TECHNICAL REFERENCE GUIDE

MICROPROCESSOR – BASED WATER TREATMENT CONTROLLER

9300/9500 Series Cooling Tower

Table of Contents

Conventions

For the remainder of this bulletin, the following conventions are in effect.

A WARNING DEFINES A CONDITION THAT COULD CAUSE DAMAGE TO BOTH THE EQUIPMENT AND THE PERSONNEL OPERATING IT. PAY CLOSE ATTENTION TO ANY WARNING.

Notes are general information meant to make operating the equipment easier.

Tips have been included within this bulletin to help the operator run the equipment in the most efficient manner possible. These "Tips" are drawn from the knowledge and experience of our staff engineers, and input from the field.

This is a procedure heading. A Procedure Heading indicates the starting point for a procedure within a specific section of this manual.

Standards:

The following standards have been developed to make using this manual easier. Formatting certain sections of text so that they stand out from the main body, alerts the user that there is some item of interest within a specific paragraph by drawing the users attention to:

- Text that has been formatted ***bold*** and ***italicized*** (e.g., ***Section 10, Maintenance***) indicates reference text.
- Text that is displayed using `Courier` as the Font type indicates a "`Command String`" (*DOS* text), or display window.
- Text that has been formatted in UPPER CASE letters, and surrounded by brackets [ ] indicates a button to be pressed (e.g., [ENTER]).
- Text that has been formatted in UPPER CASE letters, using the **Arial - Bold** Font indicates a menu selection (e.g., **CALIBRATION**).

1. Introduction

Your microprocessor based controller has been designed to monitor and control the quality of your cooling tower's water.

This instruction manual covers the features of the standard controllers listed in ***Table 1***.

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*** on the next page to see if that feature is available for your controller.
- Refer to the model number of your controller found on the enclosure of the unit. The letters after the model number are the hardware options installed.
- After the above steps, if a 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.

1.1 Description

Models with Conductivity control (refer to ***Table 1*** on the next page) are designed to monitor and control Total Dissolved Solids (TDS) in open circulating cooling systems, in terms of electrical conductivity measured in micro Siemens per centimeter (µS/CM). A setpoint 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. (A built in limit timer can also be set-up to activate an alarm if the system over-bleeds.) 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.

Models with pH control, monitor and control pH by adding acid and/or caustic based on setpoints entered into the controller through the front keypad. The pH control has a built in limit timer that acts as a fail safe to prevent system overfeed. The design also includes a High/Low pH Alarm with relay output.

Models with ORP control, monitor and control the addition of chlorine or bromine. The setpoint is entered into the unit through the front keypad. A limit timer is included to prevent system over feed.

All models include multiple Taggable Timers that allow the user to choose 1 of 7 timer modes on which to base the addition of chemicals:

1. "LIMIT TIMER" The Timer relay output is actuated simultaneously with blowdown. The timer limits feed time during any single blowdown cycle, preventing overfeed.
2. "PERCENT TIMER" The Timer runs continuously for an adjustable time cycle. The timer relay is activated for an adjustable percent of the time cycle.
3. "PERCENT POST BLOWDOWN" This Timer tracks the total blowdown time. It activates the relay when the blowdown deactivates, for a percent of total blowdown time.
4. "PULSE TIMER" The controller accepts pulses from either a contacting head or Hall Effect water meter.
5. "28 DAY TIMER" The Timer has 4 programmable start times. It uses MONTH, WEEK, DAY, HOUR and MINUTE to define the start time. If programmed, the timer will pre-bleed the system, then activate the relay (locking out all other timers) and lockout the bleed relay.
6. "CYCLE TIMER" The timer has 4 programmable start times. It uses month, week, day, hour and minute to define the start time. It then cycles the relay on and off at a specified rate.
7. "SLAVE TIMER" This timer allows the relay to be slaved to (i.e., mimic the action of) any other relay.

A mounted flow assembly with quick release sensor, flow switch and sample cock is provided with all standard models 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 when fully charged (usually after 24 hours operation) will 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.

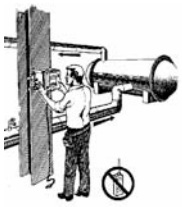
Series 9310/ 9510	☞ Conductivity ☞ 4 Timers
Series 9320/9520	☞ Conductivity / ORP ☞ 4 Timers
Series 9330/9530	☞ Conductivity / Single or Dual Setpoint pH ☞ 3 or 4 Timers
Series 9340/9540	☞ Conductivity / Makeup / Single or Dual Setpoint pH (Setpoint) ☞ 3 or 4 Timers
Series 9350/9550	☞ Conductivity / Makeup / Single or Dual Setpoint pH / ORP ☞ 2 or 3 Timers
Series 9360/9560	☞ Open Loop Conductivity ☞ Closed Loop Conductivity ☞ 4 Timers
Series 9370/9570	☞ Tower #1 Conductivity ☞ Tower #2 Conductivity ☞ 4 Timers
9500 Series Models	☞ 4 Single Point Drum Level connections (**9500** ONLY) ☞ 2 Water Meter Totalizers ☞ 1 Flow Sensor (Standard Model) ☞ 1 Powered Alarm Relay ☞ 2 Dry Contact Alarm Relay
Optional On All Models	☞ Non-Standard sensors ☞ 2 Analog Outputs (9300 Series) ☞ 2 or 4 Analog Outputs & Inputs (9500 Series)

Table 1 – Model Summary

2. Installation

2.1 Location

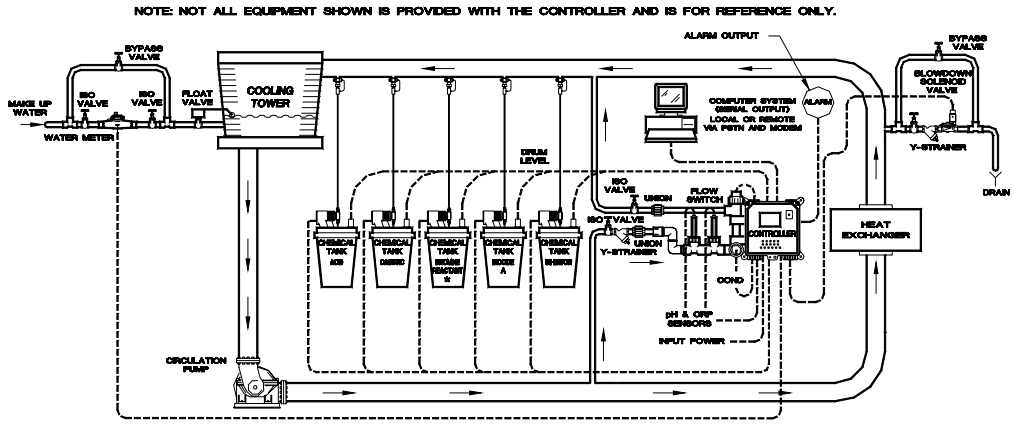
Select a mounting location convenient to grounded electrical and plumbing connections. Mount the controller on a wall or other vertical surface with adequate lighting at a comfortable level. Refer to ***Section 7, Diagram 1,*** standard dimensional data for mounting details of our standard enclosures. A mounting hole template is also provided in the literature packet supplied with your controller. Avoid locations where the controller would be subjected to extreme cold or heat. Installation should comply with all national, state and local codes.



WARNING **LOCATIONS WHERE THE CONTROLLER WOULD BE SUBJECTED TO EXTREME COLD OR HEAT {LESS THAN 0°F (-17.8°C) OR GREATER THAN 122°F (50°C)}, DIRECT SUNLIGHT, VIBRATION, VAPORS, LIQUID SPILLS OR EMI (ELECTROMAGNETIC INTERFERENCE; I.E., STRONG RADIO TRANSMISSION AND ELECTRIC MOTORS.)**

Figure 1 – Typical Installation

NOTE



The standard flow assembly, is constructed of durable glass filled polypropylene (GFPPL). Connection to the flow line is 3/4" NPT (19.05 mm). A PVC thread to slip adapter is provided so that a PVC weld joint, if preferred, can be made.

2.2 Installation Notes

1. Install sensors or sample stream flow assembly at some point before chemical injection points where chemical and water are thoroughly mixed (see *Figure 1*).
2. Measuring surfaces of the sensor electrodes must be continuously immersed in system water.
3. The difference between the inlet and output pressure must be sufficient to provide a flow rate between 1 to 5 GPM (3.81 to 19.05 l/m) to assure water will flow past the sensors and they will read properly.
4. Install strainer on the upstream side of the flow assembly to collect debris that might affect controller operation. Install unions on both the inlet and outlet (see *Figure 1*).
5. Install hand valves on each side of the flow assembly for easy isolation, flow throttling, and removal of sensors and strainer screens (see *Figure 1*).
6. Direction of flow should be from the bottom to the top of the flow assembly so flow monitoring switch will operate properly (see *Figure 2*).

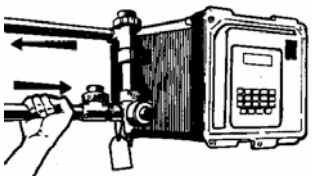


Figure 2

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) if blowdown is incorporated (see *Figure 1*).
8. Most solenoid valves require a pressure differential of 7 psi (0.48 BAR) to 15 psi (0.96 BAR) to close; if this is not available, install a 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 (see *Figure 1*).
10. For proper operation and accuracy, install water meters horizontally with meter face up if Pulse Timer mode is used.

NOTE **Water meter installation - A horizontal length equivalent to at least 12 pipe diameters must precede 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.**

11. If chemicals are to be injected into sample line (not recommended), always use a back check valve to prevent chemicals from backing up around sensors.
12. If a flow assembly or sample stream assembly is present, never install a blowdown valve off these lines. The system will not achieve proper blowdown and accuracy of controller readings may be affected.
13. Refer to the next section for sensor installation. After installation of all sensors check all connections. Then open the isolation valves and check for leaks.

2.3 Sensor Installation

Controller set-up 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 (see *Figure 3*-A). Insert is held in place by rubber "O" ring.
5. Apply six wraps of teflon tape to threads of sensors (see *Figure 3*-B).
6. If your controller is equipped with a pH or ORP sensor, remove the liquid filled protective cover from the sensor tip.

WARNING **EXERCISE CARE WHEN REMOVING THE PROTECTIVE COVER FROM THE PH OR ORP SENSOR. DO NOT HIT THE TEE OR OTHER PIPING WITH THE GLASS BULB. NEVER EXPOSE THE SENSOR TO AIR WITH POWER ON FOR MORE THAN 45 SECONDS. NEVER ALLOW THE SENSOR TO DRY OUT.**

   a) Loosen the cap by twisting prior to removal. Save for future storage.
   b) Use supplied cover filled with proper storage solution. (see *Figure 3*-D). See ***Section 10 - Maintenance*** for more information

7. Slip coupling nut over sensor, then hand tighten threaded insert on the teflon wrapped threads of sensor. (*Figure 3*-C)
8. Gently install sensor into sensor housing on flow assembly. Make sure sensor is firmly seated in housing. (*Figure 3*-E)
9. Slip coupling nut 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 ***Section 7, Diagrams 2, 2a, 3,*** and ***3a*** for information and specifications of sensors supplied with your system.

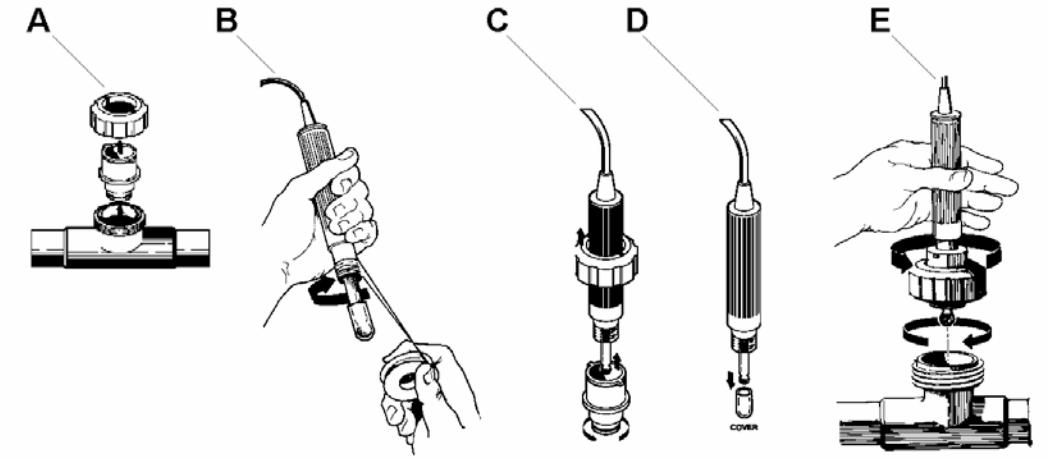


Figure 3

2.4 Accessories (not included)

The following accessories are suggested to complete the installation.

- Two manual gate valves, one on each side of the sensor/flow assembly, to isolate the sensor/flow assembly for installation and routine maintenance.
- One needle valve, for isolating and throttling the blowdown flow rate.
- Three manual gate valves, for isolating, bypassing and maintenance of water meter, if controller incorporates a water meter (optional).
- Solenoid valve for blowdown (bleed).
- Two Y-strainers, one before solenoid valve and the other before the flow assembly.
- Chemical metering pumps as required.
- Contacting head water meter (optional).
- External alarm.
- External cables, water meter, level wand, 4-20mA (input & output), Dry Contact Alarm

2.5 Electrical Wiring

UNIT MUST BE WIRED IN ACCORDANCE WITH ALL APPLICABLE ELECTRICAL CODES.

