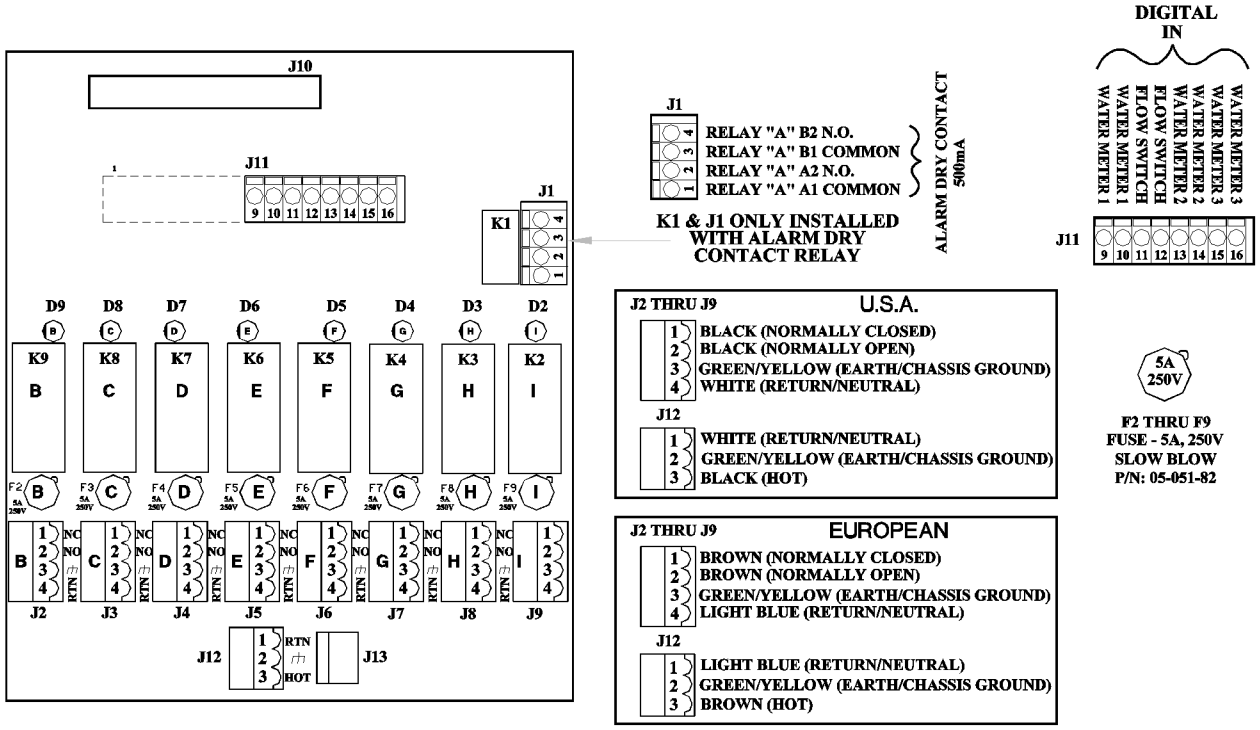
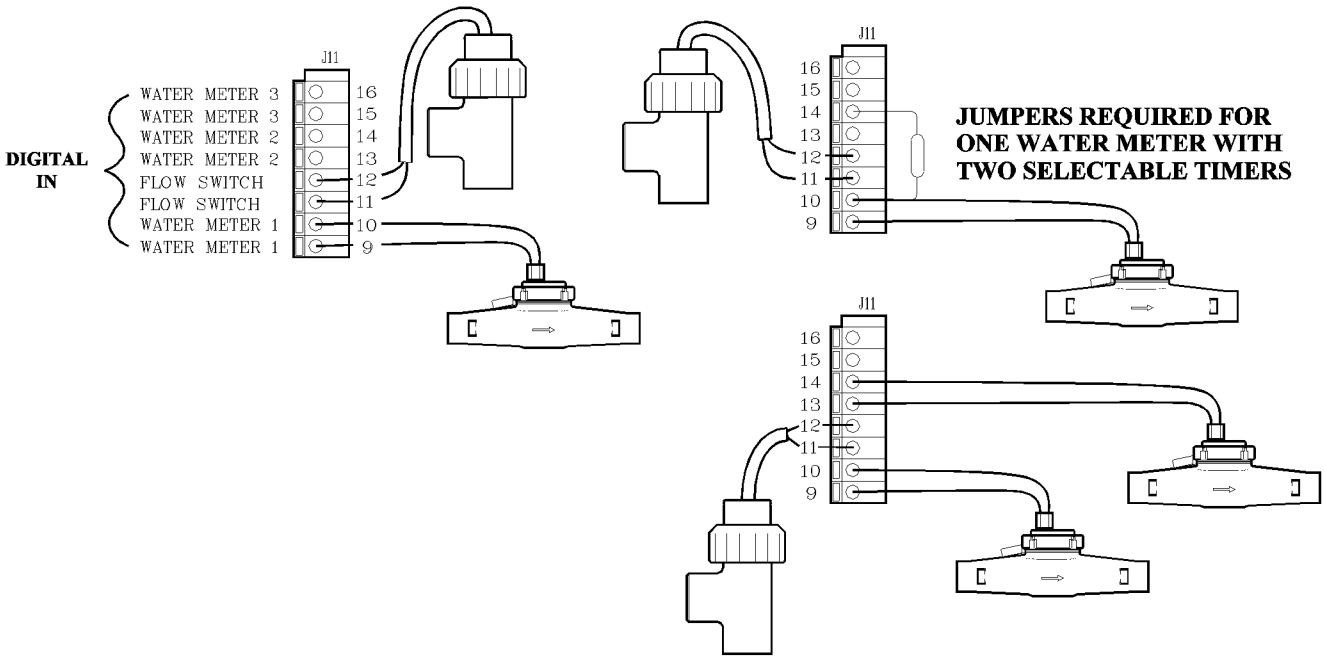


DIAGRAM 4 RELAY BOARD



CURRENT VERSION



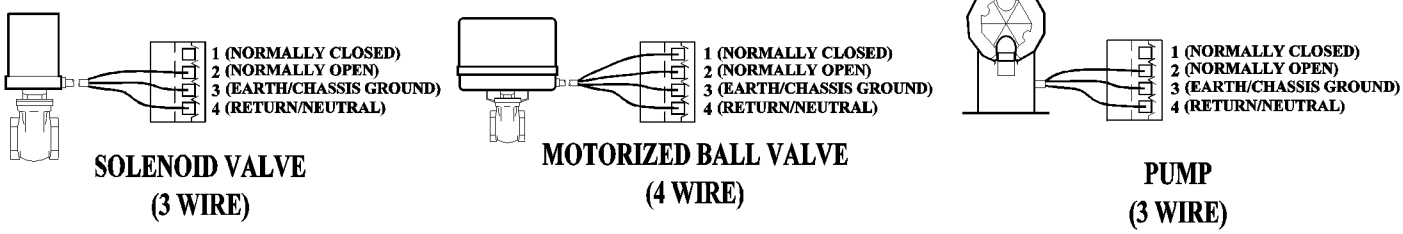
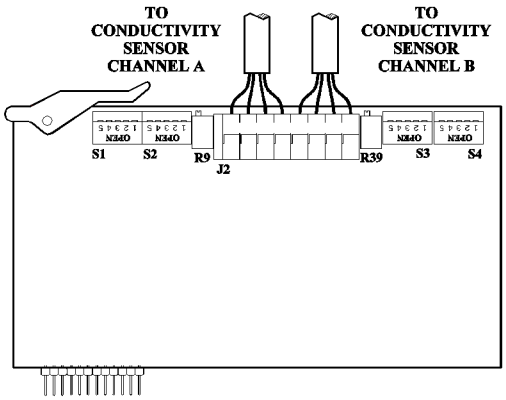


DIAGRAM 4A RELAY BOARD, SAMPLE CONNECTIONS TO PUMP, SOLENOID, & BALL VALVE



SENSOR CABLE WIRE CODE

CHANNEL "A"	CHANNEL "B"
1 - RED	5 - RED
2 - BLACK	6 - BLACK
3 - CLEAR	7 - CLEAR
4 - SHIELD	8 - SHIELD

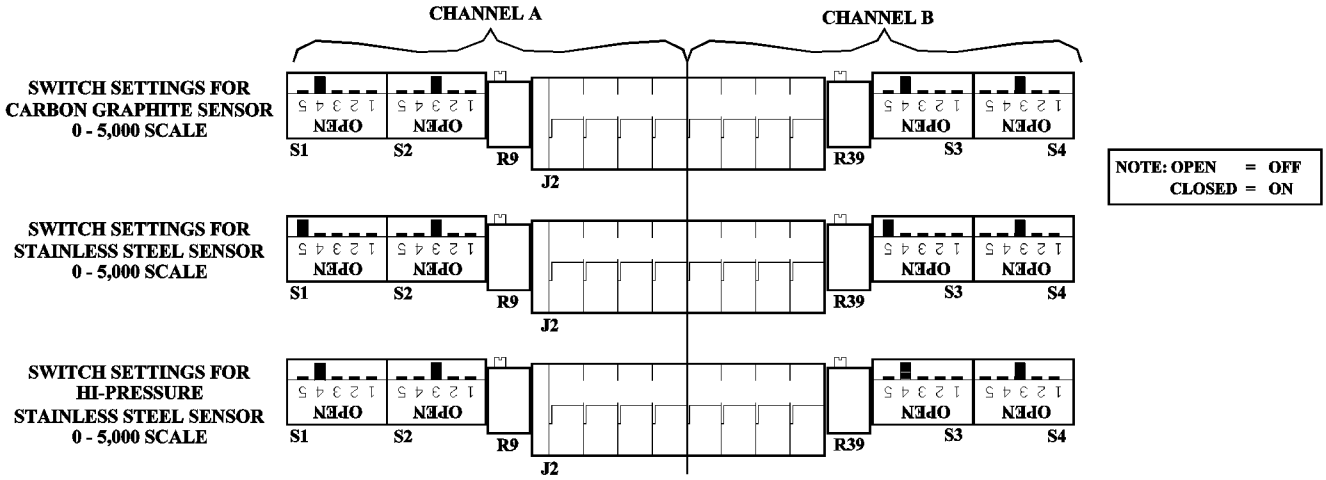
NOTE: CLEAR WIRE MAY BE GREEN OR WHITE

	SWITCH	POS.	DESCRIPTION	DEFAULT
	S1/S3	1	DISABLES SENSOR TEMP COMP.	OPEN
	S1/S3	2	NON-STANDARD SENSOR CALIBRATION	OPEN
	S1/S3	3	NO FUNCTION	OPEN
*	S1/S3	4	SELECT 1.0 CELL CONSTANT	CLOSED
*	S1/S3	5	SELECT 0.5 CELL CONSTANT	OPEN

SWITCH	POS.	DESCRIPTION	DEFAULT
S2/S4	1	SELECTS 500 uS/CM SCALE	OPEN
S2/S4	2	SELECTS 2,000 uS/CM SCALE	OPEN
S2/S4	3	SELECTS 5,000 uS/CM SCALE	CLOSED
S2/S4	4	SELECTS 10,000 uS/CM SCALE	OPEN
S2/S4	5	SELECTS 20,000 uS/CM SCALE	OPEN

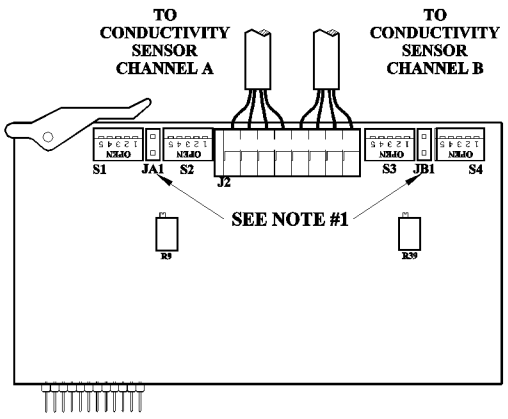
NOTE: SOFTWARE CONDUCTIVITY RANGES MUST MATCH CARD SETTINGS.