The controller electronic circuitry is fuse protected (refer to ***Section 7, Diagram 10***). In addition, each output relay is individually protected by a replaceable plug-in 5 amp fuse on the relay board (refer to ***Section 7, Diagram 4***). Use of a surge protector is strongly recommended! The device should satisfy the following minimum requirements:

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

The controller should be connected to its own 15 amp power branch (i.e., its own wiring, circuit breaker, etc.). For best results, the ground should be independent (true earth) not shared.

Pre-wired units are supplied with 6 ft (1.8 m), 18 AWG (1.2 mm^2) 3-wire grounded power cords and clearly marked 18 AWG (1.2 mm^2) 3-wire grounded receptacle cords for all controlled line voltage outputs.

Conduit units are factory predrilled with easily accessible connections for hard wiring. See ***Section 7, Diagram 4***, for input and output power connections. Use only 16 AWG (1.5 mm^2) or 18 AWG (1.2 mm^2) wire for conduit power and load connections.

Use 22 AWG (.76 mm^2) 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.

Liquid Tight fittings are provided for all signal leads.

2.5.1 User Connections

When connections are required by the end user, follow the instructions below. All electrical diagrams, circuit boards, etc., are located in Section 7.

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!

2.5.1.1 Open Enclosure

1. Loosen the thumb screw on the dust cover and lift up.
2. Remove the two captive screws from upper control panel. Gently swing the panel down on its hinges.

NOTE

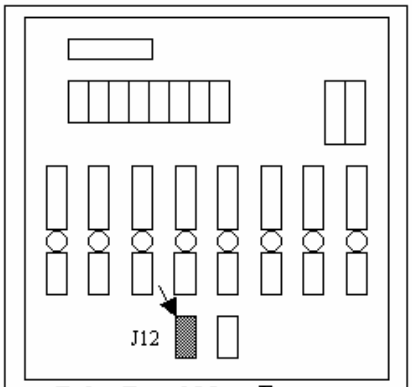
The screws are retained and will not fall out.

2.5.1.2 Power

NOTE

The controller should be connected to its own 15 amp power branch (i.e., its own wiring, circuit breaker, etc.). For best results, the ground should be independent (true earth) not shared.

Connect the incoming power to J12 on the Relay Board located at the bottom of the enclosure. Connect the Neutral to position '1' labeled 'RTN.' Connect the Earth Ground to position '2' labeled with the earth ground symbol. Connect the Line to position 3 labeled 'HOT.' Use only 16 AWG (1.5 mm^2) wire.



Relay Board Map: Power
Note: Use of a surge protector is recommended!

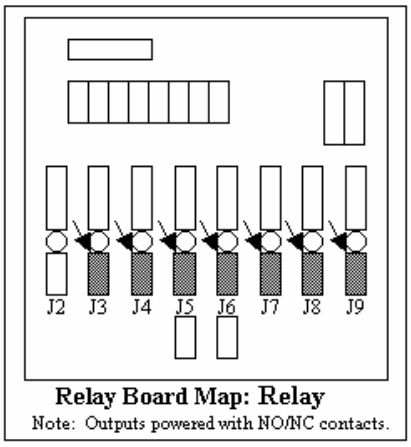
The control circuit is fuse protected (refer to ***Section 7, Diagram 10***). In addition, each output relay is individually protected by a replaceable plug-in 5 amp fuse on the relay board (refer to ***Section 7, Diagram 4***).

Use of a surge protector is strongly recommended! The device should satisfy the following minimum requirements:

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

2.5.1.3 Relay Connections

Relay connections are made to J3, J4, J5, J6, J7, J8 and J9. Use only 16 or 18 AWG (1.5mm^2 or 1.22mm^2) wire. Both normally open and normally closed powered contacts are available. To complete the wiring, first locate your model number (refer to ***Table 1***). Then note the relay positions and associated functions. Wire your blowdown device (e.g., motorized ball valve) to the appropriate position. Note all outputs are powered at line voltage and fused at 5A. Many motorized ball valves require connections to both the Normally Open (NO) and Normally Closed (NC) terminals. Refer to ***Section 7, Diagram 4*** for further wiring details.



Relay Board Map: Relay
Note: Outputs powered with NO/NC contacts.

2.5.1.4 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 the cooling tower is shut down. This connection is provided on all standard units.

To use the interlock feature, connect a flow switch or auxiliary dry contact from another device. Refer to ***Section 7, Diagram 4,*** for flow switch or interlock connection location (connections are position 11 and 12 labeled FLOW SWITCH).

To activate this function:

1. Turn the power switch off.
2. Turn switch S1-"2" on.

   This switch is located on the mother board (refer to ***Section 7, Diagram 7***).
3. Wait 15 seconds, and turn power back on.

2.5.1.5 Sensor Connections

Units supplied with Glass Filled Polypropylene flow assemblies come from the factory with all sensors pre-connected. Refer to ***Section 7, Diagrams 5 and 6*** for location of sensor connections. Use of non-factory provided sensors will void the warranty.

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.**

2.5.1.6 Water Meter (for Pulse Timer)

Electrical wiring is not required for water meters. A DIN connector has been wired to the Relay Board at the bottom of the enclosure and is mounted on the side of the enclosure for quick connection. Refer to ***Section 7, Diagram 4***, for the internal water meter connection locations. The connections are made to J11. Connect water meter #1 to positions 13 and 14. Connect water meter #2 to positions 15 and 16.

The external water meter connection cables are available as an accessory with customer specified lengths.

The Controller can be configured with one or more (model dependent) water meters driving one or more pulse timers. The association is made in software not in hardware. Refer to ***Controller Setup*** for further information.

2.5.1.7 Drum Level

Electrical wiring is not required for single point drum level sensors. A DIN connector has been wired to the Relay Board at the bottom of the enclosure and is mounted on the side of the enclosure for quick connection. Refer to ***Section 7, Diagram 4***, for the internal connection locations. The connections are made to J11 positions 1, 2, 3, 4, 5, 6, 7, and 8 on the Relay Board.

The external drum level connection cables are available as an accessory with customer specified lengths. See ***Section 7, Diagram 11***.

2.5.1.8 Alarm Dry Contact

Alarm dry contacts (rated @ 500 mA) are standard..

The internal connections are made to J1 positions 1, 2, 3 and 4 on the Relay Board at the bottom of the enclosure.

External connection is made on the side of the enclosure through a DIN connector. Optional pigtails are available at a customer specified length.

Refer to ***Section 7, Diagram 4,*** for the Alarm Dry Contact connection location.

2.5.1.9 Receptacles

The Controller offers a unique pre-wired package as standard. Each cord is clearly marked and readily accessible for connecting external electrical devices to be controlled.

A conduit option is available. Refer to ***Section 7, Diagram 4*** for wiring.

2.5.1.10 4-20 mA Input connections. (9500 Series Only)

Electrical wiring is not required for 4-20 mA Inputs. A DIN connector mounted to the side of the enclosure is connected to the Daughter Board (plugged into the Mother Board). The connections are made to J2 positions 1, 2, 3, 4, 5, and 6.

A pigtail is available, at a customer specified length, with the appropriate connectors for 4-20 mA transmitters. See ***Section 7, Diagram 6,*** for Daughter Board location.

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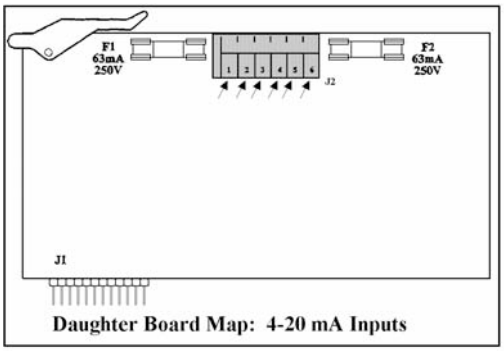
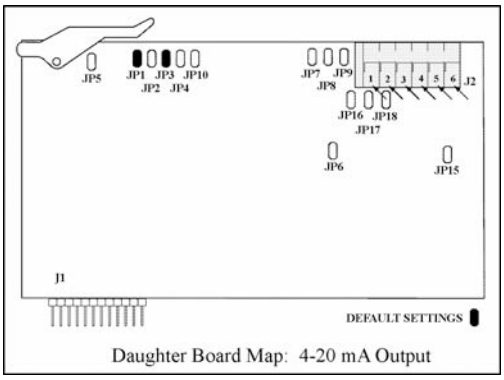


Daughter Board Map: 4-20 mA Inputs

2.5.1.11 4-20 mA Output connections.

Electrical wiring is not required for 4-20 mA Outputs. A DIN connector mounted to the side of the enclosure is connected to the Daughter Board (plugged into the Mother Board). The connections are made to J2 positions 1, 2, 3, 4, 5, and 6.

A pigtail is available, at a customer specified length, with the appropriate connectors for 4-20 mA transmitters. See ***Section 7, Diagram 6,*** for Daughter Board location.



Daughter Board Map: 4-20 mA Output

2.5.2 Hardware Settings

The default hardware settings for your controller will satisfy a majority of cooling tower installations. Review the default operating ranges listed in the table below. If you expect to operate outside of the stated range, check the 'User Setting?' column to see if you can change the setting. If you can (YES), refer to the associated page listing for jumper / switch setting diagrams and instructions.

Input/Output Description	Default Setting	User Setting?	Page Ref.
System Conductivity	0-5000 µS/CM	YES	126
Make-up Conductivity	0-2000 µS/CM	YES	126
pH	0-14 pH	NO	N/A
ORP	0-1000 mV	NO	N/A
4-20mA Input	0-20mA	NO	N/A
4-20mA Output	0-20mA	YES	127
Power Supply (In)	90-250 VAC, 50/60 Hz	NO	N/A
Flow Switch	ON (if flow assembly supplied)	YES	128
Serial Communications	RS-232	NO	N/A

3. Start Up Instructions

READ THE FOLLOWING BEFORE PROCEEDING ANY FURTHER!!

3.1 Power-up

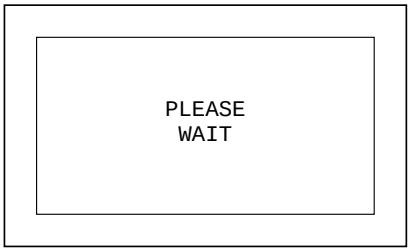
WARNING

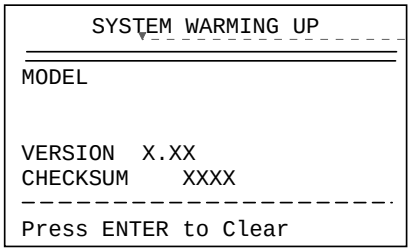
BEFORE APPLYING POWER, INSURE THAT DEVICES BEING CONTROLLED ARE NOT IN A POSITION TO CAUSE HARM OR DAMAGE IF ACTIVATED UPON INITIAL START-UP.

With the controller now installed in a convenient location, supply power to the controller and turn the Logic Power switch on.

The power LED indicator light will be illuminated.

A **PLEASE WAIT** screen is displayed briefly followed by the **SYSTEM WARMING UP** screen.





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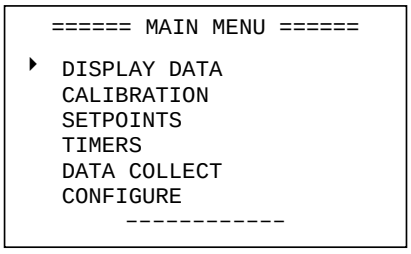
During warming up, the controller performs internal diagnostics.

When the diagnostics check is complete, the **MAIN MENU** is displayed.



NOTE

The results of the Diagnostic check is reported in the Configure/Diagnostics menu. Refer to *Section 4, Diagnostics*.

3.2 Front Panel

Take a moment to review *Figure 4*, to become familiar with the controller front panel.

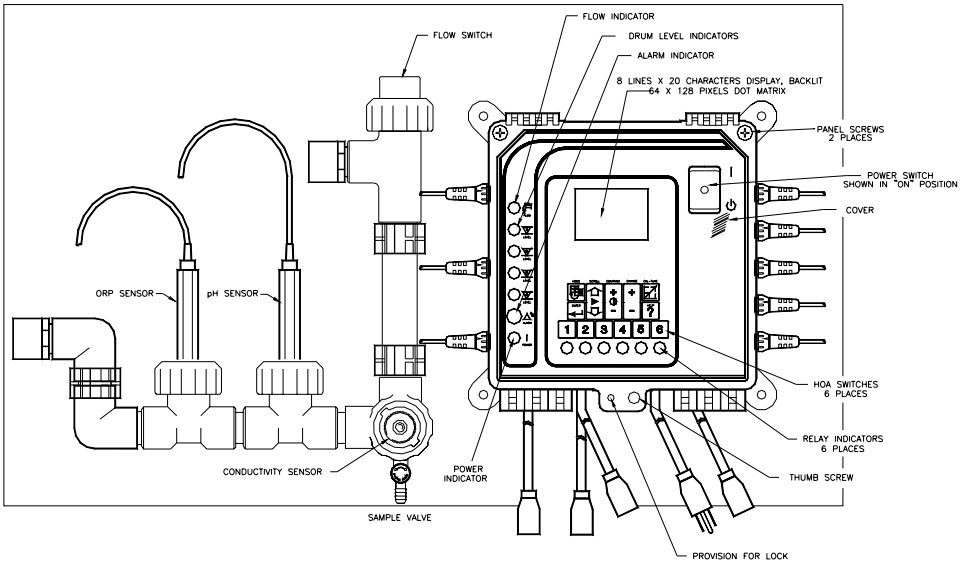
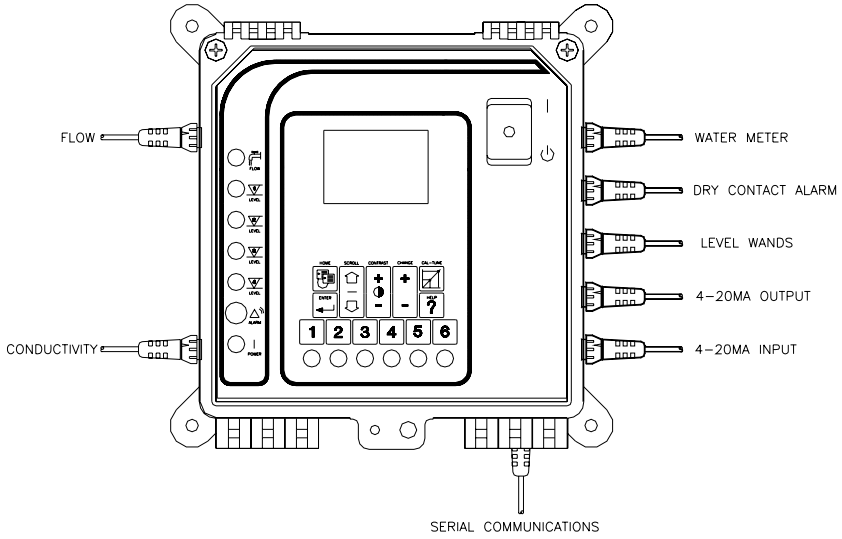


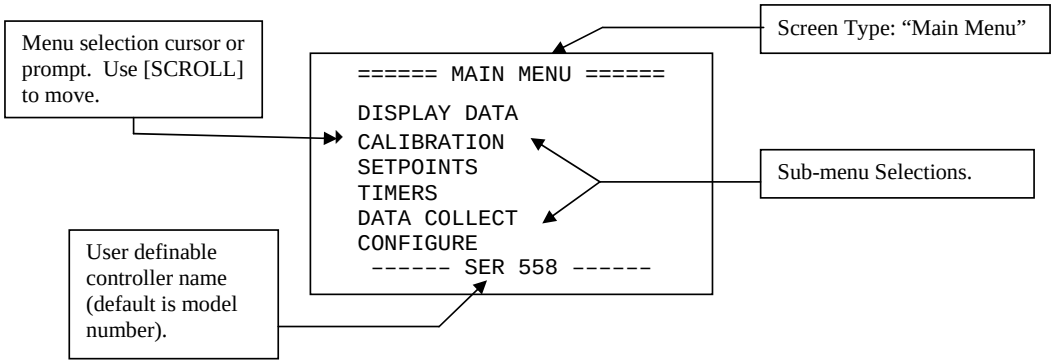
Figure 4 – Front Panel

Your controller will come mounted to a polypropylene panel. The size of this panel will vary depending on the model and options ordered. The Conductivity controllers are mounted on a small panel, 20.5 x 13, Conductivity/pH/ORP controllers are mounted on a large panel, 29 x 13.



3.3 Menu Structure

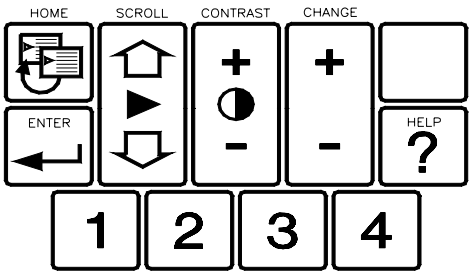
The Controller's menu structure is designed to be user friendly. The **MAIN MENU** structure diagram shows the first level of all sub-menus in the controller. Not all sub-menus shown here may be present on your controller. The laminated "MENU MAP" supplied with the controller reflects your specific system with options.



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

- **Display Data** – Displays date, time, week number, software version, present sensor readings, set-points, system alarms, and relay on times. After five minutes of no keypad activity, the controller will start to scroll through the display data screens automatically. It is possible to lock any of the display data screens to display continuously. This menu displays information only. No settings or adjustments are made through this menu.
- **Calibration** – This menu is for analog input sensor calibration, such as conductivity, pH, and ORP. In this menu, you can choose either 1 or 2 point calibration. The calibration values and "**LAST CAL**" date stamp are displayed on the menu. You can also use the "**TUNE**" feature to adjust the current value to a hand held tester's measurement.
- **Setpoints** – In this menu, you are prompted to enter settings pertaining to setpoints that control the system's operation and associated alarms.
- **Timers** – In this menu, you are prompted to enter settings pertaining to the Timers. You can select between five different timer types.
- **Data Collection** – In this menu you make manual recordings of field data.
- **System Configure** – This is generally the first selection made at start up. In this menu, you are prompted to configure system functions and options to your specific application. System Configure includes such things as time of day, date, security, communications, diagnostics, relay on time and factory re-initialization.

3.4 Key Pad Operation



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

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 [HOME] to return to the previously displayed menu. Press [HOME] to exit an edit field. Press [HOME] to reject a setting.
- **SCROLL UP/SCROLL DOWN** – Press [SCROLL] to move the triangular cursor or "prompt" to the next line.
- **CONTRAST UP/CONTRAST DOWN** – Press [CONTRAST] to control the contrast of the viewing screen. Pressing [UP] will darken the display, pressing [DOWN] will lighten it.
- **ARROWS** – The Arrow keys are used to change the numbers or values associated with the various settings you will be entering. Use [DOWN] to select lower numbers and [UP] to select higher numbers.

TIP **When using the Arrow Keys, press once to change the number by one unit.**

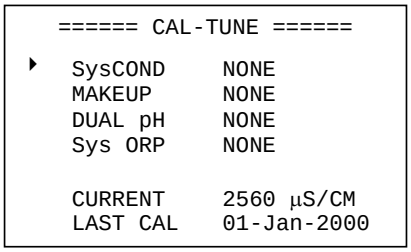
- **ENTER** – Enter has three functions:

1. After moving the prompt using the [SCROLL] key to a menu choice, press [ENTER] to display the sub menu of the choice you selected.
2. (Within the sub menu), after moving the prompt with [SCROLL] to the selection of your choice, press [ENTER] to edit the selection (the prompt will disappear and the value to be changed will reverse - **a white character is displayed against a black background**).

WARNING **NEVER LEAVE A SCREEN IN THE MIDDLE OF EDITING A FIELD! CONTROLLER ACCURACY MAY BE AFFECTED, AND/OR THE CONTROLLER MAY NOT OPERATE PROPERLY. IF YOU FORGET, SIMPLY RETURN TO THAT MENU AND COMPLETE YOUR PROGRAMMING.**

3. After changing/selecting the value needed with [UP] / [DOWN] press [ENTER] to "lock-in" the value. The prompt and value selected will appear normal.

- **CAL-TUNE** – When pressed, the controller displays a **CAL-TUNE** menu where you can "**TUNE**" the calibration of any of the controllable inputs (e.g., system conductivity, pH ORP, etc.).



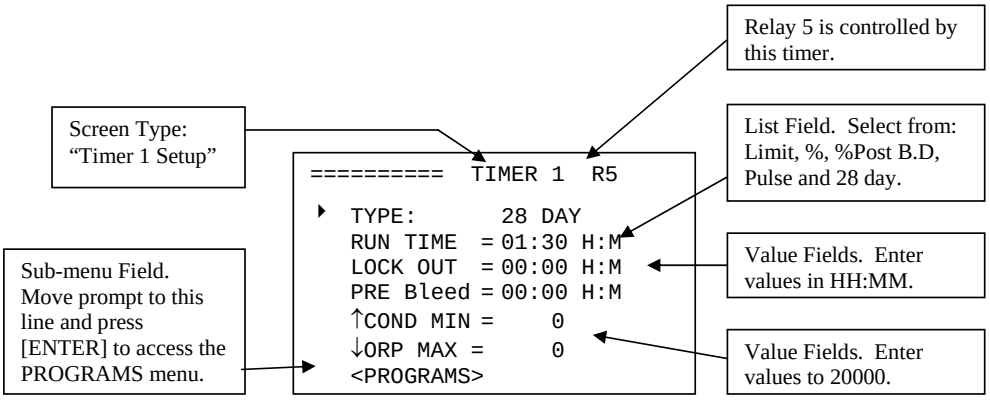
- **HELP** – When pressed, this key will display simple instructions for the operation of the [ENTER], [HOME], [ARROW], and [SCROLL] keys.
- **RELAYS (1-6)** – These Hand/Off/Auto (HOA) keys allow immediate control of the relays powering attached pumps, solenoid valves, etc. Press a [RELAY] key once to force the relay on for 5 minutes (an amber light is displayed below that key). Press the [RELAY] key again to force the relay off (a red light is displayed below that key, relay will be forced off until the key is pressed again or the power is cycled on the unit). 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 off).

3.5 Screen Format

The controller screens are formatted in a manner that will help you understand what you can and cannot do.

- **Value Field: "RUN TIME = 01:30"**
  A line on the screen with an "=" sign means that you may change the value. If a line were to read "RUN TIME = 01:30" then you will be able to change the value of TIME one position at a time. So you can change the hour and the minute.
- **List Field: "TYPE: 28 DAY"**
  A line that has a ":" means that you can change a value by selecting from a list. For example "**TYPE : 28 DAY**" means that you will be able to select from a list of values. **disabled LIMIT, PERCENT, % POST B.D, PULSE, CYCLE,** and **Slaved to**.
- **Sub-Menu Field: "<PROGRAMS>"**
  A line that has a word surrounded by "<" and ">" means that there is a sub-menu. To access the sub-menu, move the prompt to the line and press [ENTER].

The following is a sample screen that demonstrates all 3 field types:



3.6 Change Verification

Whenever you make changes to a menu on your controller, a change verification screen appears when you leave that menu. To accept your changes, press [ENTER]. To reject your changes press [HOME].

```
---- SYSTEM CHANGES ----
    HAVE BEEN MADE !

   ?? SAVE CHANGES ??
 Press ENTER to SAVE
 Press HOME to ABORT
```

When you accept your changes, the value will be changed and the previous menu will be displayed. When you reject your changes, the menu values will be restored to their original values and the menu will be re-displayed. Press [HOME] to exit the menu.

3.7 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.

NOTE **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**."

1. If not already displayed, press the [HOME] key until **MAIN MENU** is displayed. Then use the [SCROLL] key to move prompt to **CONFIGURE**.

```
  ====== MAIN MENU ======
  DISPLAY DATA
  CALIBRATION
  SETPOINTS
  TIMERS
  DATA COLLECT
▸ CONFIGURE
      ------------
```

   Press [ENTER] to display the **CONFIGURE** menu.

```
  ------ CONFIGURE ------

▸ DATE TIME
  SECURITY
  COMMUNICATIONS
  DIAGNOSTICS
  RELAY TIME
  FACTORY INITIALIZE
```

2. Press [ENTER] to display the **DATE TIME** menu.

```
  ------ DATE TIME ------

▸ TIME = 21:05
  DATE = 01-Jan-2000
  DAY:   SAT
  WEEK:  2nd

  Values are frozen
```

3. Move the prompt with the [SCROLL] keys to **TIME**.
   Press [ENTER].

4. You are now editing a “Value” field. The prompt will disappear and the first digit (2 in this case) is displayed with a black background.

```
------ DATE TIME ------

TIME = 21:05
DATE = 01-Jan-2000
DAY:   SAT
WEEK:  2nd

Values are frozen
```

   You are now editing just this one position in the time setting (24 hour format). Use the [ARROW] keys to change the value. Press [ENTER] to accept the value and move to the next position. Repeat this process until you have set the current time. Press [ENTER] on the last position (5 in this case) and the prompt will return at the left side of the screen.

5. Press [SCROLL] to move the prompt to the **DATE** line.

```
------ DATE TIME ------

TIME = 21:05
▸DATE = 01-Jan-2000
DAY:   SAT
WEEK:  2nd

Values are frozen
```

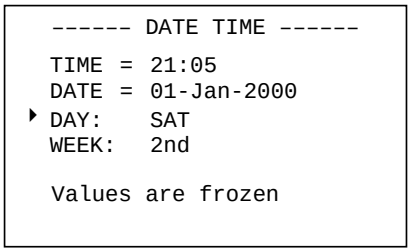
Be sure to press keys firmly until you feel or hear a faint click, then pause before you try again. There is a very slight delay for the controller to react to your command. This is normal.

6. Press [ENTER]. The prompt will disappear and the first digit (1 in this case) is displayed as white text on a black background.

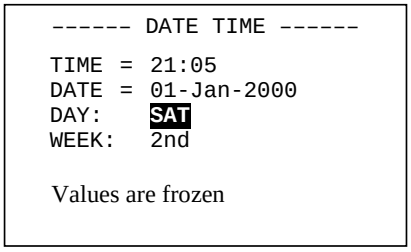
```
------ DATE TIME ------

TIME = 21:05
DATE = 1-Jan-2000
DAY:   SAT
WEEK:  2nd

Values are frozen
```

   Again, just like you did in Step 3, use the [ARROW] keys to change the value and the [ENTER] key to move the edit box. Press [ENTER] on the last position (0 in this case) and the prompt will return to the left side of the screen.

7. Press [SCROLL] to move the prompt to the **DAY** line.

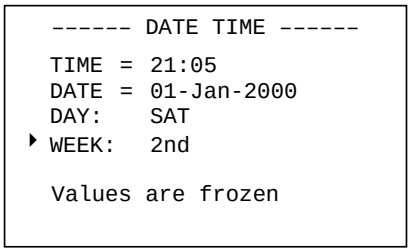


8. Press [ENTER]. The prompt will disappear and the entire day field is displayed as white text on a black background. You are now editing a "List" field. Use [UP] / [DOWN] to display values in the list. In this case the values will be: **MON, TUE, WED, THU, FRI, SAT** and **SUN**. When the correct day is displayed, press [ENTER] to accept. The prompt will return to the left side of the screen.

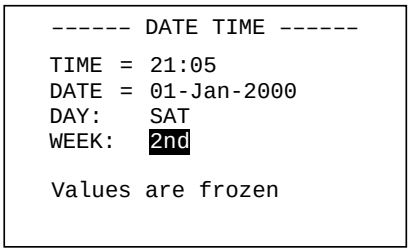


If at any time, while programming your controller, you get lost or confused, press the [HOME] key repeatedly until you get back to the Main Menu and start again.