*** WHEN EJECTOR IS SO MARKED THE CELL CONSTANTS WILL BE 1.5 & 0.5 RESPECTIVELY.**



CURRENT VERSION

OBSOLETE VERSION REPLACED BY VERSION SHOWN ABOVE



SENSOR CABLE WIRE CODE

CHANNEL "A"	CHANNEL "B"
1 - RED	5 - RED
2 - BLACK	6 - BLACK
3 - CLEAR	7 - CLEAR
4 - SHIELD	8 - SHIELD

NOTE: CLEAR WIRE MAY BE GREEN OR WHITE

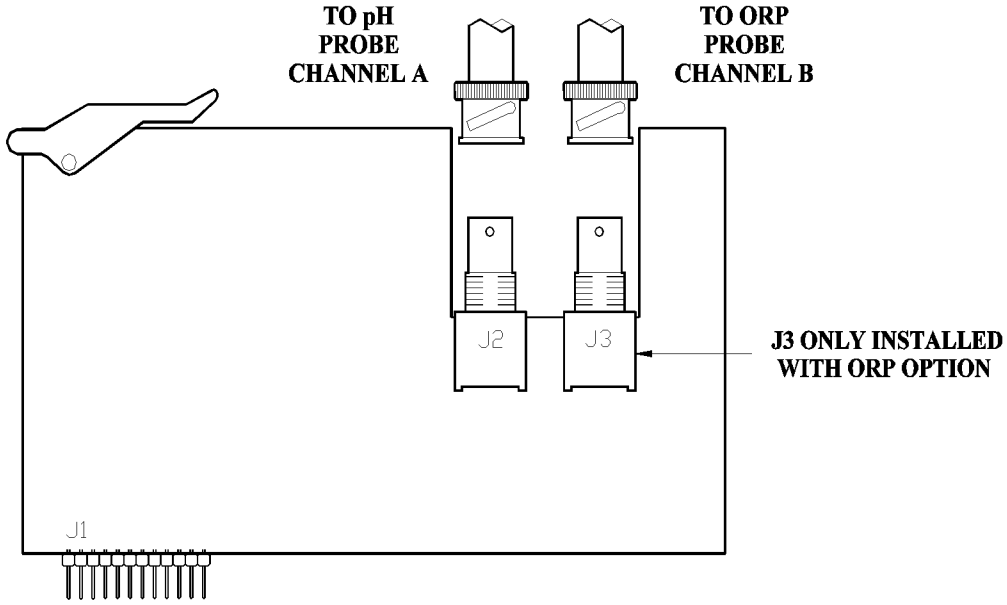
CHANNEL A						
SCALE	JA1	S2-1	S2-2	S2-3	S2-4	S2-5
500	NOTE 1	X	OFF	OFF	OFF	OFF
200	NOTE 1	OFF	X	OFF	OFF	OFF
5000	NOTE 1	OFF	OFF	X	OFF	OFF
10000	NOTE 1	OFF	OFF	OFF	X	OFF
20000	NOTE 1	OFF	OFF	OFF	OFF	X

CHANNEL B						
SCALE	JB1	S4-1	S4-2	S4-3	S4-4	S4-5
500	NOTE 1	X	OFF	OFF	OFF	OFF
200	NOTE 1	OFF	X	OFF	OFF	OFF
5000	NOTE 1	OFF	OFF	X	OFF	OFF
10000	NOTE 1	OFF	OFF	OFF	X	OFF
20000	NOTE 1	OFF	OFF	OFF	OFF	X

NOTE 1: JUMPER FOR NON-COMPENSATED SENSOR. REMOVE FOR TEMPERATURE COMPENSATED SENSOR.

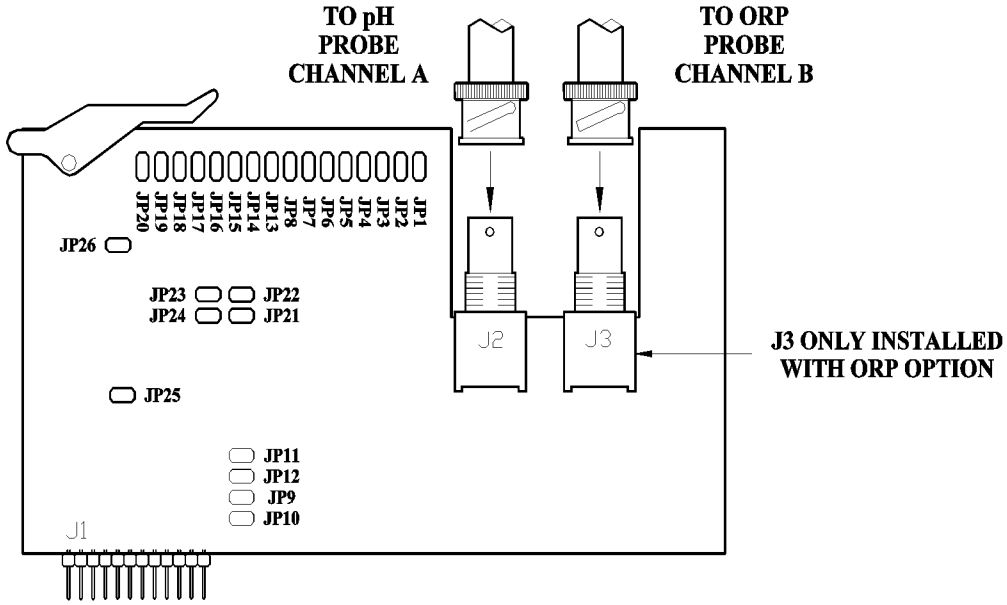
2: ALL SWITCHES ON S1/S3 SHOULD BE IN THE OPEN POSITION.

DIAGRAM 5 CONDUCTIVITY DAUGHTER BOARD



CURRENT VERSION

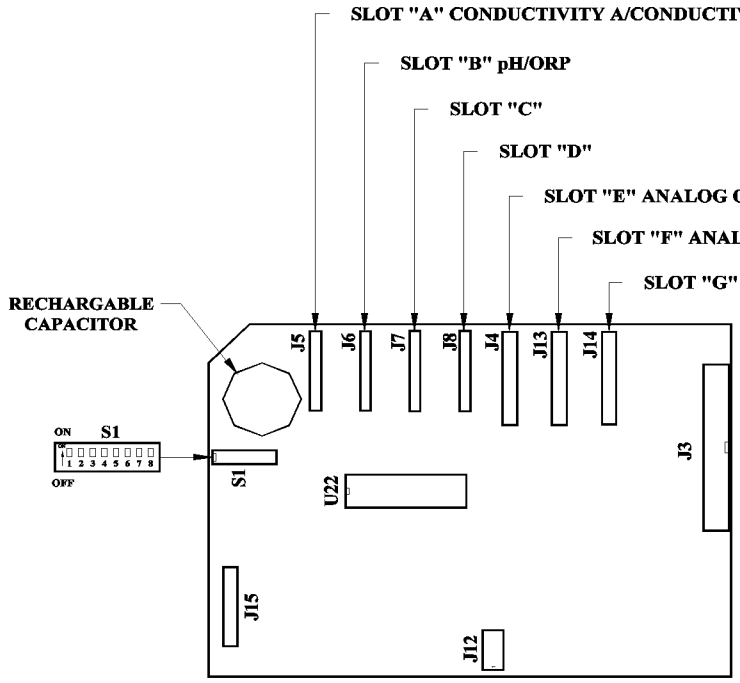
OBSOLETE VERSION REPLACED BY VERSION SHOWN ABOVE



CONFIGURATION	JP1	JP2	JP3	JP4	JP5	JP6	JP7	JP8	JP9	JP10	JP11	JP12	JP25
pH OPERATE					X			X		X		X	X
14pH CAL			X				X			X		X	X
0pH CAL		X					X			X		X	X
7pH CAL				X			X			X		X	X

DIAGRAM 6 PH/ORP DAUGHTER BOARD

ANALOG SIGNAL DAUGHTER BOARD SLOT LOCATIONS, IF CONTROLLER IS SO EQUIPPED



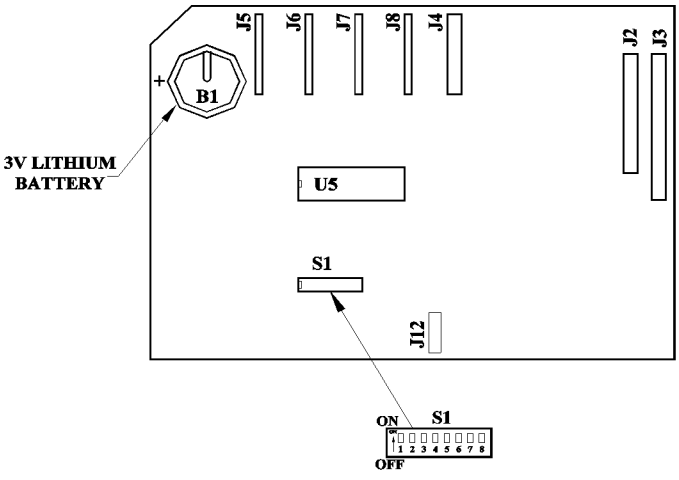
"S1" DIP SWITCH SETTINGS		
POS	"ON"	"OFF"
1	N/A	N/A
2	FLOW SWITCH ENABLE	N/A
3	N/A	N/A
4	N/A	N/A
5	N/A	N/A
6	N/A	N/A
7	N/A	N/A
8	N/A	N/A

J12

1	+5VDC
2	GROUND
3	+12VDC
4	GROUND
5	-12VDC
6	GROUND

CURRENT VERSION

OBSOLETE VERSION REPLACED BY VERSION SHOWN ABOVE

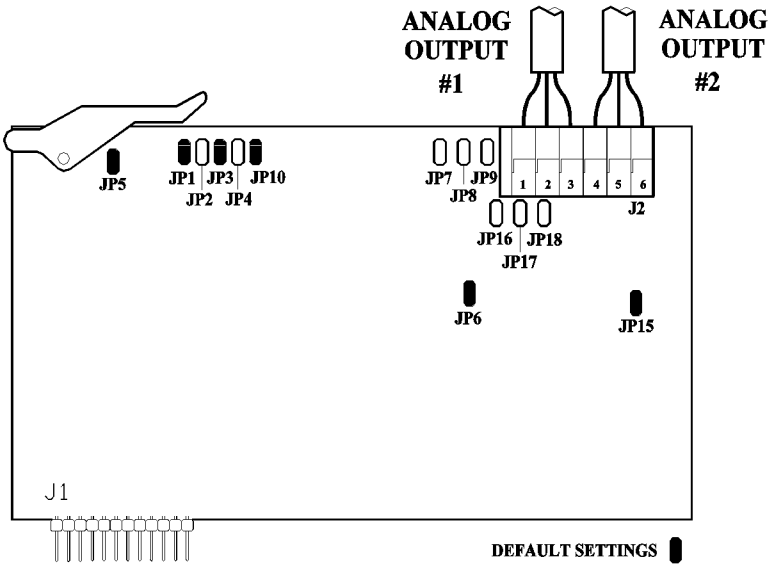


"S1" DIP SWITCH SETTINGS		
POS	"ON"	"OFF"
1	N/A	N/A
2	FLOW SWITCH ENABLE	N/A
3	N/A	N/A
4	N/A	N/A
5	N/A	N/A
6	N/A	N/A
7	DIAGNOSTICS	N/A
8	FACTORY REINIT	N/A

J12

1	+5VDC
2	GROUND
3	+12VDC
4	GROUND
5	-12VDC
6	GROUND

DIAGRAM 7 MOTHER BOARD



WIRE CODE

1 - RED (+)
2 - BLACK (-)
3 - SHIELD
4 - RED (+)
5 - BLACK (-)
6 - SHIELD

SINGLE CHANNEL (08-600-13)

CHANNEL 1	JP1	JP2	JP5	JP6	JP7	JP8	JP9
0-1mA		X					
0-20mA	X						
*4-20mA	X		X	X			
0-2V	X				X		
0-5V	X					X	
0-10V	X						X

* DEFAULT SETTING

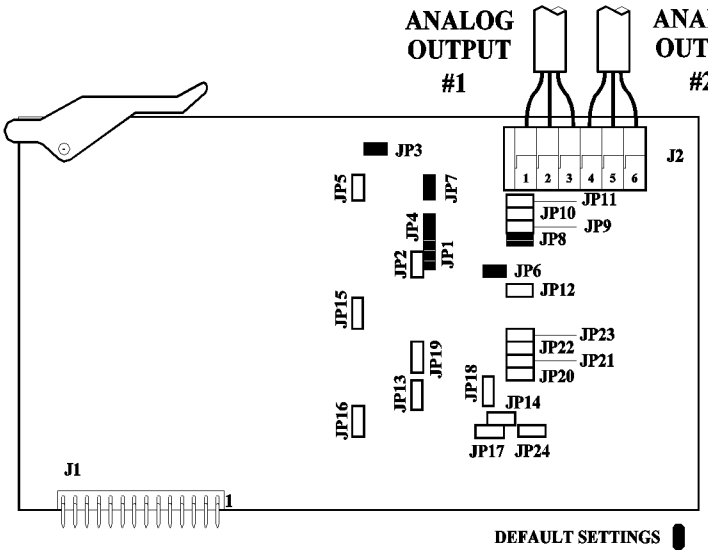
DUAL CHANNEL (08-600-12)

CHANNEL 2	JP3	JP4	JP10	JP15	JP16	JP17	JP18
0-1mA		X					
0-20mA	X						
*4-20mA	X		X	X			
0-2V	X				X		
0-5V	X					X	
0-10V	X						X

* DEFAULT SETTING

CURRENT VERSION

OBSOLETE VERSION REPLACED BY VERSION SHOWN ABOVE



WIRE CODE

1 - RED (+)
2 - BLACK (-)
3 - SHIELD
4 - RED (+)
5 - BLACK (-)
6 - SHIELD

SINGLE CHANNEL (08-600-13) **DUAL CHANNEL (08-600-12)**

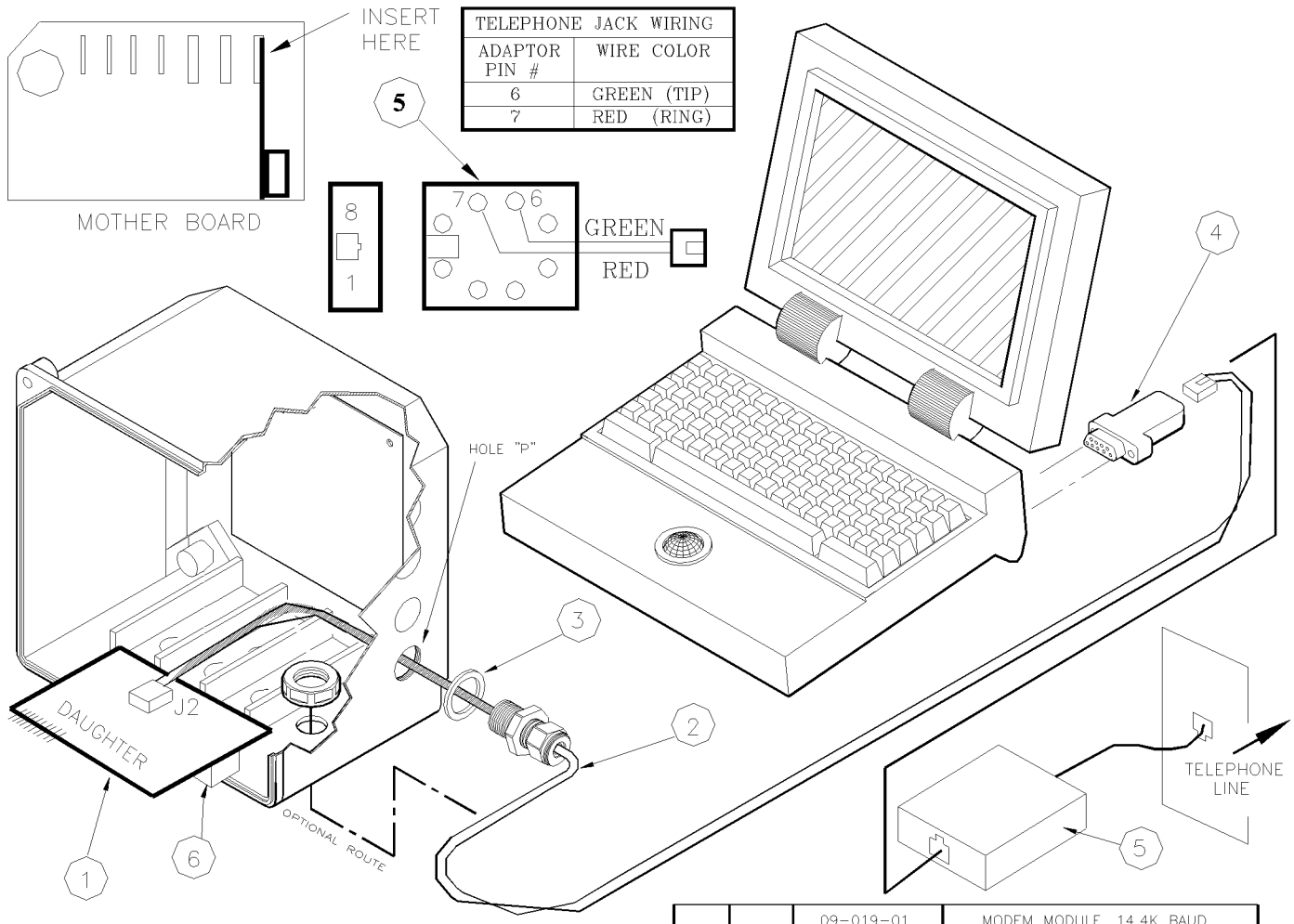
CHANNEL 1	JP1	JP2	JP3	JP4	JP5	JP6	JP7	JP8	JP9	JP10	JP11	JP12
CHANNEL 2	**JP13**	**JP14**	**JP15**	**JP16**	**JP17**	**JP18**	**JP19**	**JP20**	**JP21**	**JP22**	**JP23**	**JP24**
0-1mA			X	X				X				
0-20mA					X		X	X				
*4-20mA	X			X	X	X	X	X				
0-2V	X		X	X					X			X
0-5V	X		X	X						X		X
0-10V	X		X	X							X	X

* DEFAULT SETTING

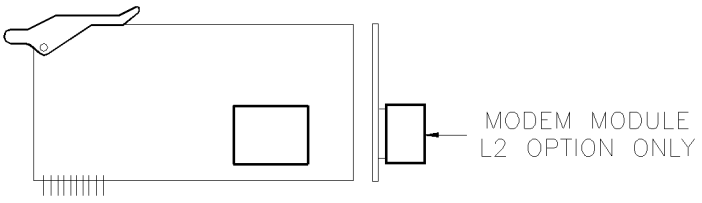
DIAGRAM 8 DAUGHTER BOARD - ANALOG OUTPUTS

FIELD INSTALLATION OF DAUGHTER BOARD/CABLE ASSY, SERIAL LINE COMMUNICATION WITH OR WITHOUT MODEM

1. **Disconnect power to unit at main. Open enclosure and remove power supply cover.**
2. **Pass Cable through tapped hole "P" in enclosure, if provided. If not, punch out an unused knockout in bottom of enclosure and use Locknut, Item #4 to secure cable. See "Optional Route" in illustration below.**
3. **Attach Cable to daughter card jack labeled "J2". Insert card in slot closest to hinge. When inserting card, check the alignment of the pins with the connector.**
4. **Re-install power supply cover.**
5. **Check all internal connections and close unit.**
6. **Insert free plug on cable 2 into either adaptor 4 (direct conn) or adaptor 5 (phone line)**
7. **Attach adaptor to appropriate interface: 1) The serial port on your PC, or 2) A telephone line jack.**
8. **Re-connect power at main.**



TELEPHONE JACK WIRING	
ADAPTOR PIN #	WIRE COLOR
6	GREEN (TIP)
7	RED (RING)



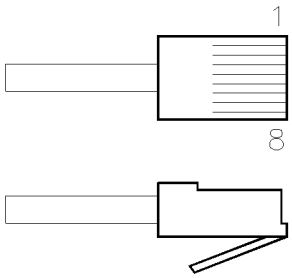
REF.	6	09-019-01 OR 09-019-00	MODEM MODULE, 14.4K BAUD OR MODEM MODULE, 2400 BAUD
1	5	13-079-72	CABLE,PHONE JACK ASSY
1	4	* 06-089-11 AND 06-089-05	DIRECT/CONNECT, 25 PIN ("CE" VERSION ONLY) AND DIRECT/CONNECT, 9 PIN
1	3	03-007-00	RETAINING RING
1	2	13-079-70 OR * 13-079-73	CABLE, 7FT (2.13m) MODEM OR CABLE, "CE" 7FT (2.13m) MODEM
1	1	08-600-43 OR 08-600-45 OR 08-600-48 OR 08-600-49	SERIAL LINE COMM BOARD OR SERIAL LINE COMM BOARD W/MODEM OR SERIAL LINE COMM BOARD OR SERIAL LINE COMM BOARD W/MODEM
QTY	ITEM #	PART NUMBER	DESCRIPTION
BILL OF MATERIALS			

* NOT SHOWN

DIAGRAM 9 COMMUNICATION, FIELD INSTALLATION

CABLE* PIN-OUT

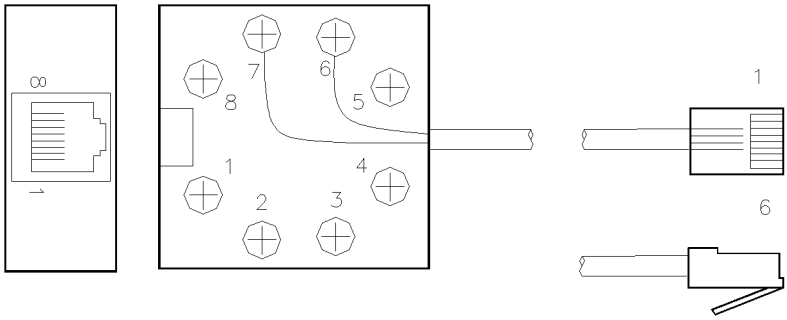
* CABLE IS WIRED STRAIGHT THROUGH, PIN #1 TO PIN #1, ETC.



RJ-45	
POS.	POS.
1	ISO GROUND
2	RS-232 IN
3	RS-232 OUT
4	ISO GROUND
5	CTS
6	RING
7	TIP
8	RTS

TELEPHONE LINE ADAPTOR

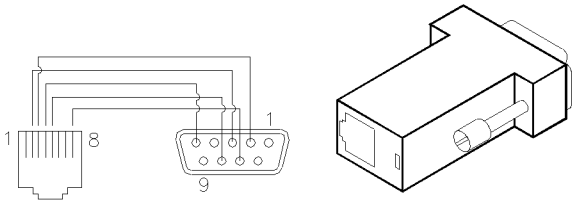
RJ-45	
POS.	POS.
1	NC
2	NC
3	NC
4	NC
5	NC
6	RING
7	TIP
8	NC



RJ-11	
POS.	POS.
1	NC
2	NC
3	RING
4	TIP
5	NC
6	NC

SERIAL PORT ADAPTOR

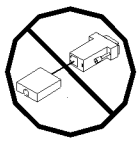
RJ-45	
POS.	POS.
1	NC
2	RS-232 IN
3	RS-232 OUT
4	ISO GROUND
5	CTS*
6	NC
7	NC
8	RTS*



DB-9	
POS.	POS.
1	NC
2	RS-232 OUT
3	RS-232 IN
4	NC
5	ISO GROUND
6	NC
7	RTS
8	CTS
9	NC

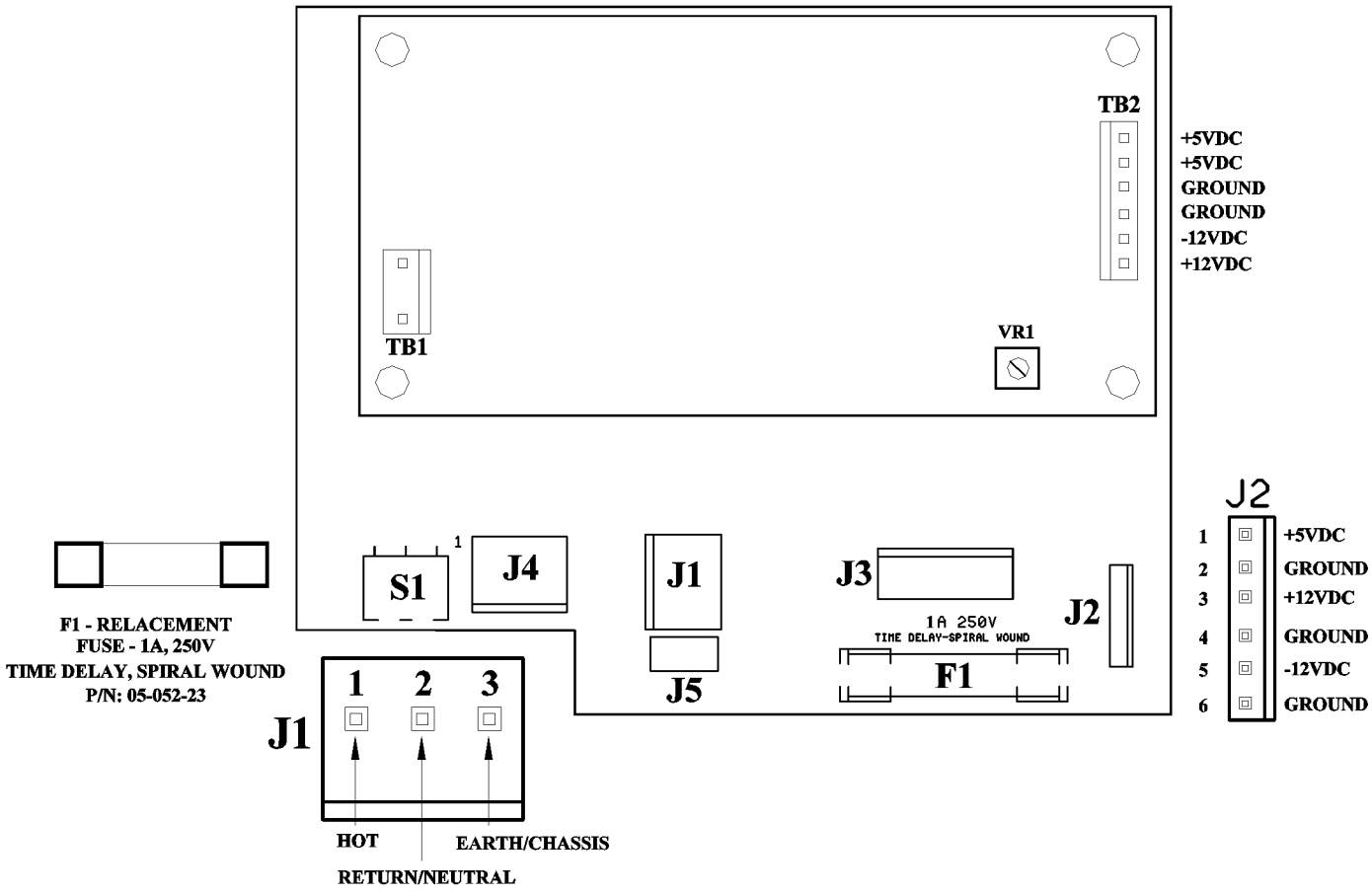
* CTS SHORTED TO RTS ON DAUGHTER CARD.