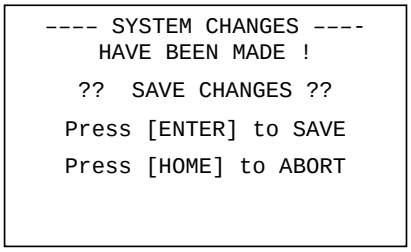
9. Press [SCROLL] to move the prompt to the **WEEK** field.



10. Press [ENTER]. Again the prompt will disappear and the entire week field is displayed as white text on a black background. Again you are editing a "List" field. Use [UP] / [DOWN] to display the values in the list**: 1st, 2nd, 3rd** and **4th**. When the correct week is displayed, press [ENTER] to accept. The prompt will return to the left side of the screen.



11. Repeat any of the Steps 4 to 10 above until you are satisfied with your settings.
12. Press [HOME] to exit the **DATE TIME** screen. A confirmation screen is displayed. If you are satisfied with your settings press [ENTER] to save them. If you want to abandon your settings and revert to the original values press [HOME].



13. Press [HOME] repeatedly until the **MAIN MENU** is displayed.

4. Controller Set Up

4.1 General Information

WARNING

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, apply power and turn the power switch on. The power LED indicator light will illuminate. When the controller is powered up, the **PLEASE WAIT** and **SYSTEM WARMING UP** screens are displayed until the internal diagnostics tests are complete, then the **MAIN MENU** is displayed.

```
  ====== MAIN MENU ======

▸ DISPLAY DATA
  CALIBRATION
  SETPOINTS
  TIMERS
  DATA COLLECT
  CONFIGURE
       ------------
```

If the display contrast requires adjustment, use [CONTRAST UP] or [CONTRAST DOWN] keys on the control panel key pad to adjust the 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.

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.

4.2 System Configure

Configure the controller functions using the [SCROLL] keys to move the prompt to **CONFIGURE** on the **MAIN MENU**. Press [ENTER] and the **CONFIGURE MENU** will be displayed. If the security system has been activated, see the TIP on the next page.

```
  ------ CONFIGURE ------

▸ DATE TIME
  SECURITY
  COMMUNICATIONS
  DIAGNOSTICS
  RELAY TIME
  FACTORY INITIALIZE
```

4.2.1 Set Date Time:

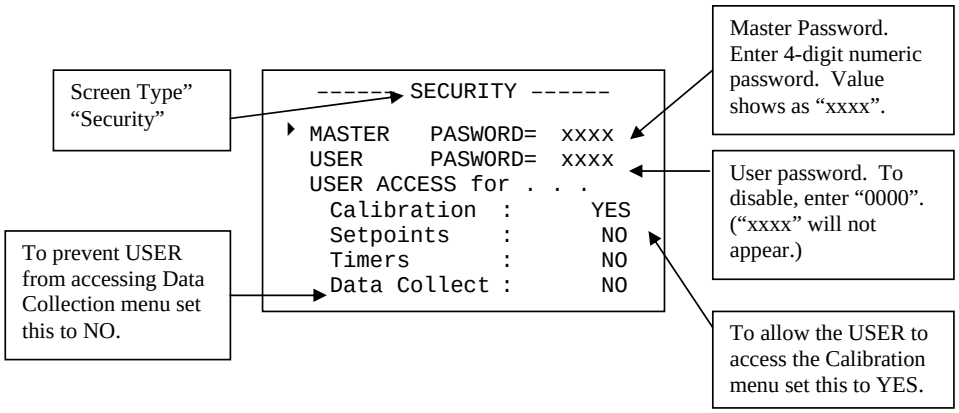
1. Please refer to ***Section 3.7 Sample Programming***.
2. When completed press [HOME] once to return to **CONFIGURE**.

4.2.2 Set Security:

The Controller can be configured to have two Security Access Codes - a Master and a User. The Master level can access all functions of the controller. The User level can only access those **MAIN MENU** items selected by the Master. A password level is not required for access to the **DISPLAY DATA** menu item. Note: The Master Password is required to enter the **CONFIGURE** menu.

TIP **When the password system is active, you will be prompted to enter a password. Press [ENTER] and use the [ARROW] keys to set each digit of your password - use [ENTER] to move between digits. Press [HOME] to return to the MAIN MENU. Then press [ENTER] to enter the menu item you have selected. If the [ENTER] PASSWORD screen re-appears, the password you entered was not accepted or you have not been granted access to that menu.**

The following is the Security screen with the major components labeled:



❖ **To configure security on your controller follow this procedure:**

1. Use the [SCROLL] keys to move the prompt to **SECURITY** and press [ENTER]. The **SECURITY** sub-menu is displayed.

```
------ SECURITY ------
MASTER PASWORD=
USER PASWORD=
USER ACCESS for . . .
  Calibration  :    NO
  Setpoints    :    NO
  Timers       :    NO
  Data Collect :    NO
```

2. Use the [SCROLL] keys to move the prompt to **"MASTER PASWORD="**. Press [ENTER].
3. Use the [UP] / [DOWN] keys to set each digit. Press [ENTER] to move to the next digit. Before you press [ENTER] on the last digit, check the value you have entered. Write it down if necessary! When you press [ENTER] on the last digit, the prompt will re-appear and your entry will be displayed as "xxxx".

```
   ------ SECURITY ------
▸ MASTER PASWORD= 1000
  USER PASWORD=
  USER  ACCESS  for  . . .
    Calibration   :    NO
    Setpoints     :    NO
    Timers        :    NO
    Data Collect  :    NO
```

4. Use the [SCROLL] keys to move the prompt to **USER PASWORD** level. Repeat Step 3 for the **USER PASWORD**.
5. Use the [SCROLL] keys to move the prompt to the **USER ACCESS** for **. . . Calibration** line. Press [ENTER]. Use [UP] / [DOWN] to set the access to the calibration menu to "**YES**" or "**NO**".

```
   ------ SECURITY ------

▸ MASTER PASWORD=  xxxx
  USER PASWORD=    xxxx
  USER  ACCESS  for  . . .
    Calibration: YES
    Setpoints:   NO
    Timers:      NO
    Data Collect: NO
```

   If set to "**YES**", the USER will be allowed to access this sub-menu from the **MAIN MENU** when the security system is active. If set to "**NO**", the **MASTER PASWORD** will be required for access. Press [ENTER] to accept your value. The prompt will return to the left side of the screen.
6. Repeat Step 5 to set access for the remaining menus: **Setpoints**, **Timers**, and **Data Collect**.

   Once you have successfully entered a password it will remain in effect until the controller has not detected a key press for 5 minutes. If the unit is automatically scrolling through the **DISPLAY DATA** screens, then the 5 minute timer has expired and you will have to re-enter your password to gain access to the sub-menus.

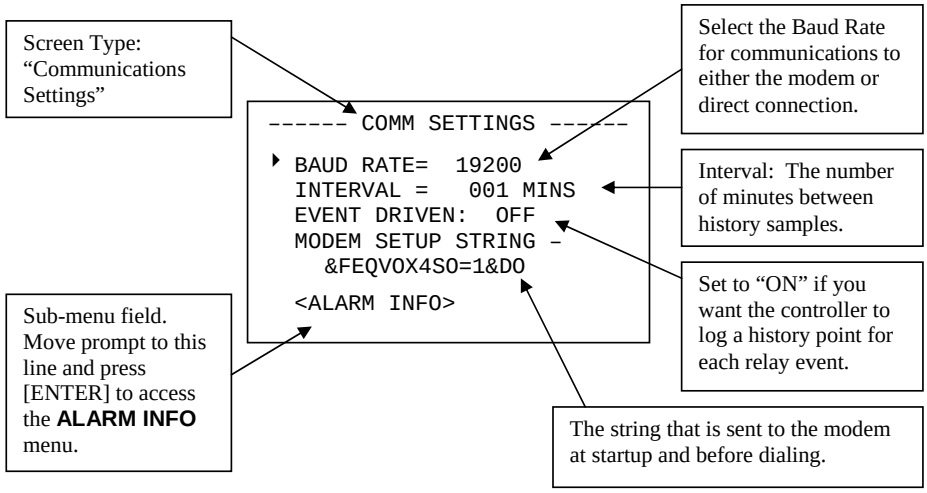
To disable the security system, enter a password of "0000" for both the MASTER and USER levels. To activate the security system immediately (after entering a password), enter the display data menu and unlock the display (press [ENTER]).

4.2.3 Communications

Use the **COMMUNICATIONS** sub-menu to configure parameters associated with the Serial Communications system.

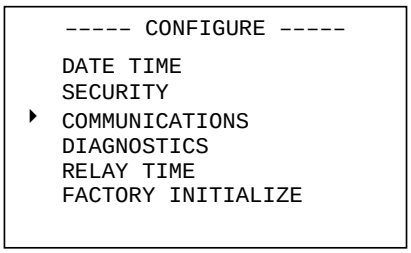
NOTE **The COMMUNICATIONS sub-menu is active on all models regardless of whether you purchased a communications option with your controller. If you did not purchase the option, you can change the settings, but they will have no effect on the operation of your controller.**

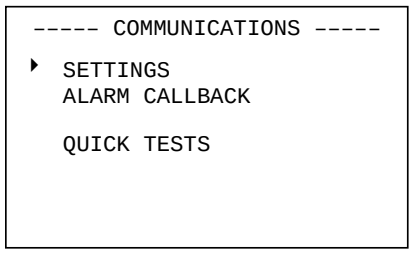
The following figure labels the major components of the **COMMUNICATIONS** menu.



Use this procedure to set-up serial communications on your controller:

1. Use the [SCROLL] keys to move the prompt to **COMMUNICATIONS** on the **CONFIGURE** menu. Press [ENTER]. The **COMMUNICATIONS** menu is displayed.





2. **SETTINGS** is the default selection. Press [ENTER]. The **COMM SETTINGS** menu is displayed.

```
----- COMM SETTINGS -----
▸ BAUD RATE:  19200
  INTERVAL = 001 MIN
  EVENT DRIVEN:  OFF
  MODEM SETUP    STRING
  &FE0V0X4S0=1&DO
  <ALARM>
```

3. With the prompt next to **BAUD RATE,** press [ENTER]. Use [UP] / [DOWN] to select from the list of baud rates: **300, 1200, 2400, 9600, 14400, 19200, 28800** or **57600**. Select the default value (**19200**) for best results when using the internal modem or performing a direct connection. Press [ENTER] after making your selection.

```
----- COMM SETTINGS -----
▸ BAUD RATE:  19200
  INTERVAL = 001 MIN
  EVENT DRIVEN:  OFF
  MODEM SETUP STRING
  &FE0V0X4S0=1&DO
  <ALARM>
```

When connecting the controller directly to a PC, the baud rate settings must match or the connection will fail.

4. Move the prompt to **INTERVAL**. Press [ENTER]. Using [UP] / [DOWN] / [ENTER] set the interval rate, in minutes, at which the history will be collected. You can set this value between 1 and 120 minutes.

```
----- COMM SETTINGS -----
  BAUD RATE:  19200
▸ INTERVAL = 001 MINS
  EVENT DRIVEN:  OFF
  MODEM SETUP STRING -
  &FE0V0X4S0=1&DO
  <ALARM INFO>
```

The controller will hold approximately 372 data points. At an interval of 1 minute, you will have to download your controller every 6 hours to avoid missing data points. At an interval of 120 minutes you will only have to download it once a month.

5. Move the prompt to **EVENT DRIVEN**. Press [ENTER]. Using [UP] / [DOWN] / [ENTER] select either **YES** or **NO**. If you select **YES**, history will be collected every time an event (i.e., a change in the relay status) occurs on the controller regardless of the **INTERVAL** setting. This allows you to capture exact times and values when major events occur. Normally, when using this mode you would set the **INTERVAL** to a large value (e.g., 060 MIN).
6. Move the prompt to the line below **MODEM SETUP STRING** which reads **&FE0V0X4S0=1&D0** on the example screen shown below. This item displays the current modem setup string and allows you to edit the current setting. Press [ENTER]. Using [UP] / [DOWN] / [ENTER] set the modem setup string value one character at a time. Move the prompt to the **MODEM SETUP STRING** line and press [ENTER]. The new string is sent immediately to the serial port and/or modem.

```
----- COMM SETTINGS -----
  BAUD RATE:  19200
  INTERVAL = 001 MINS
  EVENT DRIVEN:  OFF
  MODEM SETUP STRING
▸ &FE0V0X4S0=1&DO
  <ALARM INFO>
```

NOTE **We strongly recommend that you do not change the MODEM SETUP STRING. The default setting is designed for use with the supplied modem. Use of non-standard modems and/or setup strings will not be supported by the Technical Services group.**

7. Move the prompt to **<ALARM INFO>** and press [ENTER] to display the **HISTORY 80%** setup window. If the history on the controller is 80% full (i.e., you are about to lose history), you can have the controller activate a number of alarm states. Move the prompt to **Alarm LED**. Press [ENTER]. Using [UP] / [DOWN] / [ENTER] set the **Alarm LED** value to **YES** if you want the front panel **LED** to flash when this alarm occurs. Likewise, set the **Alarm RELAY** to **YES** if you would like the alarm relay to come ON with the alarm and the **Alarm CALLBACK** to **YES** if you would like the system to perform an alarm callback. Press [HOME] to exit this window.