Note:
DO NOT plug the telephone line adaptor into the serial line adaptor



WARNING
DO NOT plug the oversized modular telephone plug into a digital phone system or Local Area Network! You may damage the unit and void the warranty.

DIAGRAM 9A COMMUNICATION, FIELD INSTALLATION



STANDARD VERSION

"CE" VERSION

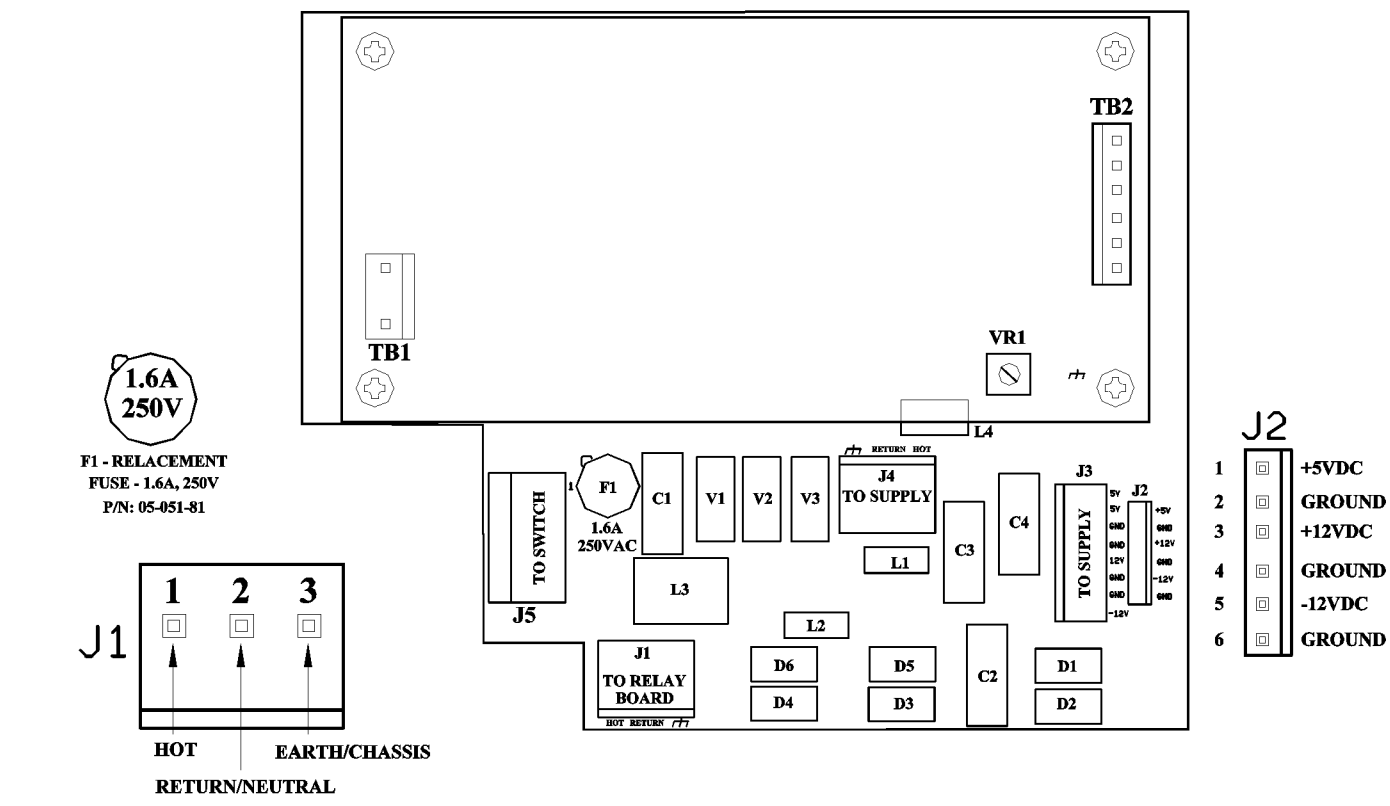


DIAGRAM 10 POWER SUPPLY

7. SPECIFICATIONS

(Factory settings are default values)

GENERAL

Power Input	90/250VAC @ 50/60 Hz 100 VA.
Control Output	Line voltage @ 600 VA (5 amps @ 120 VAC) per relay.
Enclosure Prewired	High impact resistant polystyrene designed to NEMA 4X, with convenient molded receptacle cords and power cord with molded plug for electrical connections.
Enclosure Conduit	High impact resistant polystyrene designed to NEMA 4X, factory predrilled with easily accessible terminals for hard wiring.
Display	64 X 128 pixels dot matrix backlit display (8 line by 20 characters).
Power Switch	Recessed front panel.
H/O/A Switches	Front panel keypad.
Contrast Adjustment	Front panel keypad.
Lockable Viewing Window	Standard
Security Code	Standard (Configure Menu only)
Environment	Ambient temp. 0°F (-17.8°C) to 125°F (52°C); relative humidity 0 to 100%.
Dimensions	Width 10" (25.40cm) X height 10" (17.78cm) X depth 7.08" (17.98cm)
Controller Weight	8 lbs (3.63 kgs)
Shipping Weight	10 lbs (4.54 kgs)
Flow Switch or Interlock	Connection provided. Function activated by dip switch if mounted flow switch or remote flow switch not ordered with controller.
Inputs	4 analog and 4 digital
Outputs	2 analog and 6 relays
Power Surge	Not protected. Surge suppression required. See Electrical wiring, pg. 7.

CONDUCTIVITY FUNCTION

Sensor	Temperature compensated from 45°F (7.2°C) to 105°F (40.6°C), quick-release 3/4" glass filled polypropylene flow tee. Pressure 125 psi @ 125°F (52°C).
Set Point	Select rising or falling. Factory set rising @ 1500 µS/cm.
Range	Selectable 0 to 500, 2000, 5000, 10,000 & 20,000. Factory set @ 5000 µS/cm.
Accuracy	+/- 1% of full scale, at point of measurement, excluding sensor.
Differential	Adjustable. Factory setting @ 100 µS/cm.
High/Low Alarm	Adjustable. Select follow set point or independent set of HIGH and LOW, factory set track set point @ +/- 200 µS/cm.

pH FUNCTION

Sensor	Sealed combination type; KCI-AgCI reference with 3/4" Glass Filled Polypropylene flow tee, 100 psi @ 176°F (80°C).
Set Point	Select rising or falling, factory set rising 7.4 pH.
Accuracy	+/- 1% of full scale at point of measure, excluding sensor.
Differential	Adjustable; factory setting 0.2 pH.
High/Low Alarm	Adjustable. Select follow set point or independent set of HIGH and LOW; factory set follow set point +/- 1 pH.

Limit Timer . . . . . .Adjustable in 1 minute increments up to 24 hours; factory set at 1:30 hr/min.

ORP SPECIFICATIONS

Sensor . . . . . Sealed combination type; KCI-AgCI reference with 3/4" glass filled polypropylene flow tee; 50 psi @ 176°F (80°C), 100 psi @ 77°F (25°C).

Set Point . . . . . Select rising or falling, factory set falling 400 mV.

Range . . . . . 0 to 1000 mV.

Accuracy . . . . . +/- 1% of full scale, at point of measure, excluding sensor.

Differential . . . . . Adjustable; factory setting 50 mV.

High/Low Alarm . . . . . Adjustable. Select track set point (follows set point) or independent set of HIGH and LOW. Factory setting track set point +/- 100.

Limit Timer . . . . . Adjustable in 1 minute increments up to 23 hours, 59 minutes; factory set at 1:30 hr/min.

SUMMARY OF KEYPAD

Home . . . . . When pushed, returns display back one level in menu structure.

Enter . . . . . When pushed, enters displayed variable or value.

Scroll Up . . . . . Used to scroll-up through (view) menu structure and to display variables.

Scroll Down . . . . . Used to scroll-down through (view) menu structure.

Contrast Keys . . . . . Used to control contrast of viewing screen.

Arrow Keys . . . . . Used to move between variables and to increase/decrease numerical settings.

Language . . . . . Not functional.

Help . . . . . Used to display information about present displayed menu level.`

Relay Keys . . . . . Hand/Off/Auto (HOA) switches, depressing key:

ONCE - Forces corresponding output relay on for five minutes; LED color amber.
TWICE - Forces corresponding output relay off indefinitely; LED color red.
THREE times - Returns control to automatic; LED off if within set point, green if out of set point.

SUMMARY OF LED INDICATOR LIGHTS

Power Indicator . . . . . Illuminates when power is supplied to unit.

Flow Indicator . . . . . Illuminates when flow is present through flow switch. This indicator will not be functional or labeled if mounted flow assembly was not ordered. User can activate function on site.
GREEN - Indicates flow
RED - Indicates no flow
OFF - Indicates disabled

Alarm Indicator . . . . . Flashes red when an alarm condition is present.

Relay Indicators . . . . . AMBER if forced on.
RED if forced off.
OFF if in auto mode and control function is not automatically activated.
GREEN if activated automatically.

8. FACTORY DEFAULT VALUES

NOTE: Your controller may not include all of these features

	DEFAULT
SYSTEM CONDUCTIVITY SCALE	5000 µS/cm
High Alarm	1700 µS/cm
Low Alarm	1300 µS/cm
Set Point	1500 µS/cm rising
Set Point Differential	100 µS/cm
Alarm Offset	200 µS/cm
SYSTEM pH SCALE	0-14 pH
High Alarm	9.40 pH
Low Alarm	5.40 pH
Set Point	7.40 pH rising
Set Point Differential	0.20 pH
Alarm Offset	2.00 pH
Limit Timer	01:30 HH:MM
SYSTEM ORP SCALE	0-1000 mV
High Alarm	500 mV
Low Alarm	300 mV
Set Point	400 mV falling
Set Point Differential	50 mV
Alarm Offset	100 mV
MAKE-UP CONDUCTIVITY SCALE	2000 µS/cm
High Alarm	700 µS/cm
Low Alarm	500 µS/cm
Set Point Differential	0.40 Cycles
INHIBITOR TIMER	Limit
Feed Timer	10:00 HH:MM
BIOCIDE TIMERS	
Week	No Week
Day	Friday
Start Time	00:00 HH:MM
Run Time	01:30 HH:MM
Bleed Lock Out Time	00:00 HH:MM
Pre-Blowdown Time	00:00 HH:MM
Conductivity Min	0 µS/cm
MISCELLANEOUS	
Hi/Low Alarms	Tracking Set Point
Display Dampener	1 Second
POSSIBLE ALARMS	
All High Alarms	X
All Low Alarms	X
Limit Time pH	X
Limit Time ORP	X
No Flow	X
Inhibitor Limit Timers	X

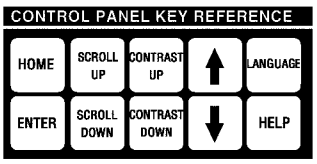
OTHER INHIBITOR FEED MODES

PULSE TIMER	
Run Time	00:30 MM:SS
Accumulator Set	10
Count Totalizer	1
PERCENT TIMER	
Percent On	0%
% of Minutes	10
% OF POST BLOWDOWN	
% of Blowdown Feed	0%

OTHER SCALES	Max Range	High Alarm	Low Alarm	Set Point	Set Pt. Diff.	Alarm Offset
0-500	500	200	100	150	20	50
0-2000	2000	700	500	600	40	100
0-10000	10000	3300	2700	3000	150	300
0-20000	20000	6600	5400	6000	200	600

9. TROUBLESHOOTING GUIDE

If your controller is not operating properly, proceed through the troubleshooting instructions below.



MOTHER BOARD

Symptom	Probable Cause	Isolation and Resolution
Keypad Locked Up	In process of changing conductivity scale.	Scroll down or scroll up after 15 seconds.
No Display (See Power Supply first)	Improper contrast	Adjust on control panel with Contrast Up/Down keys.
	Environment exceeds122°F (50°C)	Relocate controller.
	Connection loose or not made from mother board to display.	Press on front panel around display. Remove mother board and re-connect display.
	No power to mother board.	Check power supply cable connectors are tight and properly aligned. Check power supply. See power troubleshooting section.
	Failed display.	Replace display.
Display Garbled	Loose connections.	Press front panel around display, or remove mother board and re-connect.
	Power supply voltage out of specification.	Refer to power supply troubleshooting section.
	Power applied to digital input.	Disconnect ribbon cable from relay board to mother board—check inputs with volt meter.
	Mother board failure.	Run diagnostics. Hold language key while cycling power on controller. Replace mother board and software.
	Bad EPROM.	Replace EPROM.
	Power surge.	Factory re-initialize.
	4-20 mA outputs card attached to input supplying loop power.	Isolate input .
Display too dark or light.	Contrast changes due to temperature fluctuation.	Adjust contrast.
Display backlit, but not working.	Power supply voltage out of specification	Refer to power supply troubleshooting section.
	Mother board/EPROM failure.	Re-initialize. Replace mother board.
Erratic Readings	Improperly grounded power	Assure power and ground integrity. Shields of all sensors should be connected at controller end only. Verify proper earth grounding.
Flow Light Never Activates (Green indicates ON, Red indicates OFF)	Function not activated	TURN POWER OFF! Turn switch S1-"2" on mother board ON. See Diagram 7, pg. 36. TURN POWER ON.
Flow Light Stays On (Green) in No Flow Condition.	Flow switch stuck up.	Clean flow sensor (see page 51).
	Flow switch cap bad.	Check for wire integrity or replace flow cap.
		Check relay board positions 11 and 12 on J4 (pg. 32) or J11 (pg 33) for installed jumper.

Flow Light does not come On (Green) in Flow Condition	Flow switch dirty or stuck down.	Clean flow switch assembly.
	Inadequate flow.	Increase flow. One GPM minimum.
	Bad shuttle.	Replace shuttle. Refer to maintenance on page 50.
	Bad flow cap.	Replace cap.
	Wiring loose or incorrect.	Check flow switch wiring connections on relay board. Refer to pages 32 and 33.

POWER SUPPLY BOARD

Symptom	Probable Cause	Isolation and Resolution
No Power Light	Power switch off	Turn power switch ON.
	Blown fuse	Replace fuse on Power Supply board.
	No power supplied	Check power source.
	Interconnecting cables loose	Check connections.

Use the Following Procedure to Diagnose Power Related Problems: **CAUTION— MAINS VOLTAGE WILL EXIST AT THE CONNEC-TIONS YOU TEST!**	1. Check power at source (into relay board at J12 [previous version J5] Phoenix connector), if power is there, proceed. If not, check supply power. 2. Check for power to the power supply at J7 on relay board. If power is there, proceed. If not, replace relay board. 3. Check power after the wire cable from J7 to the power supply (see Diagram 10, pg. 40). If power is there, proceed. If not, replace cable. 4. Check fuse on power supply. If okay, proceed. If not, replace fuse or power supply. 5. Check voltages at output of power supply (see Diagram 10, pg. 40). If okay, proceed. If not, check power switch is turned on. If still no voltage, replace power supply. 6. Check voltages at mother board (see Diagram 7, pg. 36). If okay, proceed. If not, check and/or replace power supply to mother board cable. 7. If voltage exists at mother board, but you have no display or lights on the front panel, refer to Mother Board section of trouble shooting guide.

RELAY BOARD

Symptom	Probable Cause	Isolation and Resolution
No Outputs **NOTE: Each relay, on the Relay Board, has a fuse and a red LED**	If the Output front panel LED is lit and the Relay board LED is not lit: • ribbon cable.	Check ribbon cable between mother board and relay for good connection. Replace if necessary.
	If the Output front panel LED is lit and the Relay board LED is also lit: • blown fuse • bad relay	Replace fuse, if necessary, or replace relay
	If the Output front panel (relay) LED is not lit and the Flow LED is red.	Check for flow and flow switch.
	No Flow	Relays are forced off with loss of flow (configuration dependent).
	Limit timers exceeded.	Interrupt flow, satisfy condition or cycle power.

COOLING TOWER CONDUCTIVITY

Symptom	Probable Cause	Isolation and Resolution
Front Panel Blowdown LED Stays On	Conductivity of water is above set point, blowdown restricted.	Check blowdown line and do one of the following: • Clean strainer. • Clean solenoid. • Replace solenoid.
	Treatment chemicals or process liquid at sensor.	Check sample stream injection of treatment chemicals/process liquid at sensor. Injection should be down stream.
	Conductivity of sample stream higher than system conductivity, sample stream restricted.	Check for flow in sample stream and do one of the following: • Clean strainer. • Clean sample line.
	Make up controlling conductivity set point number below system set point.	Check cycles setting. Adjust if required. Normal occurance.
Conductivity of Controller Decreases While System Conductivity Increases	Fouled sensor.	Clean sensor. Refer to Section 10, pages 50 and 51.
Conductivity of System Stays Lower Than Set Point, Never Or Rarely Blows Down	Uncontrolled blowdown.	Close manual blowdown valve. Fix leaks in cooling system. Blowdown valve leaking. Do one of the following: • Realign ball valve; if leaking by the ball valve. • Clean solenoid valve; if leaking by the solenoid valve.
Conductivity Reading Drifts Lower than Sample Tested	Probe fouled. Calibrations procedure not carefully followed.	Clean sensor. Re-calibrate. Perform calibration. Follow stabilization time cautions. If decrease continues, necessitating frequent cleanings.
	Calibration point not near set point.	Re-calibrate with solution near set point
Front Panel Blowdown LED Cycles On and Off	Air in sample line	Bleed air off. Close isolation valves. Loosen flow switch to bleed. Re-tighten before opening valves.
	Differential (dead band) too tight	Widen differential. Check solenoid location (piping).
Controller Not Blowing Down With High Conductivity	Biocide locking out bleed.	Wait for programmed biocide activation to end. Normal behavior.
	No flow	Check flow switch and flow.
	Relay bad or fuse bad.	Check relay and fuse.
Conductivity Blowing Down with Conductivity Below Set Point	Set point differential not satisfied.	Check settings and readings.
	Biocide pre-bleed activated.	Normal
	Cycles of concentration default settings calls for it (make up sensor only).	Check settings and readings.
	Controller on Falling set point	Correct to Rising set point in configure menu.

NOTE: A zero or low makeup conductivity reading will cause cycles to sky rocket! Refer to conductivity section of troubleshooting.

Chemical Pump Not Activating	Pulse Timer: • Check for flow through water meter • Check water meter contacts • Check wiring from controller	 Renew flow. Replace water meter register. Replace wiring.
Drift	Dirty electrode.	Clean sensor
	Improper calibration	Review procedures
	Chemical coating of stainless steel sensors	Do calibration without cleaning the sensor. Change to Carbon Graphite style.
	Air bubbles or turbulence	Review plumbing set-up.
	Conductivity wiring is not correct.	Check wire integrity on conductivity card.
	Hardware scale settings do not match scale selected in program.	Check switch settings on daughter cards and scale in software section. See Diagram 5, page 34.
	Jumpers on conductivity daughter card.	Make sure conductivity card S1/S3-1 is open for a temperature compensated sensor. Closed for a non-temperature compensated sensor. See Diagram 5, page 34.
	Serial line is improperly wired with ground connected at unit and at modem.	Check wiring.
Conductivity is 0	Scale settings incorrect or no scale switch selected.	Check switch settings on daughter card and scale in software selection. See Diagram 5, page 34.
	Air lock.	Review plumbing.
	Corroded sensor	Replace.
	Wiring connections loose.	Check and rewire if necessary, sensor connection on conductivity board.
	Improper calibration.	Review procedures. See Section 5, page 23.
	Bad sensor or daughter card or mother board.	Perform the following sequence to determine which is faulty: 1. Short across the electrode. This should give a full scale reading(e.g. 20,000). If it does, sensor, daughter card and mother board are probably good. 2. If not, short across red and black wire input terminals at daughter card. Should give a full scale deflection. If it does, daughter card and mother board are probably good and the problem is in the sensor or sensor cable.
Conductivity Reading Does Not Change After Calibrating	No flow by sensor.	Check flow and flow switch.
	Sensor wires reversed.	Check wiring integrity. See Diagram 5, page 34.
	Reading is over scale selected.	Change to a higher scale.
	Failed temperature compensation network in the sensor.	Check sensor. See procedure at end of this section (page 48). Replace sensor
	Shorted sensor.	Replace sensor or check wiring.
Conductivity Changes During Communications Hook-up	Serial line direct hook-up exceeds 50' (15.25 m).	Out of spec. use modem for over 50'.
	Serial line integrity damaged.	Replace wiring or cord.

Check a conductivity sensor using a volt meter readings ohms:

Red Lead ↔ Should read an open circuit

Black Lead ↔ Should read 10K (Temp. comp.)

White/Clear Lead

Short across conductivity electrode → display should read full scale for cooling towers

COOLING TOWER pH

Symptom	Probable Cause	Isolation and Resolution
Inability To Calibrate pH	Fouled pH sensor	Clean sensor. Refer to Section 10, page 50.
	Faulty pH sensor	Replace sensor.
	Incorrect calibration	Review procedures. Refer to Section 5, page 23.
Front Panel pH Feed LED Off And: **• pH Above Rising Set Point** **• pH Below Falling Set Point**	Limit timer timed out	Reset timers. Turn system power off and on, or satisfy the conditions for control. Interrupt flow through flow assembly if installed. Verify: pump setting chemical drum level Check for leaks.
Front Panel pH Feed LED Stays On, And: **• pH Above Rising Set Point** **• pH Below Falling Set Point**	Restriction in sample line	Check for flow in sample stream and: • Clean strainer. • Flush sample line.
	Pump lost prime	Prime pump.
	Chemical drum empty	Replenish chemical supply. Reset Timer: 1) Interupt flow through flow assembly if installed 2) Satisfy the condition by manually feeding, etc.
pH Does Not Change after Calibrating or goes to 14	Bad sensor.	Replace sensor.
	Bad connection on the BNC cable.	Check by shorting BNC connection at daughter card(short center lead to outer case). If it does not display 7 on display screen, replace daughter card. If it does, replace sensor.
	Sensor disconnected.	Connect sensor.

LIMIT TIMER

Symptom	Probable Cause	Isolation and Resolution
Inhibitor Timer Does Not Activate	No flow.	Restore flow.
	Improper settings	Check inhibitor feed mode selection.
	No water meter input	Check meter and wiring.
	Blowdown locked out during biocide feed.	Wait for biocide to finish.
	Limit timer exceeded.	Reset by interrupting flow, satisfying the condition, or cycling power.

	Improper settings.	Check mode selection.
No Output for a Particular Function	Limit timer exceeded.	Interrupt flow if flow switch included. Cycle power or satisfy control parameters.

TIME, SETTINGS, HISTORY

Symptom	Probable Cause	Isolation and Resolution
Inability to keep Time/Date/ Settings/History	Line power spikes	Provide spike protector and uninterrupted power supply.
	Software failure	Replace EPROM
	Hardware failure	Replace Mother Board
	Improper wiring creating ground loop interference	Check all power wiring including relays and digital inputs. Refer to power supply troubleshooting section and pages 32 and 33.
	Experiencing data changes with brownouts when it falls below 90V	Perform factory Re-Init located in Configure menu. Install surge supressor. Refer to page 9.

REINITIALIZATION

If the above troubleshooting steps fail to explain or solve condition, perform a factory reinitialization (see Initialization, pg.9). If condition still exists, contact factory for customer service assistance. A Return Authorization (RA) number is required for any return.

10. MAINTENANCE

The only maintenance required on these controllers is periodic cleaning and calibration of the sensors. It is recommended that you establish a regular maintenance schedule designed to meet the needs of your particular application. All other service should be performed by factory authorized personnel only. Modifications to or tampering with the circuit level components makes all warranties, written or implied, and/or manufacturer's responsibility for this controller null and void.

CONDUCTIVITY SENSOR REMOVAL AND CLEANING

To remove the conductivity sensor from its tee for cleaning:

1. Remove power from the system.
2. Remove pressure from the system prior to unscrewing the sensor; to remove pressure, close hand valves located before and after flow assembly.
3. Open the sample port; this will facilitate removal of sensor.
4. Unscrew the coupling nut.
5. Remove the sensor. If necessary, assure slot on nut and tabs on sensor or sensor holder are NOT lined up (see cleaning instructions below).

To re-install the conductivity sensor:

1. Reinsert the sensor (some conductivity sensors are keyed).
2. Hand tighten nut.
3. Close sample port.
4. Reapply pressure and flow by opening hand valves slowly to avoid water hammer.
5. Reapply power to the system.

!!WARNING!!

Use proper handling procedures including rubber gloves, eye protection and protective clothing, when handling any acid solution.

To clean the Stainless Steel conductivity sensor:

1. Wipe the sensors with a clean cloth.
2. Use a fine grain emery cloth for stubborn stains.
3. Some fouled sensors might require dipping in a mild solution of muriatic acid in order to remove fouling.
4. Oils can affect sensor performance. Do not touch sensor surface. The sensor can be agitated in a mild solution of dish washing soap and water to remove oils transferred during handling.

To clean the Carbon Graphite sensor:

1. Imerse sensor in a solution of water and mild detergent. When a stronger cleaning solution is required use concentrated hydrochloric acid mixed into 50% isopropanol.
2. Rinse the cell several times with distilled or deionized water.

pH SENSOR INFORMATION

The combination pH sensor supplied with your controller is designed for maximum reliability, accuracy, and ease of use. The reference half-cell is sealed and non-refillable. The sensor is shipped with a protective boot filled with a junction wetting agent.