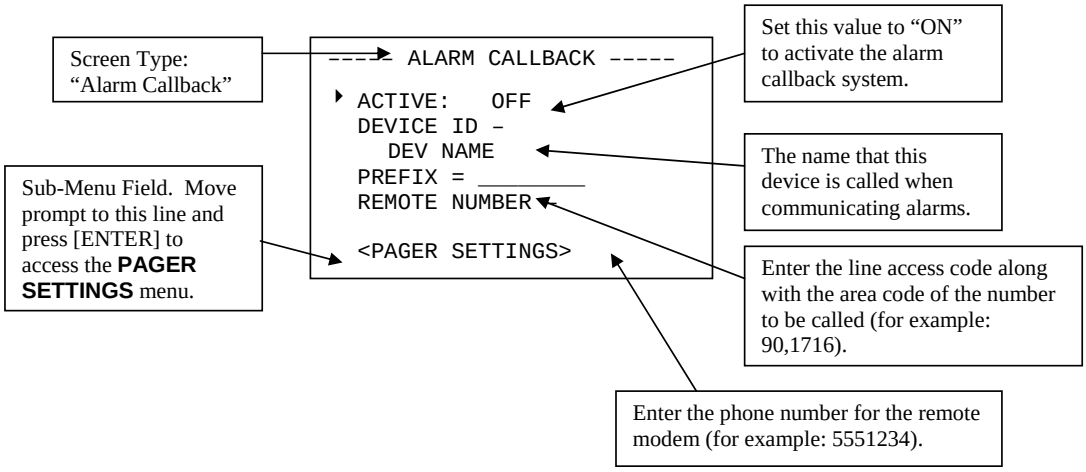
```
----- ALARM INFO -----
      HISTORY 80%

▸ Alarm LED:      YES
  Alarm RELAY:    YES
  Alarm CALLBACK: NO
```

8. If you made changes on the **ALARM INFO** window, you will be prompted to save your changes. Press [ENTER] to accept your changes and exit the window. Press [HOME] to abort your changes and remain in the window with the previous values. In this case, press [HOME] again to return to the previous **COMM SETTINGS** menu.

9. You should now be back at the **COMM SETTINGS** menu. Press [HOME] to return to the **COMMUNICATIONS** menu. If you have made changes on the **COMM SETTINGS** window you will be prompted to save or abort your settings.

```
---- SYSTEM CHANGES ----
    HAVE BEEN MADE !

?? SAVE CHANGES ??
Press ENTER to SAVE
Press HOME to ABORT
```

10. Press [SCROLL] to move the prompt to the **ALARM CALLBACK** selection. Press [ENTER] to access the **ALARM CALLBACK** menu.



11. Press [SCROLL] to move the prompt to the **ACTIVE** entry. Use [UP] / [DOWN] / [ENTER] to change the value to **YES** if you would like the **ALARM CALLBACK** system to be active.

NOTE **While you are setting up the alarm call back system, you should set active to "NO" to prevent the controller from acting on incomplete entries. After setup is complete, set active to "YES".**

```
----- ALARM CALLBACK -----
ACTIVE: NO
DEVICE ID
  TEST 1234
PREFIX = _____
REMOTE NUMBER
  5551234
<PAGER SETTINGS>
```

12. Press [SCROLL] to move the prompt to **DEVICE ID**. Use [UP] / [DOWN] / [ENTER] to change the **DEVICE ID** one character at a time. The **DEVICE ID** is the name that will be transmitted to your PC when calling out on an alarm.
13. Press [SCROLL] to move the prompt to **PREFIX**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to change the value one character at a time. The **PREFIX** is the number that is used to give access to an "outside" phone line and also includes the area code of the number to be called. Your telephone service configuration will determine what is required to get to an "outside" line (e.g., some systems require pressing 9 and 0, while some systems only require that you press 9). The **PREFIX** field can be left blank if the call is a local call.
14. Press [SCROLL] to move the prompt to **REMOTE NUMBER**. Use [UP] / [DOWN] / [ENTER] to change the value one character at a time. The **REMOTE NUMBER** is the phone number of the PC that will receive the alarm callback. The alarm must remain active for 1.5 minutes before the controller will dial this number.

You can use a comma (,) in the phone number entry to cause the modem to pause one second. This is useful when you must dial "90", then wait for a dial tone before proceeding (e.g., 90,,17162928000)

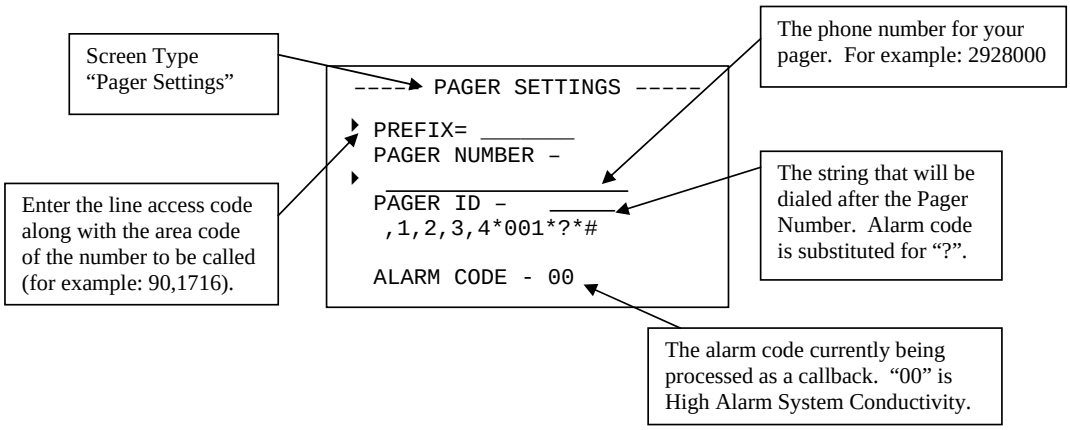
15. Move the prompt to the **<PAGER SETTINGS>** line and press [ENTER] to display the **PAGER SETTINGS** menu.
16. Press [ENTER] to enter **PAGER NUMBER**. Use [UP] / [DOWN] / [ENTER] to change the pager **PREFIX** number one character at a time. When the last number in the prefix has been entered, press [ENTER] until the prompt is displayed on the left side of the screen.

```
----- PAGER SETTINGS -----
▸ PREFIX = 90,1716__
  PAGER NUMBER -
    2928000
  PAGER ID -
    ,1,2,3,001*?#-
  ALARM CODE = 27
```

17. Press [SCROLL] to move the prompt to **PAGER NUMBER**. Use [UP] / [DOWN] / [ENTER] to change the pager phone number one character at a time. When an alarm remains active for 5 minutes the controller will dial this number and then the Pager ID Number.

```
----- PAGER SETTINGS -----
  PREFIX = __________
▸ PAGER NUMBER -
  90,17162928000
  PAGER ID -
  ,1,2,3,001*?#-
  ALARM CODE = 27
```

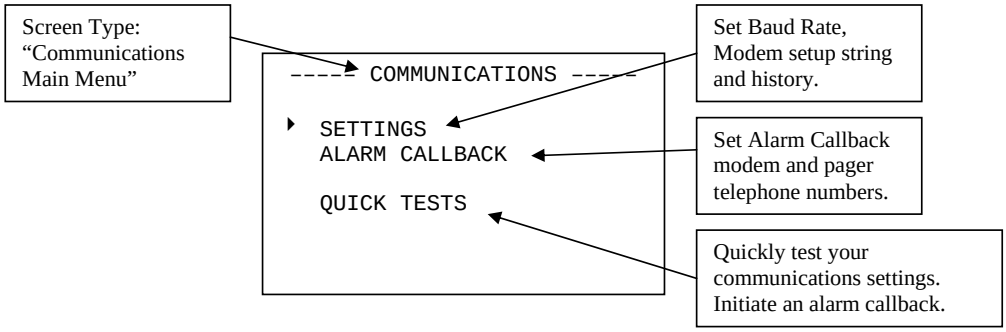
The controller will dial the pager number only one time. It will redial the remote number up to five times. Consult your communications software documentation for set-up and use of the alarm call back system.



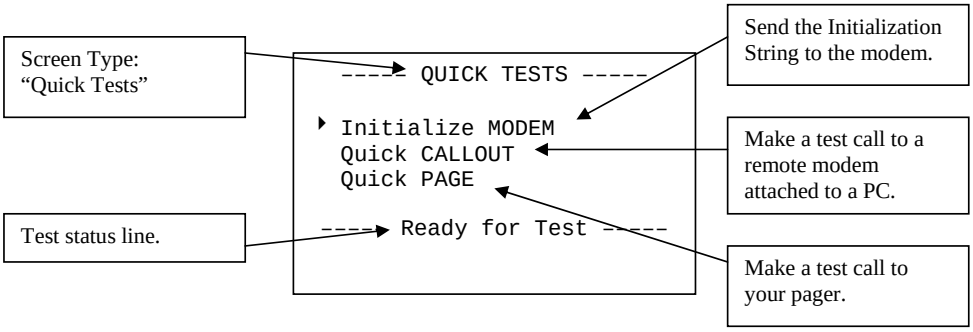
18. Press [SCROLL] to move the prompt to **PAGER ID**. Use [UP] / [DOWN] / [ENTER] to set the string that will identify this controller on your pager. The "**?**" is replaced with the alarm code. If the controller had a high Conductivity Alarm (alarm code = 00), the pager message would look like "001-00-".
19. Press [HOME] to return to the **ALARM CALLBACK MENU**. Press [HOME] again to return to the **COMMUNICATIONS** menu. Press [HOME] again to return to the **MAIN MENU**.

4.2.3.1 Quick Tests

An additional menu item has been added to the Serial Communications menu called Quick Tests. The Quick Tests menu allows you to test your modem and alarm callout (to another modem) or alarm page (to your pager). The menu shows test progress and diagnostics information. You access the **QUICK TESTS** menu from the **COMMUNICATIONS** menu. This menu is formatted as follows:



To access the **QUICK TESTS** menu, move the prompt to the **QUICK TESTS** selection and press [ENTER]. The **Quick Tests** menu is formatted as follows:



❖ **Using the QUICK TESTS menu:**

1. Press [HOME] repeatedly to return to the **MAIN MENU**. Press [SCROLL] to move the prompt to **CONFIGURE** and press [ENTER]. The **CONFIGURE** menu is displayed.
2. Press [SCROLL] to move the prompt to **COMMUNICATIONS** and press [ENTER]. The **COMMUNICATONS** menu is displayed.
3. Confirm that you have the Alarm Callback system set up. Press [SCROLL] to move the prompt to **ALARM CALLBACK**. Press [ENTER]. The **ALARM CALLBACK** menu is displayed.
   a) To test the **ALARM CALLBACK**, you must have a phone number in the **REMOTE NUMBER** field.
   b) To test **PAGING**, you must have a pager number in the **PAGER NUMBER** field.

   Press [HOME] to return to the **COMMUNICATIONS** menu.

NOTE **Important: Before leaving the ALARM CALLBACK menu, set the ACTIVE: setting to off.**

4. Press [SCROLL] to move the prompt to **QUICK TESTS** and press [ENTER]. The **QUICK TESTS** menu is displayed.

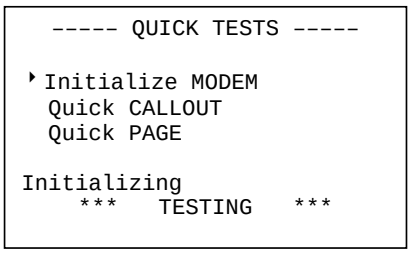
```
----- QUICK TESTS -----

Initialize MODEM
Quick CALLBACK
Quick PAGE

! ! !  NOT READY  ! ! !
```

5. The **QUICK TESTS** menu allows you to test the serial communications system and validate its operation. It includes helpful information that can help you isolate problems with your modem or Alarm Callout/Paging system. If you do not desire to test your modem, skip to Step 7. Otherwise, use [SCROLL] to move the prompt to **Initialize MODEM**.

6. Observe the bottom line of the display. It should read **' - Ready for Test -'**. If it reads **'!!! NOT READY !!! XX'** and is displaying a count-down value ('XX' in the example) wait for the count down period. If it reads '**** ACB Active **'** then the **ALARM CALLBACK** system is active. Return to Step 3 and verify that the **ACTIVE**: setting is set to **OFF**. Wait for the callout to complete or eliminate all alarm sources. When the display reads '**--- Ready for Test --'**, you can begin testing the desired item.

NOTE **You cannot perform a quick test while you are communicating with the controller. The controller must not receive any characters on its serial port for 20 seconds before a quick test can be performed. If a device is communicating with your controller, the count-down value will be re-set to 20 every time a character is received.**

7. Press [SCROLL] to move the prompt to **Initialize MODEM**. Press [ENTER] to start the **Initialize MODEM** test. The line at the bottom of the display will read **'*** TESTING ***'** to indicate that a test is in progress. The line above this gives test status information. The controller will first attempt to communicate (initialize) the modem. If the modem is present and properly configured, it will respond to this attempt with the word **'OK'**. It will then send the Modem Setup String. If this string is accepted the modem will again respond with the word **'OK'**. If the test fails, an error message will be displayed (e.g., Timed Out). Refer to ***Section 10, Trouble Shooting Guide*** for further information.



8. To test the alarm callout feature of the controller, move the prompt to the **Quick CALLOUT** selection. Press [ENTER]. The controller will initialize the modem, dial the phone number and attempt to connect an external PC running a communications package. The status is displayed above the **"*** TESTING ***"** line. The following would be a typical response of the status line. First **'Initializing...'** is displayed while the controller sends the setup string to the modem. Then **'OK'** is displayed if the modem responds to the setup string. The **'Dialing 18885551234'** is displayed as the modem dials the phone number. Once a connection has been made the **'CONNECT XXXX'** line is displayed. Finally, the **'Operation Complete'** message is displayed indicating that the operation completed correctly. The controller then hangs up the phone line and a **"No Carrier"** message is displayed on the screen. Refer to ***Section 10, Trouble Shooting Guide*** for further diagnostic information.