A) Preparation

Remove the lower portion of the protective boot and rinse the sensor tip with tap water. It is possible that air bubbles may have migrated into the pH sensitive bulb during shipment. The sensor is unable to function with air in the bulb. To remove air, gently shake the sensor downward in the same manner as a clinical thermometer. Prior to first usage or after long-term storage, immerse the lower end of the sensor in tap water for thirty minutes. This hydrates the pH bulb and prepares the liquid junction for contact with the test solution.

Occasionally during long-term storage or shipment, the sensor may develop a film on the pH bulb. The film may be removed by following sensor cleaning instructions.

B) Sensor Storage

To maintain response, sensors should always remain wet. The preferred storage solution is pH 4.0 buffer with saturated KCl added. Tap water will suffice for short term storage. NOTE: Do not soak in distilled water. The storage boot will provide an ideal chamber for lengthy storage.

C) Sensor Cleaning

Sensors which are mechanically intact can often be restored to full response by the following procedures:

1. Inorganic Scale Deposits. Dissolve the deposit by immersing the sensor first in 0.1M HCl (hydrochloric acid), then in 0.1M NaOH (sodium hydroxide), and again in 0.1M HCl. Each immersion should be for a 5-minute period.

2. Organic Oil or Grease Films. Wash sensor tip in a liquid detergent and water. If film is known to be soluble in a particular organic solvent, wash with this solvent. Rinse sensor tip in tap water.

If these procedures fail to rejuvenate the sensor, the problem is most likely a clogged liquid junction. Cleaning the liquid junction involves heating a diluted KCl (Potassium Chloride) solution to 139-176°F (60-80°C). Place sensor tip in the heated KCl solution for approximately ten minutes. Allow the sensor to cool while immersed in the solution before re-testing. If these steps fail to improve the sensor response, replace the sensor.

ORP SENSOR INFORMATION

The ORP option provides monitoring and control with a control set point in millivolts (mV).

ORP Maintenance and Troubleshooting

ORP standard buffers of 100mV and 465mV are readily available, making it easy to standardize ORP systems against buffers. Like pH sensors, ORP sensors are subjected to coating and abrasion by the measured liquid and, in certain instances, are "poisoned" by chemicals which may be present if the system goes out of control. To improve the reliability of ORP measurement and control, the following is a means of testing sensors in solutions of standard potential, which will determine if sensors are responding correctly or need maintenance attention.

!!WARNING!!

Use proper handling procedures including rubber gloves, eye protection and protective clothing, when handling any acid solution.

Testing ORP Sensor

SOLUTION A: Use sufficient 100mV buffer to immerse sensors. Potential should be within +/- 10.

SOLUTION B: Remove sensors and rinse thoroughly with water. Immerse sensors in 465mV solution. There should be a rapid response.

The millivolt difference between the two solutions is theoretically 365mV. The absolute values may shift upward or downward a few millivolts due to slight variations from theoretical potential by the reference sensor.

If system potentials are correct, flush sensors with deionized water and measure the liquid in question. If incorrect by more than 10 mV, sensors should be cleaned with aqua regia (three volumes hydrochloric acid, one volume concentrated nitric acid.) Repeat above tests. Once satis factory readings are obtained, install sensors and make measurements of liquid in question.

FLOW SENSOR

The flow sensor uses differential pressure to cause a shuttle to rise and magnetically activate a reed switch. Occasionally this assembly may become fouled, preventing the shuttle from rising and/or falling.

To clean the assembly:

1. Close isolation valves and relieve system pressure from flow assembly.

2. Remove flow cap by loosening retaining nut. Remove flow cap from flow body by pulling straight out.

3. Remove red shuttle by pulling straight out. Note post shuttle rides on.

4. Clean all internal surfaces of flow body with soft bristle bottle brush. Be careful of post that shuttle rides on, its surfaces must be clean, but do not break it while cleaning.

5. Clean shuttle exterior surfaces and shuttle bore with a soft brush. You may use a mild dish soap if desired. Flush well before re-installing.

6. Re-install shuttle and attach flow cap. Open isolation valves. Check for leaks.

11. GLOSSARY

Alarm Relay an electric circuit when triggered by a predetermined signal will activate an externally connected alarm

Analog a device that represents in terms of physical variables, i.e. conductivity, pH, ORP

Analog Recorder a device such as a plotter that physically stores or presents quantities of data in a physical manner

Auto Scroll a function of the Controller which allows unit to automatically display system status, active alarms, time, date, etc.

Biocide an agent used to control the growth of algae and other organic substances

Bleed (or blowdown) to release cooling tower water from the system, used to control conductivity

Blowdown see Bleed

Blowdown Valve the valve that opens or closes to release water from the system activated by a signal from the Controller

Buffer Solution a solution with a specific pH value used as a control in calibrating sensors and sensors

Calibration a procedure to match values "read" by sensors and sensors to actual real world values

CalKit a kit available from the manufacturer with a specific cavity volume used to calibrate conductivity sensor

Caustic burning, corrosive, a characteristic of some chemicals especially strong alkalis

Chattering a situation that occurs when relay controlled device repeatedly turns off and on

Chemical Feed Pump a relay or proportionally controlled pump that disperses chemical into the system

Chemical Metering Pump see Chemical Feed Pump

Conductivity the ability of a substance to conduct electrical current, concentrations of dissolved and suspended matter in cooling tower water directly determine the conductivity of the water

Conduit hard wired

Configure procedure to set up basic functions of the controller, i.e. date, time, set point control, etc.

Contacting head water meter a water meter that outputs a dry contact signal every time it pulses

Contrast difference in brightness between adjacent objects, i.e., darkness of text in screen display versus lightness of the screen background

Cooling Tower a structure of various sizes that allows heat to radiate away from the system water.

Cycle Timer a timing device that can be preset to turn off and on at specific intervals

Daughter Board an auxiliary circuit board within the controller dedicated to a specific function(s) of the controller

Differential also referred to as dead band or hysteresis, this is a range or offset applied to a set point value (see chattering)

Dip Switch very small switches located on the circuit boards usually used in combination with other dip switch settings

Display Dampener a setting in the System Configure menu that determines the number of samples that are averaged and the number of seconds before a new reading is displayed on the screen

Double Junction type of construction on a pH sensor

Dry Contact relay contacts without power

EEPROM Electrically Erasable Programmable Only Memory

Electrodes the metal protrusions that measure conductivity in the conductivity sensor assembly

Fish Paper thin paper that is inserted between battery and battery clip to prevent battery drain during shipping or storage of controller

Float Switch a mechanical switch that shuts off fresh water supply to the cooling tower system when water level rises to a predetermined height

Flow refers to the movement of water through the system

Flow Assembly an option which attaches to the controller and incorporates a flow switch, sensor/sensor ports, and sample valve

Gate Valve a type of on/off valve for controlling the flow of liquid

GFPPL Glass Filled Polypropylene

Ground Loops unwanted stray electrical signals that adversely affect controller

Heat Exchanger a mechanical device which produces energy and is cooled by the flow of water in the cooling tower system

HCl Hydrochloric Acid

Hi Lo Alarm a function of the controller that signals the user when conditions exceed a predetermined high or low value

History Files information that is stored in the controller, (history files are lost if battery fails or is removed)

HOA abbreviation for Hands Off Auto

HOA Switches manual relay switches or keys (relay 1 - 6) located on the control panel of the controller

Home this key when pressed returns user to the previous menu displayed on the viewing screen, press repeatedly to return to the main menu

Independent Set Point this feature, when selected under HI LO ALARM in the System Configure menu, allows user to independently set the high and low alarm values

Inhibitor a chemical or compound used to aid the control of corrosion or scaling in the cooling tower system

Inhibitor Feed term referring to the dispersement of inhibitor in to the system

Inhibitor Timer a function of the controller which regulates the amount of time inhibitor is introduced to the system

Initialization a procedure to set up the starting condition of the controller

Inorganic Scale Deposits undesirable precipitate formations within the cooling tower system

Inputs receptacles or hookups for signals delivered to the controller

(ISO) Isolation Valves general term which refers to valves in the system used to isolate various components of the system from the main flow

Jumper a wire connector (shunt) that connects two points

KCl Potassium Chloride

LED abbreviation for Light Emitting Diode

Limit Timer also referred to as lockout timer or feed limit timer, it limits the amount of time output is activated

Line Voltage voltage equivalent to outside source voltage to the controller

Lockout intentionally preventing blowdown or other functions of the system

Menu Map printed document supplied with controller illustrating all menu item locations

Metering Pump see chemical feed pump

Micro Siemens unit of measure of conductivity expressed as uS/cm

Mother Board main circuit board located in controller

NaOH Sodium Hydroxide

ORP Oxidation Reduction Potential, measured in milliVolts (mV) to detect and control level of chlorine or other oxidizing agents in system water

Outputs receptacles or hookups for signals originated at the controller

Overfeed a condition in which the quantity of an ingredient dispersed into the system exceeds the amount desired

Percent Post Blowdown refers to the amount of time as a percentage of blowdown time that chemical feed pumps are activated when blowdown is deactivated

Percent Timer also referred to as a cycle timer that runs continuously that activates an output to run as a percent of total cycle time

pH the measurement of acidity or alkalinity (acid or base) of an aqueous solution

Pre-Bleed refers to the time bleed (or blowdown) is executed before biocide feed

Pre-Blowdown see Pre-Bleed

Program Parameters the user programmed settings that determine how the controller responds to the conditions of the cooling tower water

Pulse the action of a water meter that when equipped with a contact head, can generate a signal sent to the controller

Pulse Timer a feature of the controller in which a timer accepts pulses from a water meter to actuate a chemical feed pump

Relay Board a circuit board in the controller for relay outputs, water meter hookups, flow switch, etc.

Relay Indicators lights (LEDs) located beneath the relay keys on the face of the control panel that indicates the status of individual relays

Sample Cock see Sample Valve

Sample Line a line within the cooling tower flow where sensors and other monitoring devices are located controlled with isolation valves

Sample Stream Flow Assembly an option (standard on many models) which is a modular assembly that mounts to the controller with quick-release sensor(s), flow switch and sample cock or (valve)

Sample Valve small valve on the flow assembly that provides user a means to drain small quantities of water from the system for testing

Scale/Range the adjustable monitoring range of the controller in reference to conductivity levels in the system

Security Code a code that can be entered by the user when configuring the system to secure access to the controller settings

Sensor a device connected to the controller which monitors or measures a value in the cooling tower flow stream

Sensorless Calibration a calibration procedure used to test and verify operation of the controller

Set Point the user determined value within a monitored range at which the controller initiates action

Set Point Differential also referred to as dead band or hysteresis; the offset applied to a set point to prevent chattering of an output relay around a set point

Solenoid an electromagnetically controlled switch

Storage Boot small protective rubber boot filled with a junction wetting agent found on the tip of a new pH or ORP sensor to keep tip wet during shipment and storage

System Overfeed usually a malfunction condition where a feed pump fails shut off

System Parameters see program parameters

System pH level of pH in the system water

TDS abbreviation for Total Dissolved Solids, measured in terms of electrical conductivity(µS/cm)

Temperature Compensation displays conductivity as if measured at 77°F (25°C)

Temp Sensor used to measure temperature, not currently available

Throttling the act of adjusting a valve or other flow control device to vary flow volume

Totalizer a resetable function of the controller which keeps count of the number of water meter pulses

Track Set Point a function of the controller in which set point offset range is determined by set point value

uS/cm micro Siemens

Water Hammer a potentially damaging situation that occurs if a valve in the system is opened to quickly, where the action results in a "hammering" effect throughout the system water lines

Y-Strainer inline filter or screen to remove debris from system flow assembly

12. ADDITIONAL CALIBRATION TECHNIQUES

Conductivity Calibration, 3-point method
Sensors: Carbon-Graphite, Platinum Black

1. Remove the conductivity sensor, refer to Section 5 Conductivity Calibration for instructions..

2. Install sensor into the CALKIT tee (see fig. 19). Rinse with and then refill with Low Cal solution.

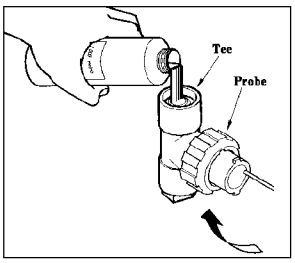


FIGURE 19
Conductivity sensor shown installed in CAL-KIT tee with deionized water being added.