NOTE **You must have entered proper phone numbers for the CALLOUT and PAGING in the Alarm Call Back system for the quick tests to function properly.**

9. To test the paging callout capabilities of the controller, move the prompt to the **Quick PAGE** selection. Press [ENTER]. The controller will initialize the modem, dial the phone number, issue the alarm string, then hang-up the phone line.
   a) **'Initializing...'** is displayed while the controller sends the setup string to the modem.
   b) **'OK'** is displayed if the modem responds to the setup string.
   c) **'Dialing 18885551234'** is displayed as the modem dials the phone number.
   d) **"Operation Complete"** is displayed, indicating the controller has completed the page call out.

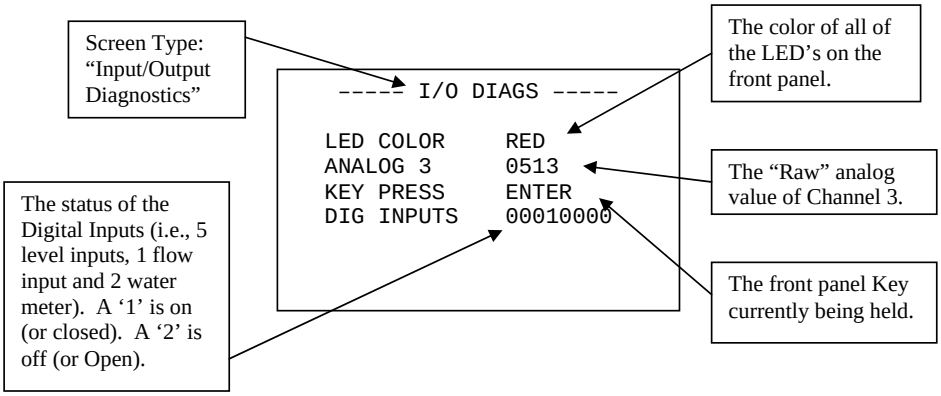
   Refer to ***Section 10, Trouble Shooting Guide*** for further diagnostic information.

NOTE **If you set the ALARM CALL BACK ACTIVE: setting to "OFF", be sure to set it back to "ON" after you have completed your quick test.**

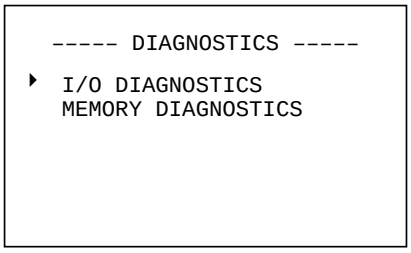
10. Press [HOME] repeatedly to return to the **MAIN MENU**.

4.2.4 Diagnostics

This section lets you see how the inputs (e.g., key presses or water meter pulses) and outputs (e.g., display and LED's) are working and view internal diagnostics results for your controller. Normally, on power-up, the controller tests its internal EPROM (the device that holds the program that allows your controller to function), the RAM (the device that holds your history and other temporary system settings), the EEPROM (the device that holds your more permanent settings) and the Real Time Clock.

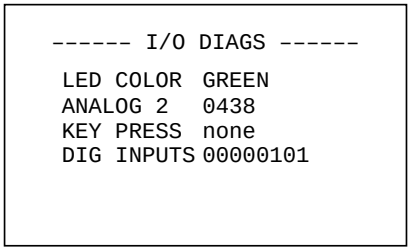


1. Move the prompt to the **I/O DIAGNOSTICS** line and press [ENTER].



WARNING **WHEN RUNNING I/O DIAGNOSTICS ALL CONTROL WILL CEASE.**

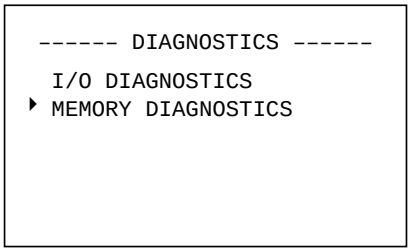
The **I/O DIAGS** menu is displayed. When you enter this menu, you will note that all of the LED's begin to illuminate.



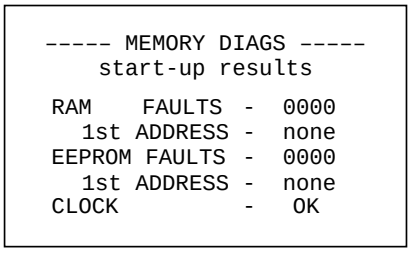
In addition, they begin to cycle through their colors (RED, GREEN, YELLOW, OFF). The **LED COLOR** menu item indicates the current color. The **ANALOG N** item will change approximately every second. It will cycle through numbers where N is a value between 1 and 8. These values represent the analog input channels. For example, Channel 1 is typically **SYSTEM CONDUCTIVITY**. The number shown next to the channel number is the raw analog value for the displayed channel. It will be in a range between 0 and 1023. The **KEY PRESS** item indicates which key is currently pressed. If you press any key (with the exception of [HOME] which will take you out of the **I/O DIAGS** menu) the description is displayed here for as long as you hold that key down. The **DIG INPUTS** represents the current status of the **DIGITAL INPUT** hardware. The field displays 8 digits, each of which has a value of 1 or 0. The positions correlate to the digital inputs on the J11 connector of the Relay board. The display will show a '1' if the input is closed and a '0' if it is open. For example, if the only digital input is **FLOW** and the flow is currently ON then the display would appear like this: **00000100**. When flow is OFF, the display would look like this: **00000000**.

Unused analog channels typically "float." Their value is unpredictable. Do not be alarmed if you see a value here for a channel in which there is no installed hardware. This is normal.

2. Press [HOME] to return to the **DIAGNOSTICS** menu.



3. Press [SCROLL] to move the prompt to **MEMORY DIAGNOSTICS**. Press [ENTER]. The **MEMORY DIAGS** menu is displayed. The results of the last power-on test are displayed. If any items failed the diagnostics test, the number of failures and first failure address is displayed.



4. Press [HOME] to return to the **DIAGNOSTICS** menu. Press [HOME] again to return to the **CONFIGURE MENU**.

```
------ CONFIGURE ------
 DATE  TIME
 SECURITY
 COMMUNICATIONS
▸DIAGNOSTICS
 RELAY  TIME
 FACTORY  INITIALIZE
```

4.2.5 Relay Time

This menu allows you to reset the relay on times that appear in the **DISPLAY DATA: RELAY** screen. It also records a date time stamp to indicate when the relay on times were last reset.

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

1. From the **CONFIGURE MENU**, press [SCROLL] to move the prompt to **RELAY TIME**. Press [ENTER]. The **RELAY TIME** menu is displayed. Use this menu item to zero the relay ON times reported on the **DISPLAY DATA:RELAY TIME** window.

```
------ RELAY TIME ------
▸ZERO TIME
    LAST ZEROED AT -
    01-Jan-2000 08:01
```

2. Press [ENTER] to zero the relay ON times. The line below the **LAST ZEROED AT** heading shows the date and time the relays were last zeroed.
3. Press [HOME] to return to the **CONFIGURE MENU**.

```
------ CONFIGURE ------
 DATE  TIME
 SECURITY
 COMMUNICATIONS
 DIAGNOSTICS
 RELAY  TIME
▸FACTORY INITIALIZE
```

4.2.6 Factory Initialize

You can re-initialize your controller to its factory settings.

1. From the **CONFIGURE MENU**, press [SCROLL] to move the prompt to **FACTORY INITIALIZE**. Press [ENTER]. The **FACTORY INIT** menu is displayed.

```
------ FACTORY INIT ------

▸ INITIALIZE to
       FACTORY DEFAULTS



  <ALARM INFO>
```

2. Press [ENTER] to begin Factory Initialization.

WARNING **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. A warning screen is displayed.

```
------ FACTORY INIT ------

    FACTORY ReINIT WILL
       OVERWRITE ALL
     PREVIOUS SETTINGS

 Press ENTER to ReINIT
 Press HOME to ABORT
```

   Press [ENTER] to continue the Initialization, press [HOME] to abort. If you continue with initialization, the display will blank and the system will re-start.

4. If you aborted the Initialization, the **FACTORY INIT** menu is displayed. Press [SCROLL] to move the prompt to **<ALARM INFO>**. Press [ENTER]. The **ALARM INFO** screen is displayed for the **INIT ALARM**. When the controller has started from a factory re-initialization, the items that you indicate here are activated.

```
------ ALARM INFO ------
       INIT ALARM

▸ Alarm LED:       YES
  Alarm RELAY:     YES
  Alarm CALLBACK:  YES
```

5. Press [HOME] to return to the **FACTORY INIT** menu. Press [HOME] again to return to the **CONFIGURE MENU**. Press [HOME] one more time to return to the **MAIN MENU**.

4.3 Setpoints and Alarms

4.3.1 Setpoints: SysCond, pH, ORP

4.3.1.1 Rising/HIGH or Falling/LOW Setpoint

NOTE **The setpoint type can only be changed on the single pH or ORP input. The type is listed for the other inputs but cannot be changed.**

A Setpoint is a setting at which the controller activates an output, such as a solenoid valve. The type – **Rising/HIGH** or **Falling/LOW** defines which side of the set-point the relay activates. A **Rising/HIGH** type means that the output activates when the input goes above the setpoint. A Rising setpoint is commonly used in conductivity control where you want to keep conductivity below a certain value. A **Falling/LOW** type activates the output when the value goes below the setpoint. A common example of this is ORP control, where you wish to maintain a certain minimum level of Bromine or Chlorine in the system.

The **SETPOINTS** menu is designed to allow you to easily configure your setpoints. A line at the bottom of the screen displays the current value of the analog input whose setpoint you are modifying.

4.3.1.1.1 Setpoint – SysCond

❖ **Follow this procedure to configure your setpoints:**

1. Use [SCROLL] to move the prompt in **MAIN MENU** to **SETPOINTS**. Press [ENTER] and the **SETPOINTS** menu is displayed.

```
====== MAIN MENU ======

 DISPLAY DATA
 CALIBRATION
▸SETPOINTS
 TIMERS
 DATA COLLECT
 CONFIGURE
      ------------
```

2. Use [SCROLL] to move the prompt to **SysCond**. Press [ENTER]. The **SysCond** menu is displayed.

```
------ SETPOINTS ------

▸SysCOND    INPUT 4
 MAKEUP     LEVEL 1
 DUAL pH    LEVEL 2
 Sys ORP    LEVEL 3
 INPUT 1    LEVEL 4
 INPUT 2    LEVEL 5
 INPUT 3    FLOW
```

```
------ SysCOND  R1 ------
        Rising/HIGH
▸SETPT = 12000 µS/CM
 DIFF=   1000
 HiALRM =18000 µS/CM
 LoALRM= 2000
 CURRENT  1250 µS/CM
 <ALARM INFO>
```

3. Use [SCROLL] to move the prompt to **SETPT =.** Use [UP] / [DOWN] / [ENTER] to set the setpoint value. This is the value at which the System Conductivity (Blow Down) relay will activate. Press [ENTER] on the last digit to return the prompt.

```
------ SysCOND  R1 ------
       Rising/HIGH
▸ SETPT = 12000 µS/CM
  DIFF=   1000
  HiALRM =18000 µS/CM
  LoALRM= 2000
  CURRENT  1250 µS/CM
  <ALARM INFO>
```

4. When the prompt returns, press [SCROLL] to move it to the line labeled **DIFF =**.

NOTE **4-20mA inputs (i.e., SysINPUT N) do not control a relay. No setpoint or differential settings are required.**

4.3.1.1.2 Differential

Also referred to as dead band or hysteresis. The differential is the offset applied to a setpoint to prevent chattering of an output relay around a setpoint.

1. Press [ENTER] to begin editing the **DIFF=** value. Use [UP] / [DOWN] / [ENTER] to set the value. Press [ENTER] on the last digit to return the prompt.

   EXAMPLE: If the system conductivity setpoint is 2500 (**Rising /HIGH**) and the differential is set at 100, then the bleed relay will turn "ON" when the conductivity rises above 2500 and it will turn "OFF" when the conductivity falls below 2400 (2500 - 100 = 2400).

NOTE **Your system will track between the setpoint and the setpoint minus the differential if you have a Rising /HIGH setpoint. It will track between the setpoint and the setpoint plus the differential if you have a Falling/LOW setpoint.**

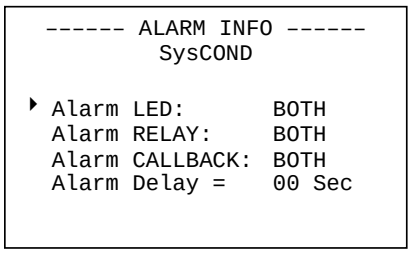
4.3.1.1.3 High or Low Alarm Settings

Every analog input has a high and low alarm indicator. The alarm limits or setpoints are set under the **HiALRM** and **LoALRM** menu items.

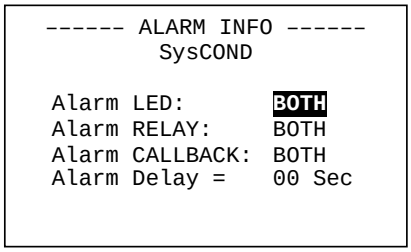
❖ **Setting the High or Low Alarm setpoint values:**

1. Press [SCROLL] to position the prompt on **HiALRM**. Press [ENTER] to edit the **HiALRM** value. Use [UP] / [DOWN] / [ENTER] to set the value. Press [ENTER] on the last digit to complete your entry.
2. Press [SCROLL] to position the prompt on **LoALRM**. Repeat Step 1.

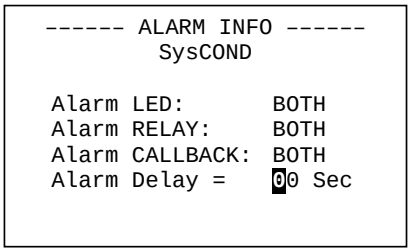
3. Press [SCROLL] to position the prompt on the **<ALARM INFO>** menu item. Press [ENTER]. The **ALARM INFO** menu is displayed.