3. Use the keys to move the prompt through the **MAIN MENU** to **CALIBRATE SENSORS**. Press ENTER.

```
        MAIN MENU
  AUTO SCROLL ON
  DISPLAY DATA
▶ CALIBRATE SENSORS
  SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
  SYSTEM CONFIGURE
```

4. **CALIBRATE SENSORS** menu will be displayed. Use the ARROW keys to move prompt next to **SYSTEM CONDUCTIVITY.** Press ENTER.

```
     CALIBRATE SENSORS
▶SYSTEM CONDUCTIVITY
  SYSTEM PH
  SYSTEM ORP


  PRESS  <HELP>
```

5. **SYSTEM CONDUCTIVITY** menu will be displayed. Using ARROW keys move prompt to **3 PT CAL**. Press ENTER.5. Press HOME key until **MAIN MENU-DISPLAY DATA** is displayed. SCROLL DOWN to **MAIN MENU-CALIBRATE SENSOR**. Press ENTER.

```
     CALIBRATE SENSORS
   SYSTEM CONDUCTIVITY
 CHOOSE 2 OR 3 PT CAL
   2 PT CAL
▶ 3 PT CAL


  PRESS  <HELP>
```

6. **3 PT SYS COND CAL** menu is displayed. Use ARROW keys to move prompt to **LOW**, press ENTER and prompt will flash. Use ARROW keys to input **0** (if not using a "Low Cal" solution) or enter the µS/CM value of the Low Cal solution and wait two minutes with the entered flashing. Press ENTER.

```
 3 PT SYS COND CAL
 ENTER CAL SOLUTION

▶ LOW          0 US/CM
  MID          0 US/CM
  HIGH         0 US/CM

  PRESS  <HELP>
```

7. Discard the Low Cal solution. Rinse and refill with the Mid Cal solution.

8. Use ARROW keys to move prompt to **MID**. Press ENTER and prompt will flash. Enter the µS/CM value of the Mid Cal solution. Press Enter.

```
 3 PT SYS COND CAL
 ENTER CAL SOLUTION

  LOW          0 US/CM
▶ MID          0 US/CM
  HIGH         0 US/CM

  PRESS  <HELP>
```

9. Discard the Mid Cal solution. Rinse and refill with the High Cal solution.

10. Use ARROW keys to move prompt to **HIGH**. Press ENTER and prompt will flash. Enter the mS/CM value of the High Cal solution and wait two minutes with the entered flashing. Press ENTER.

```
 3 PT SYS COND CAL
 ENTER CAL SOLUTION

  LOW          0 US/CM
  MID          0 US/CM
▶ HIGH         0 US/CM

  PRESS  <HELP>
```

11. Discard High Cal solution. Reinstall conductivity sensor into flow assembly, close sample valve and slowly open isolation valves. Let system stabilize 2 minutes. Press HOME key to return to **MAIN MENU**. Select **DISPLAY DATA** menu to verify calibration.

NOTE:

Be sure to allow sensor to stabilize for at least 2 minutes each time its environment is changed before evaluating readings.

pH Calibration, 3-point method

1. Close isolation valves and relieve pressure on the system by opening the sample valve. Remove sensor from flow assembly by unscrewing coupling ring. Pull sensor straight up with no side motion to prevent breakage (see fig. 20.) Inspect sensor, if deposits or fouling is present, clean sensor per instructions in Section 10, Maintenance, pg. 50.

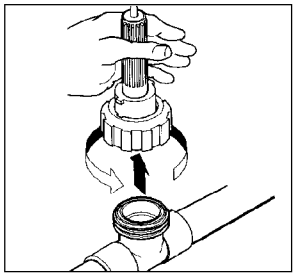


FIGURE 20
Removing sensor from flow assembly.

2. Use the arrow keys to move the prompt through the **MAIN MENU** to **CALIBRATE SENSORS**. Press ENTER.

```
        MAIN MENU
  AUTO SCROLL ON
  DISPLAY DATA
▶ CALIBRATE SENSORS
  SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
  SYSTEM CONFIGURE
```

3. **CALIBRATE SENSORS** menu will be displayed.Use the ARROW keys to move prompt next to **SYSTEM PH.** Press ENTER.

```
    CALIBRATE SENSORS
  SYSTEM CONDUCTIVITY
▶ SYSTEM PH
  SYSTEM ORP



  PRESS  <HELP>
```

4. **SYSTEM PH** menuwill be displayed. Using ARROW keys to move prompt to **3 PT CAL**. Press ENTER.

```
    CALIBRATE SENSORS
  SYSTEM PH
  CHOOSE 2 OR 3 PT CAL
  2  PT  CAL
▶ 3  PT  CAL


  PRESS  <HELP>
```

5. Rinse pH sensor with low buffer solution then place sensor in a clean container. Pour enough low buffer solution into the container to cover the sensor's tip (approximately 1") (see fig. 21).

6. **3 PT SYS PH CAL** menu is displayed with prompt next to **LOW**. Press ENTER and prompt will flash. Use ARROW keys to enter pH value of the low buffer solution and wait two minutes with entered value flashing. Press ENTER, prompt will stop flashing.

```
  3  PT  SYS  PH  CAL
  ENTER CAL SOLUTION

▶ LOW              0.00 PH
  MID              0.00 PH
  HIGH             0.00 PH

  PRESS  <HELP>
```

7. Rinse pH sensor with mid buffer solution then place sensor in a clean container. Pour enough low buffer solution into the container to cover the sensor's tip (approximately 1") (see fig. 21).

8. Use ARROW keys to move prompt to **MID**. Press ENTER and prompt will flash. Use ARROW keys to enter the pH value of the mid buffer solution and wait two minutes with entered value flashing. Press ENTER, prompt will stop flashing.

```
  3  PT  SYS  PH  CAL
  ENTER CAL SOLUTION

  LOW              0.00 PH
▶ MID              0.00 PH
  HIGH             0.00 PH

  PRESS  <HELP>
```

9. Rinse pH sensor with high buffer solution then place sensor in a clean container. Pour enough low buffer solution into the container to cover the sensor's tip (approximately 1") (see fig. 21).

10. Use ARROW keys to move prompt to **HIGH**. Press ENTER and prompt will flash. Use ARROW keys to enter the pH value of the high buffer solution and wait two minutes with entered value flashing. Press ENTER, prompt will stop flashing.

```
  3  PT  SYS  PH  CAL
  ENTER CAL SOLUTION

  LOW              0.00 PH
  MID              0.00 PH
▶ HIGH             0.00 PH

  PRESS  <HELP>
```

NOTE:

Be sure to allow sensor to stabilize for at least 2 minutes each time its environment is changed before evaluating readings.

11. Reinstall pH sensor into flow assembly (see fig. 22), close sample valve and slowly open isolation valves. Important, wait 2 minutes for sensor to stabilize before continuing!

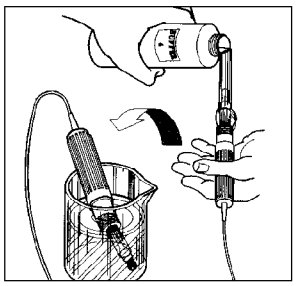


FIGURE 21
Adding buffer solution to sensor in a clean container for calibration.

ORP Calibration, 3-point method

1. Close isolation valves and relieve pressure on the system by opening the sample valve. Remove sensor from flow assembly by unscrewing coupling ring. Pull sensor straight up with no side motion to prevent breakage (see fig. 20) Inspect sensor, if deposits or fouling is present, clean sensor per instructions in Section 10, Maintenance, pg. 50.

2. Rinse ORP sensor with 100 mV, low buffer solution, then place sensor in a clean container. Pour enough low buffer solution into the container to cover the sensor's tip (see fig. 21).

3. Use the ARROW keys to move the prompt through the **MAIN MENU** to **CALIBRATE SENSORS**. Press ENTER.

```
        MAIN MENU
  AUTO SCROLL ON
  DISPLAY DATA
▶ CALIBRATE SENSORS
  SET POINTS & ALARMS
  INHIBITOR FEED SET
  BIOCIDE PROGRAMS
  SYSTEM CONFIGURE
```

4. **CALIBRATE SENSORS** menu will be displayed. Use the ARROW keys to move prompt next to **SYSTEM ORP.** Press ENTER.

```
    CALIBRATE SENSORS
  SYSTEM CONDUCTIVITY
  SYSTEM PH
▶ SYSTEM ORP



  PRESS  <HELP>
```

5. **SYSTEM ORP** menu will be displayed. Using ARROW keys move prompt to **3 PT CAL**. Press ENTER.

```
    CALIBRATE SENSORS
  SYSTEM ORP
  CHOOSE 2 OR 3 PT CAL
  2  PT  CAL
▶ 3  PT  CAL



  PRESS  <HELP>
```

6. **3 PT SYS ORP CAL** menu is displayed with prompt next to **LOW**. Press ENTER and prompt will flash. Use ARROW keys to input **100 MV**, the value of the low buffer solution and wait two minutes with the entered value flashing. Press ENTER, prompt will stop flashing.

```
  3  PT  SYS  ORP  CAL
  ENTER CAL SOLUTION

▶ LOW              100  MV
  MID                0  MV
  HIGH               0  MV

  PRESS  <HELP>
```

7. Rinse ORP sensor with 300 mV, mid buffer solution, then place sensor in a clean container. Pour enough mid buffer solution into the container to cover the sensor's tip (see fig. 21).

8.Use ARROW keys to move prompt to **MID**. Press ENTER and prompt will flash. Use ARROW keys to input **300 MV**, the value of the mid buffer solution and wait two minutes with the entered value flashing. Press ENTER, prompt will stop flashing.

```
  3  PT  SYS  ORP  CAL
  ENTER CAL SOLUTION

  LOW              100  MV
▶ MID              300  MV
  HIGH               0  MV

  PRESS  <HELP>
```

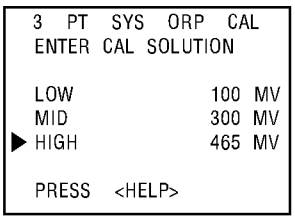
9. Rinse ORP sensor with 465 mV, high buffer solution, then place sensor in a clean container. Pour enough high buffer solution into the container to cover the sensor's tip (see fig. 21).

56

10.Use ARROW keys to move prompt to **HIGH**. Press ENTER and prompt will flash. Use ARROW keys to enter **465 MV,** the value of the high buffer solution and wait two minutes with the entered value flashing. Press ENTER, prompt will stop flashing.

11. Reinstall ORP sensor into flow assembly (see fig. 22), close sample valve and open isolation valves.

12. Press HOME repeatedly to return to **MAIN MENU**. Enter **DISPLAY DATA** to verify calibration.



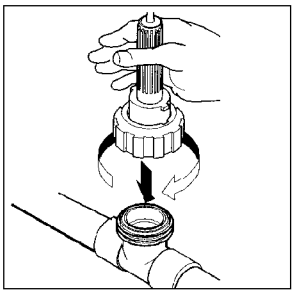


FIGURE 22
Reinstall sensor into flow assembly prior to verifying calibration.

13. MAKE-UP CONDUCTIVITY

OPERATION

If your controller is equipped with make-up conductivity, the blow down valve will be controlled by the lower of two set-points. One set-point is specified normally as the System Conductivity Set point, the other is calculated from the Make-up Conductivity.

The System Conductivity Set point is simple to understand. If you enter a Set point of 1,000 µS/cm, the blow down valve will open when the System Conductivity climbs above 1,000 µS/cm.

Make-up Conductivity is not as simple. The Make-up Conductivity is used to calculate a second System Conductivity Set-point in the Make-up Conductivity setup, you enter a Set point in terms of Cycles of Concentration or Cycles for short. The Cycles value is the ratio of the System Conductivity to the Make-up Conductivity.

Example: The System Conductivity is 2500 µS/cm and the Make-up Conductivity is 500 µS/cm. You determine the Cycles by dividing the System Conductivity (2500 µS/cm) by the Make-up Conductivity (500 µS/cm). So the CYCLES value in this example is 5.00 (2500/500=5.00).

If the Cycles value of the system exceeds the Set point, the blowdown valve will activate. But, don't forget, the System Conductivity Set point is active at the same time! Whichever Set point is lower activates the blowdown valve when the System Conductivity or System Cycles exceeds it. The following example should help you better understand these relationships.

Example: The System Conductivity Set point is 2800, the Make-up Set point is 5.00 Cycles.

Condition#1: If the System Conductivity is 2000 µS/cm, and the Make-up Conductivity is 500 µS/cm -- the System is operating at 4.00 Cycles. The blowdown valve will be closed. The System Conductivity is below the System Conductivity Set point (2000 is less than the Set point of 2800), and the System Cycles are below the Make-up Set point (4.00 is less than the Set point of 5.00).

Condition#2: If the System Conductivity rises to 2600, and the Make-up Conductivity remains the same at 500 µS/cm -- the System is operating at 5.20 Cycles. The blow down valve will open because the Make-up Conductivity Set point of 5.00 Cycles has been exceeded (5.20 is greater than the Set point of 5.00). The System Conductivity Set point is ignored (2600 is less than the Set point of 2800).

Condition#3: If the System Conductivity is 2000 µS/cm and the Make-up Conductivity falls to 200 µS/cm -- the system is operating at 10.00 Cycles. The blow down valve will be opened because of the Make-up Conductivity Set point of 5.00 Cycles (10.00 is greater than the Set point of 5.00). The System Conductivity Set point is ignored (2000 is less than the Set point of 2800).