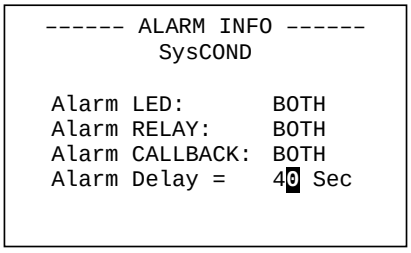
4. Press [SCROLL] to position the prompt on the line you wish to edit – **Alarm LED**, **Alarm RELAY** and **Alarm CALLBACK**. Press [ENTER] (the changeable field is highlighted).



5. Using [UP] / [DOWN] / [ENTER] set the values for each line item (you can select from: **BOTH, NONE, HIGH** and **LOW**). For example, if you select **BOTH**, then the alarm item (e.g., relay), will activate when the input passes either the Hi or Lo setpoints.
6. Press [SCROLL] to position the prompt on the **Alarm Delay** line. The **Alarm Delay** item allows you to set a delay time up to 99 seconds. When the controller recognizes an alarm, it will wait for this time period before any action is taken. Press [ENTER] and the first character of the delay field is activated. Using [UP] / [DOWN] to set the first digit of the delay value.



7. Press [ENTER] to accept the first digit value and to highlight the second digit.



8. Press [UP] / [DOWN] to set the second digit of the delay value.
9. Press [ENTER] to accept your **Alarm Delay** setting.
10. After making your settings on the **ALARM INFO** menu, press [HOME] to return to **SysCond** menu. Press [HOME] to return to the **SETPOINTS** menu.
11. If you have made any changes to the screen you will be asked to verify your input. Press [ENTER] to save, [HOME] to abort.
12. Repeat the above steps for the other analog inputs on your controller (e.g., **Makeup, pH, ORP** and **4-20mA Input channels**).

4.3.1.1.4 Setpoint Type

1. Use the [SCROLL] keys to move the prompt in **MAIN MENU** to **SETPOINTS**. Press [ENTER]. The **SETPOINTS** menu is displayed.

```
  ====== MAIN MENU ======

   DISPLAY DATA
   CALIBRATION
 ▸ SETPOINTS
   TIMERS
   DATA COLLECT
   CONFIGURE
        ------------
```

NOTE **The example menus shown here will not necessarily match those on your controller. The menus will vary between models depending on the supported inputs.**

2. Use the [SCROLL] keys to move the prompt to a setpoint you would like to set. In our example, we will use **Sys ORP** (the abbreviation for System ORP). Press [ENTER].

```
  ------ SETPOINTS ------

  SysCOND   INPUT 4
  MAKEUP    LEVEL 1
  DUAL pH   LEVEL 2
▸ Sys ORP   LEVEL 3
  LEVEL 1   LEVEL 4
  LEVEL 2   LEVEL 5
  LEVEL 3   FLOW
```

3. The **Sys ORP** menu is displayed. The prompt will be positioned on the second line of this menu. Press [ENTER]. Use the [ARROW] keys to select between **Rising/HIGH** and **Falling/LOW**. Press [ENTER] to accept your change.

```
 ------ Sys ORP  R3 ------

▸  ↑ or ↓: Falling/LOW
  SETPT  =   400 mV
  DIFF   =    50
  HiALRM =   500 mV
  LoALRM =   300
  CURRENT    382 mV
  <ALARM INFO>
```

The setpoint type option is not available for all inputs. For example, you cannot change the SysCond setpoint type.

4.3.1.1.5 Setpoints: Makeup Conductivity

The interaction of makeup conductivity and its effect on the operation of the controller is one of the most difficult concepts of the controller to understand and configure properly.

Refer to Section 11 for further information on understanding makeup conductivity.

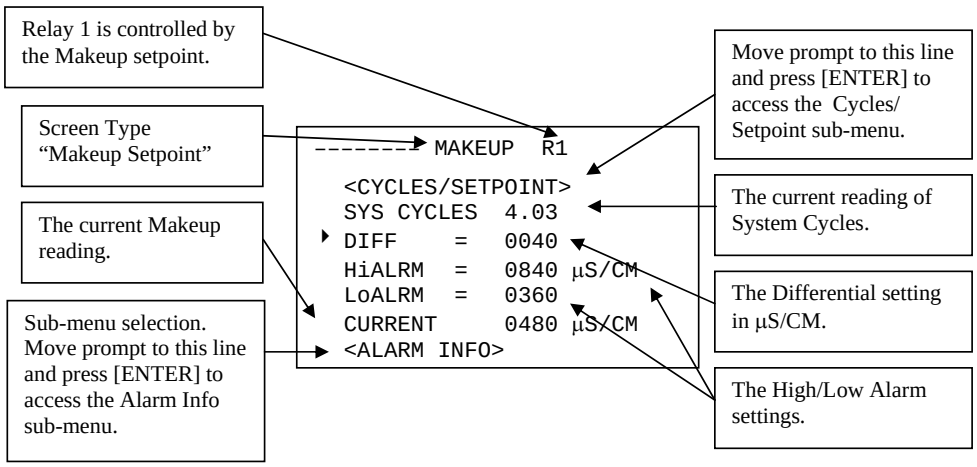
The objective of the makeup conductivity system is to monitor the makeup water and determine a blowdown setpoint that makes sense. For example, if the makeup water is reading 1000 µS/CM you know that the system conductivity will never fall below 1000 µS/CM. If you had a setpoint of 900 µS/CM the system would bleed forever. So, you normally set the system setpoint at some level above the makeup water conductivity. If you set a setpoint of 2000 µS/CM, adding 1000 µS/CM makeup water will drive the system conductivity down. And, at some point you would have a good chance of achieving the setpoint. The ratio of System Conductivity to Makeup Conductivity is known as a Cycle of Concentration or Cycle for short.

So, in our example, if the setpoint is 2000 µS/CM and the makeup water is 1000 µS/CM, then the system is running with a setpoint of 2.0 Cycles (2000/1000 = 2.0).

Because the system conductivity setpoint is so dependent on the conductivity of the makeup water, it is desirable for the system conductivity setpoint to change with the makeup water. If during the day, the makeup water conductivity goes from 1200 µS/CM in the morning to 500 µS/CM in the evening, you may want to run 1.5 cycles (or a system conductivity of 1800 µS/CM) during the day and 2.0 cycles (or 1000 µS/CM) during the evening.

Your controller divides the makeup conductivity scale into 5 ranges and allows you to enter a setpoint based on either Cycles or a fixed conductivity value for each range. If you select Cycles, the controller will calculate the actual system conductivity setpoint by multiplying the makeup conductivity by the Cycles that you have entered.

For example, if your makeup conductivity is 1200 µS/CM and it falls into a range with a setpoint of 2.0 cycles, then the system conductivity setpoint will be 2400 µS/CM (1200 x 2.0 = 2400). If the makeup conductivity falls to 1190 µS/CM, the setpoint will become 2380 µS/CM (1190 x 2.0 = 2380).



Because the setpoint is moving with the makeup conductivity, it is difficult to tell if your controller is responding properly. Alternatively, you can set actual hard setpoints for each range. Then if the makeup conductivity falls into a given range, a fixed makeup setpoint for that range will be used. This selection is one of the first settings to consider when configuring your makeup conductivity.

Use the following procedure to set-up the makeup conductivity control:

NOTE **When you are using the makeup conductivity system, your controller really has 2 setpoints: the one you configure under SysCond in the SETPOINTS menu and the dynamic one defined by MAKEUP. The controller will bleed on the lowest setpoint! If your SysCond setpoint is set at 1500 µS/CM and your makeup determines a setpoint of 1800 µS/ CM, then the system will bleed at 1500 µS/CM - the lower of the two.**

1. From the **SETPOINTS** menu, use [SCROLL] to move the prompt to **MAKEUP**. Press [ENTER]. The **MAKEUP** menu is displayed.

```
------ SETPOINTS ------
  SysCOND    OUTPUT 4
▸ MAKEUP     LEVEL 1
  DUAL pH    LEVEL 2
  Sys ORP    LEVEL 3
  OUTPUT 1   LEVEL 4
  OUTPUT 2   LEVEL 5
  OUTPUT 3   FLOW
```

```
------ MAKEUP  R1 ------
▸ <CYCLES/SETPOINT>
  SYS CYCLES   4.03
  DIFF    =    0040
  HiALRM  =    0700 µS/CM
  LoALRM  =    0500
  CURRENT      0480 µS/CM
  <ALARM INFO>
```

2. As shown in the example above - right, the prompt is located next to **<CYCLES/SETPOINT>**. Press [ENTER]. The **SET: CYCLES** menu is displayed.
3. Look at the ranges displayed below the **FORMAT**: line (e.g., **0-400, 401-800**, etc.) when the makeup conductivity falls into one of these ranges the associated cycle/setpoint will be used. If the display ranges are satisfactory, skip to Step 6. Otherwise, go to Step 4.

```
------ SET:  CYCLES ------

 <RANGES/SCALE>
  FORMAT: SETPOINT
 0    -   400  = 1000
 401  -   800  = 2000
 801  -   1200 = 3000
 1201 -   1600 = 4000
 1601 &   over   5000
```

```
------ SET:  CYCLES ------

 <RANGES/SCALE>
  FORMAT:   CYCLES
 0     -  400  =  6.0
 401   -  800  =  5.0
 801   -  1200 =  4.0
 1201  -  1600 =  3.0
 1601  &  over   2.0
```

4. With the prompt next to **RANGES/SCALE,** press [ENTER] and the **SET: RANGES** screen is displayed. Using [UP] and [DOWN] select an operating scale. Press [ENTER] to accept your change.

NOTE

```
-------- SET:  RANGES

 SCALE:  0 - 2000
     0 -     400 µS/CM
     401 -   800
     801 -  1200
     1201 - 1600
     1601 & over
```

5. The SCALE setting on the SET: CYCLES menu only applies to the range division. It does not constrain makeup to operate in that range, affect calibration or change high and low alarm setpoints.
6. Observe the displayed ranges for the scale you have selected. If you would like to change the upper value of a given range, move the prompt to that line using [SCROLL] and press [ENTER]. Use [UP] / [DOWN] to set the upper range value one digit at a time. Use [ENTER] to move between digits. Press [ENTER] on the last digit to accept your value. When you do so, the low end of the next range will be updated to the value you just entered plus 1. For example, if the first two ranges read **0-0400** and **401-0800** and you change the first range to **0-0600**, then the second range will automatically update to **601-0800**. Press [HOME] to return to the **SET: CYCLES** menu. Follow the on screen prompts to accept your changes.

NOTE **The smallest acceptable range is 1 unit (e.g., 0-0001).**

7. Move the prompt to the **FORMAT**: line. Press [ENTER]. Use [UP] / [DOWN] to select either **SETPOINT, CYCLES** or **DISABLED**. Use the **SETPOINT** setting to define a fixed setpoint for each given range. Use the **CYCLES** setting to define a dynamic setpoint based on **CYCLES**. Use **DISABLED** to disable the makeup conductivity system and alarms. Press [ENTER]. If you selected **CYCLES**, the Cycle units (formatted like ##.#) is displayed next to the ranges. If you selected **SETPOINT**, the setpoint units are displayed (formatted like: #####). If you selected **DISABLED**, the 'N/A' designator is displayed for each setpoint field (indicating Not Applicable).

To disable your Makeup Conductivity System, set the FORMAT menu item on the SET: CYCLES menu to "disabled".

8. Move the prompt to the first range (e.g., **0-400**) and press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the setpoint value based on the type you selected in Step 6.
9. Repeat Step 7 for all remaining ranges. When the menu is setup to your satisfaction press [HOME].
10. The **SYSTEM CHANGES** screen is displayed. Press [ENTER] to save, press [HOME] to abort. If you accepted your changes the **MAKEUP** menu is displayed.

```
  ---- SYSTEM CHANGES ----
       HAVE BEEN MADE!

     ?? SAVE CHANGES ??

Press ENTER to SAVE

Press HOME to ABORT
```

```
  ------ MAKEUP  R1 ------

   <CYCLES/SETPOINT>
   SYS CYCLES   4.03
 ▸ DIFF    =    0040
   HiALRM  =    0840 µS/CM
   LoALRM  =    0360
   CURRENT      0480 µS/CM
   <ALARM INFO>
```

11. Move the prompt to the **DIFF=** line. Press [ENTER] to edit each digit of the differential value. Use [UP] / [DOWN] / [ENTER] to set the differential that will be used to bleed the system based on makeup. Press [ENTER] to accept your value.
12. Move the prompt to the **HiALRM=** line. Press [ENTER] to edit the **HiALRM** for makeup conductivity. Press [ENTER] to accept your value.
13. Repeat Step 11 for the **LoALRM=** line.
14. Move the prompt to the **"<ALARM INFO>"** sub-menu line. Press [ENTER]. The **ALARM INFO** menu is displayed.

```
  ------ ALARM INFO ------
           MAKEUP

 ▸ Alarm LED:       BOTH
   Alarm RELAY:     BOTH
   Alarm CALLBACK:  BOTH
   Alarm Delay =    00 Sec
```

15. Edit each line to set the alarm condition for **MAKEUP**. Press [HOME]. The **SYSTEM CHANGES HAVE BEEN MADE!** menu is displayed. Press [ENTER] to save, [HOME] to abort.
16. Continually press [HOME], answering any **SYSTEM CHANGES HAVE BEEN MADE!** menus that may appear, until you reach the **MAIN MENU**.