Condition#4: If the System Conductivity rises to 3000 µS/cm and the Make-up Conductivity also rises to 750 µS/cm -- the system is operating at 4.00 Cycles. The blow down valve will be opened because of the System Conductivity Set point of 2800 µS/cm (3000 is greater than the Set point of 2800). The Make-up Set point is ignored (4.00 is less than the Set point of 5.00).

Your controller offers 5 Cycle Set points. Each Cycle Set point is effective over a range of Make-up Conductivity that you define. The default factory settings for the scale of 0-2000 µS/cm are shown in the following table.

Scale 2,000 µS/cm		
Lo Range	Hi Range	Set point
0	400	6 Cycles
401	800	5 Cycles
801	1200	4 Cycles
1201	1600	3 Cycles
1601	2000	2 Cycles

Example: If the Make-up Conductivity is 300 µS/cm, the Set point is 6 Cycles. If the Make-up Conductivity is 1,100 µS/cm, the Set point is 4 Cycles.

SENSOR CONNECTIONS

The Make-up Conductivity sensor is wired to channel B on the conductivity daughter board (see Diagram 5, page 34).

MENU STRUCTURE

The following menu changes are included:

NOTE:

For help with menu locations, refer to the laminated "Menu Map" supplied with your controller.

A) Main Menu/Display Data

Includes Make-up Conductivity, Cycles of concentration setting, system cycles and high or low make-up alarm if present.

```
      DISPLAY DATA
SYS COND     XXX US/CM
R SET PT     XXXX US/CM
M UP COND    XX US/CM
SYS CYCLE    X.XX CYC


PRESS  <HELP>
```

B) Main Menu/Calibrate Sensor

Includes Make-up Conductivity. Refer to Section 5: SENSOR INFORMATION/CALIBRATION and calibrate in the same manner as System Conductivity.

```
   CALIBRATE SENSORS
  SYSTEM CONDUCTIVITY
▶ MAKE-UP CONDUCTIVITY




PRESS  <HELP>
```

NOTE:

Make-up Alarms always act independently of the Set point and each other.

C) Main Menu/Set Points and Alarms

Includes Set point, Set point Differential and Hi/Lo Alarm. Refer to Section 4: CONTROLLER SET-UP/SET POINTS AND ALARMS for further information.

```
    SYSTEM MAKE UP
  R SET PT      6.00 CYC
▶ SPT DIFF      0.40 CYC
  HI ALARM      700 US/CM
  LO ALARM      500 US/CM


PRESS  <HELP>
```

Press SCROLL DOWN to change the display between the Differential/Alarms window and the Set Point and Range Assignments window.

You can set the upper range (e.g., 400) and associated Set point (e.g., 6.00 cycles) for each of 5 ranges.

```
    SYSTEM MAKE UP
    SCALE 200 US/CM
▶    0- 400      6.00 CY
   401- 800      5.00 CY
   801-1200      4.00 CY
  1201-1600      3.00 CY
  1601-2000      2.00 CY
  PRESS  <HELP>
```

D) System Configure

Includes Scale/Range setting for Make-up Conductivity. Refer to Section 4: CONTROLLER SET-UP/Scale-Range and set in the same manner as System Conductivity.

```
    SYSTEM CONFIGURE
▶ SCALE/RANGE SYS COND
  SCALE/RANGE MAKE-UP
  INHIBITOR TIMER 1
  TOTALIZER
  FACTORY REINIT

  PRESS  <HELP>
```

FACTORY SETTING FOR MAKE-UP CONDUCTIVITY CYCLE OF CONCENTRATION

Scale 500 µS/cm			Scale 2,000 µS/cm			Scale 5,000 µS/cm			Scale 10,000 µS/cm			Scale 20,000 µS/cm		
0	100	6 cy	0	400	6cy	0	1000	6 cy	0	2000	6 cy	0	4000	6 cy
101	200	5 cy	401	800	5 cy	1001	2000	5 cy	2001	4000	5 cy	4001	8000	5 cy
201	300	4 cy	801	1200	4 cy	2001	3000	4 cy	4001	6000	4 cy	8001	12000	4 cy
301	400	3 cy	1201	1600	3 cy	3001	4000	3 cy	6001	8000	3 cy	12001	16000	3 cy
401	500	2 cy	1601	2000	2 cy	4001	5000	2 cy	8001	10000	2 cy	16001	20000	2 cy
Hi - 210/Lo - 90			Hi - 840/Lo - 360			Hi - 2100/Lo - 900			Hi - 4200/Lo - 1800			Hi - 8400/Lo - 3600		

0-2,000 uS/cm Scale Factory Configured

Electrode	HCN-3A temperature compensated from 45°F (7.2°C) to 105°F (40.6°C), 1" NPT insertion type with quick release 3/4" glass filled polypropylene tee. Pressure rating: 125 psi at 125°F (52°C).
Set Point	Rising set point of cycles of concentration. See table above.
Range	Selectable 0 to 500, 2000, 5000, 10000 and 20000; factory set at 2000 µS/cm.
Accuracy	+/- 1% of full scale, at point of measure, excluding electrode.
Differential	Adjustable; factory set at .20 cycles.
High/Low Alarm	Adjustable; independent set point of high and low alarm. See above table.

MAKE-UP CONDUCTIVITY SPECIFICATIONS

MAKE-UP CONDUCTIVITY ACCESSORIES

(Available through your distributor or sales representative, but not included as standard.)

1. Isolation Valves, to isolate for maintenance.

14. BIOCIDE PROGRAMMING WORK SHEET

(Please make copies of this sheet for future use)

CHEMICAL NAME _____ **BIOCIDE** _____

PROGRAM #1

Week _____ Day _____

Start Time: _____:_____H:M

PROGRAM #2

Week _____ Day _____

Start Time: _____:_____H:M

PROGRAM #3

Week _____ Day _____

Start Time: _____:_____H:M

PROGRAM #4

Week _____ Day _____

Start Time: _____:_____H:M

Biocide ___ Run Time _____:_____H:M

Biocide ___ Pre-Bleed Time _____:_____H:M

Biocide ___ Pre-Bleed Min Conductivity _____:_____H:M

Biocide ___ Bleed Lock-Out _____:_____H:M

Make Copies and Repeat For Each Biocide

NOTES:

15. CONDUIT WIRING TABLE

Conduit units are factory predrilled with easily accessible terminals for hard wiring. See Relay Board, Diagram 4, 4a, pg. 32, 33, and Electrical Wiring section in this manual, pg. 7.

NOTE: Use only 16 (1.5 mm) or 18 AWG (1.2 mm) wire for conduit power and load connections. Never run power and signal wiring together in same conduits. (Example: Sensor Outputs with Power wiring)

INSTRUCTIONS: Find the type of your controller and its options in the far left column. Options that do not require wiring will not appear in the model number. Find the output in the columns to the right. The connection for that output will be the letter in the row labeled "Relay/Fuse Connection."

	RELAY 1	RELAY 2	RELAY 3	RELAY 4	RELAY 5	RELAY 6	RELAY 8
RELAY/FUSE	**C**	**D**	**E**	**F**	**G**	**H**	**I**
CONDUCTIVITY CONTROLLER WITH OPTION							
Standard	BLOWDOWN	TIMER OUT 1					ALARM RELAY
C	BLOWDOWN	TIMER OUT 1	TIMER OUT 2				ALARM RELAY
CC	BLOWDOWN	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3			ALARM RELAY
CCE	BLOWDOWN	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3	BIO A		ALARM RELAY
CCF	BLOWDOWN	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3	BIO A	BIO B	ALARM RELAY
CE	BLOWDOWN	TIMER OUT 1	TIMER OUT 2	BIO A			ALARM RELAY
CF	BLOWDOWN	TIMER OUT 1	TIMER OUT 2	BIO A	BIO B		ALARM RELAY
CG	BLOWDOWN	TIMER OUT 1	TIMER OUT 2	BIO A	BIO B	BIO C	ALARM RELAY
E	BLOWDOWN	TIMER OUT 1	BIO A				ALARM RELAY
F	BLOWDOWN	TIMER OUT 1	BIO A	BIO B			ALARM RELAY
G	BLOWDOWN	TIMER OUT 1	BIO A	BIO B	BIO C		ALARM RELAY
pH CONTROLLER WITH OPTION							
Standard	pH CONTROL						ALARM RELAY
C	pH CONTROL	TIMER OUT 1					ALARM RELAY
CC	pH CONTROL	TIMER OUT 1	TIMER OUT 2				ALARM RELAY
CCC	pH CONTROL	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3			ALARM RELAY
CCCE	pH CONTROL	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3	BIO A		ALARM RELAY
CCCF	pH CONTROL	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3	BIO A	BIO B	ALARM RELAY
CCE	pH CONTROL	TIMER OUT 1	TIMER OUT 2	BIO A			ALARM RELAY
CCF	pH CONTROL	TIMER OUT 1	TIMER OUT 2	BIO A	BIO B		ALARM RELAY
CCG	pH CONTROL	TIMER OUT 1	TIMER OUT 2	BIO A	BIO B	BIO C	ALARM RELAY
CE	pH CONTROL	TIMER OUT 1	BIO A				ALARM RELAY
CF	pH CONTROL	TIMER OUT 1	BIO A	BIO B			ALARM RELAY
CG	pH CONTROL	TIMER OUT 1	BIO A	BIO B	BIO C		ALARM RELAY
E	pH CONTROL	BIO A					ALARM RELAY
F	pH CONTROL	BIO A	BIO B				ALARM RELAY
G	pH CONTROL	BIO A	BIO B	BIO C			ALARM RELAY
I	pH CONTROL	ORP CONTROL					ALARM RELAY
CI	pH CONTROL	ORP CONTROL	TIMER OUT 1				ALARM RELAY
CCI	pH CONTROL	ORP CONTROL	TIMER OUT 1	TIMER OUT 2			ALARM RELAY
CCCI	pH CONTROL	ORP CONTROL	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3		ALARM RELAY
CCCEI	pH CONTROL	ORP CONTROL	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3	BIO A	ALARM RELAY
CCEI	pH CONTROL	ORP CONTROL	TIMER OUT 1	TIMER OUT 2	BIO A		ALARM RELAY
CCFI	pH CONTROL	ORP CONTROL	TIMER OUT 1	TIMER OUT 2	BIO A	BIO B	ALARM RELAY
CEI	pH CONTROL	ORP CONTROL	TIMER OUT 1	BIO A			ALARM RELAY
CFI	pH CONTROL	ORP CONTROL	TIMER OUT 1	BIO A	BIO B		ALARM RELAY
CGI	pH CONTROL	ORP CONTROL	TIMER OUT 1	BIO A	BIO B	BIO C	ALARM RELAY
EI	pH CONTROL	ORP CONTROL	BIO A				ALARM RELAY
FI	pH CONTROL	ORP CONTROL	BIO A	BIO B			ALARM RELAY
GI	pH CONTROL	ORP CONTROL	BIO A	BIO B	BIO C		ALARM RELAY
CONDUCTIVITY/pH CONTROLLER WITH OPTION							
Standard	BLOW DOWN	pH CONTROL	TIMER OUT 1				ALARM RELAY
C	BLOW DOWN	pH CONTROL	TIMER OUT 1	TIMER OUT 2			ALARM RELAY
CC	BLOW DOWN	pH CONTROL	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3		ALARM RELAY
CCE	BLOW DOWN	pH CONTROL	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3	BIO A	ALARM RELAY
CE	BLOW DOWN	pH CONTROL	TIMER OUT 1	TIMER OUT 2	BIO A		ALARM RELAY
CF	BLOW DOWN	pH CONTROL	TIMER OUT 1	TIMER OUT 2	BIO A	BIO B	ALARM RELAY
E	BLOW DOWN	pH CONTROL	TIMER OUT 1	BIO A			ALARM RELAY
F	BLOW DOWN	pH CONTROL	TIMER OUT 1	BIO A	BIO B		ALARM RELAY
G	BLOW DOWN	pH CONTROL	TIMER OUT 1	BIO A	BIO B	BIO C	ALARM RELAY
I	BLOW DOWN	pH CONTROL	ORP CONTROL	TIMER OUT 1			ALARM RELAY
CI	BLOW DOWN	pH CONTROL	ORP CONTROL	TIMER OUT 1	TIMER OUT 2		ALARM RELAY
CCI	BLOW DOWN	pH CONTROL	ORP CONTROL	TIMER OUT 1	TIMER OUT 2	TIMER OUT 3	ALARM RELAY
CEI	BLOW DOWN	pH CONTROL	ORP CONTROL	TIMER OUT 1	TIMER OUT 2	BIO A	ALARM RELAY
EI	BLOW DOWN	pH CONTROL	ORP CONTROL	TIMER OUT 1	BIO A		ALARM RELAY
FI	BLOW DOWN	pH CONTROL	ORP CONTROL	TIMER OUT 1	BIO A	BIO B	ALARM RELAY

PULSAFEEDER®
Standard Products Operations
27101 Airport Rd.
Punta Gorda, FL 33982
941-575-3800 Fax: 941-575-4085
800-333-6677
Fax Orders 800-274-6677