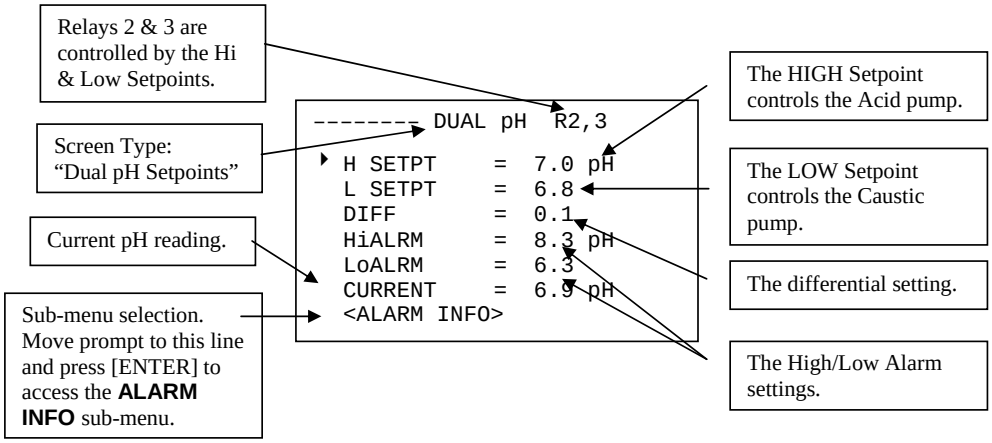
    You have now completed setup of your **MAKEUP** setpoints.

NOTE **The MAKEUP DIFF, HiALRM and LoALRM values are always set in units of µS/CM not cycles.**

```
  ---- SYSTEM CHANGES ----
       HAVE BEEN MADE!

     ?? SAVE CHANGES ??

Press ENTER to SAVE

Press HOME to ABORT
```

4.3.1.1.6 SETPOINTS: Dual pH

Systems supplied with Dual pH have a slightly different **SETPOINT** menu selection.



Instead of specifying a setpoint type, you set Hi and Low setpoints explicitly.

NOTE **Your high and low setpoints must be separated by at least two times your differential.**

To configure pH control use the following procedure.

17. From the **SETPOINTS** menu, move the prompt to **DUAL pH** and press [ENTER]. The **DUAL pH** menu is displayed.

```
------ SETPOINTS ------
  SysCOND       INPUT 4
  MAKE UP       DRUM 1
▸ DUAL pH       DRUM 2
  Sys ORP       DRUM 3
  INPUT 1       DRUM 4
  INPUT 2       DRUM 5
  INPUT 3       FLOW
```

```
----- DUAL pH  R2,3 -----
▸ H SETPT =    7.0 pH
  L SETPT =    6.8
  DIFF    =    0.1
  HiALRM  =    8.3 pH
  LoALRM  =    6.3
  CURRENT      6.9 pH
  <ALARM INFO>
```

18. If necessary move the prompt to the first line **H SETPT=**. Press [ENTER] to edit the value. Use [UP] / [DOWN] / [ENTER] to set your High pH Setpoint. Press [ENTER] on the last digit to accept your entry.

```
----- DUAL pH  R2,3 -----
▸ H SETPT =    7.0 pH
  L SETPT =    6.8
  DIFF    =    0.1
  HiALRM  =    8.3 pH
  LoALRM  =    6.3
  CURRENT      6.9 pH
  <ALARM INFO>
```

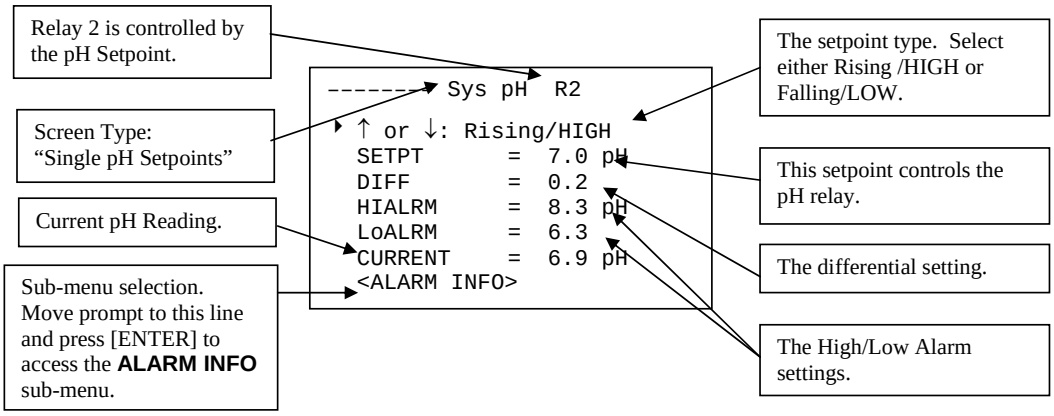
19. Move the prompt to the **L SETPT=** line. Press [ENTER]. Using [UP] / [DOWN] / [ENTER], set your Low pH setpoint. Press [ENTER] on the last digit to accept your entry.
20. Move the prompt to the **DIFF =** line. Press [ENTER]. Using [UP] / [DOWN] / [ENTER], set the differential.

NOTE **For DUAL pH control, the differential is used for both the Hi and Low setpoints.**

21. Using a similar technique, set the High Alarm (**HiALRM=**) and the Low Alarm values (**LoALRM=**).
22. Move the prompt to the **"<ALARM INFO>"** item and press [ENTER] to display the **ALARM INFO** menu for pH. Edit each line to set the alarm condition for **DUAL pH**.
23. Press [HOME]. The **SYSTEM CHANGES HAVE BEEN MADE!** menu is displayed. Press [ENTER] to save, [HOME] to abort.
24. Press [HOME] to return to **DUAL pH**. Follow the on screen prompts.
25. Press [HOME] to exit the **DUAL pH** menu back to the **SETPOINTS** menu.

4.3.1.1.7 SETPOINTS: Single pH

Systems supplied with Single pH have a slightly different menu selection. Since the input controls only one relay, you can set either a **Rising/HIGH** or a **Falling/LOW** setpoint.



❖ **To configure pH control use the following procedure.**

1. From the **SETPOINTS** menu, move the prompt to **Sys pH** and press [ENTER]. The **Sys pH** menu is displayed.

```
------ SETPOINTS ------
  SysCOND     INPUT 4
  MAKE UP     DRUM 1
▸ Sys pH      DRUM 2
  Sys ORP     DRUM 3
  INPUT 1     DRUM 4
  INPUT 2     DRUM 5
  INPUT 3     FLOW
```

```
------ Sys pH  R2 ------
▸ ↑ or ↓: Rising/HIGH
  SETPT      =  7.0 pH
  DIFF       =  6.8
  HIALRM     =  8.3 pH
  LoALRM     =  6.3
  CURRENT    =  6.9 pH
   <ALARM INFO>
```

2. If necessary move the prompt to the first line **↑ or ↓: Rising/HIGH**. Press [ENTER] to change the setpoint type.

   Press [ENTER] to accept your selection.

```
------ Sys pH  R2 ------
▸ ↑ or ↓: Rising/HIGH
  SETPT      =  7.0 pH
  DIFF       =  0.2
  HIALRM     =  8.3 pH
  LoALRM     =  6.3
  CURRENT    =  6.9 pH
   <ALARM INFO>
```

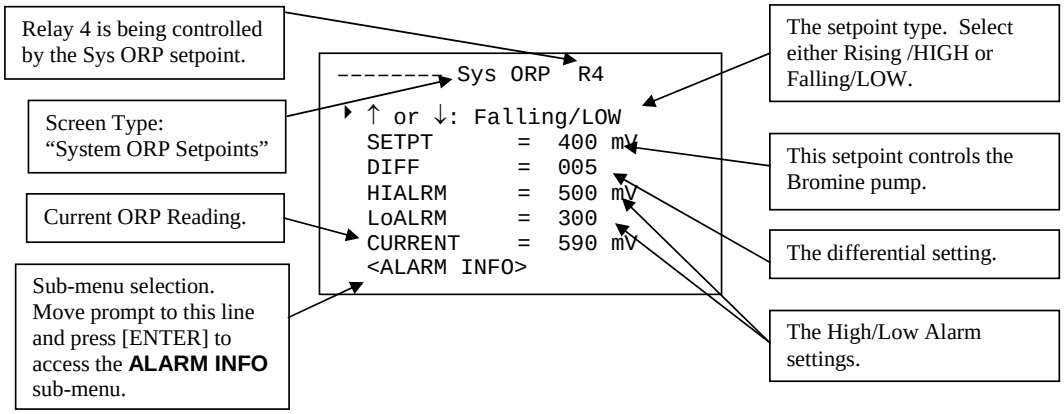
3. Move the prompt to the **SETPT=** line. Press [ENTER]. Using [UP] / [DOWN] / [ENTER], enter your setpoint value.

   Press [ENTER] on the last digit to accept your entry.

4. Move the prompt to the **DIFF =** line. Press [ENTER]. Using [UP] / [DOWN] / [ENTER], set the differential.
5. Using a similar technique, set the High Alarm (**HiALRM=**) and the Low Alarm values (**LoALRM=**).
6. Move the prompt to the **"<ALARM INFO>"** item and press [ENTER] to display the **ALARM INFO** menu for **Sys pH**. Edit each line to set the alarm condition for **Sys pH**.
7. Press [HOME]. The **SYSTEM CHANGES HAVE BEEN MADE!** menu is displayed. Press [ENTER] to save, [HOME] to abort.
8. Press [HOME] to return to Press [HOME] to return to **Sys pH**. Follow the on screen prompts.
9. Press [HOME] to exit the **Sys pH** menu back to the **SETPOINTS** menu.

4.3.1.1.8 SETPOINTS: System ORP

The **Sys ORP** setpoint entry screen is similar to the **SysCond** setpoint entry screen. The one exception is that the setpoint type can be configured as **Rising/HIGH** or **Falling/LOW**.



To configure ORP control use the following procedure:

1. From the **SETPOINTS** menu select **Sys ORP**. Press [ENTER]. The **Sys ORP** menu is displayed.

```
------ Sys ORP   R4 ------
↑ or ↓:  Falling/LOW
SETPT   =  400  mV
DIFF    =  050
HiALRM  =  500  mV
LoALRM  =  300
CURRENT    590  mV
<ALARM INFO>
```

2. The prompt is located on the second line on the display. Press [ENTER]. Use the [UP] / [DOWN] keys to change the value between **Falling/LOW** and **Rising/HIGH**. If you select **Falling/LOW** the relay will come on when the ORP falls below the setpoint. If you select **Rising/HIGH**, the relay will come on when the ORP rises above the setpoint.

Use Falling/LOW for most Bromine or Chlorine applications.

3. Set the other entries in accordance with the steps outlined in ***System Conductivity***.
4. SETPOINTS: System Input

   The term "System Input" refers to the controller's 4-20mA inputs. They can be configured to accept the output from a wide variety of 4-20mA capable sensors, but are most commonly used in conjunction with a continuous drum level sensor. System Inputs strictly monitor. They do not control relays.

   Monitor Only System Input Menu Example:

```
------ SET:  INPUT 1 ------

   HiALRM    =   5000 µS/CM
   LoALRM    =   0000

   CURRENT       3265 µS/CM

   <ALARM INFO>
```

❖ **Accessing the System Inputs menu from the SETPOINTS menu:**

The units (e.g., µS/CM, mV, PSI, etc.) for the System Inputs are configured through the CALIBRATION menu.

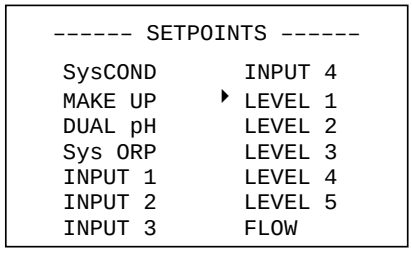
1. Move the prompt to the **INPUT #** line (where # is a numerical value between 1 and 4). Press [ENTER]. The **INPUT #** menu is displayed.
2. Set parameters displayed. Refer to the ***SETPOINTS: System ORP*** section on the previous page for more detailed information.

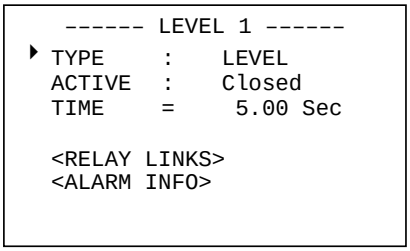
4.3.1.1.9 SETPOINTS: Level (Single Point)

Level Inputs are designed to operate with dry contact switching devices (e.g., float style level switch). They can be configured to operate with a switch that produces a continuous signal (e.g., a float switch turns on when the level is low), or an alternating one (e.g., a flow monitor generating a pulse every 2 seconds when the pump is operating). Level Inputs can be configured to activate the **Alarm LED**, activate the **Alarm RELAY** and/or initiate an **Alarm CALLBACK** event. Each input can be configured independently. The first 4 inputs (J11 positions 1 to 8 on the relay board) also illuminate the 4 LED positions (Level 1 - 4) between the **FLOW** and **Alarm LED**'s on the left side of the front panel. These LED's turn RED when the contact is closed (provided **ACTIVE** is set to closed) and GREEN when it is open. The inputs are configured with an adjustable de-bounce delay.

❖ **Procedure for setting the single point LEVELS:**

1. From the **SETPOINTS** menu, move the prompt to **LEVEL #** (where # is the Level Number). Press [ENTER]. The **LEVEL #** menu is displayed.





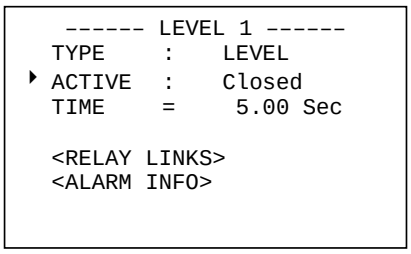
2. On the second line of the screen, the usage **TYPE** field is displayed. If necessary press [SCROLL] to move the prompt to the **TYPE** line. Press [ENTER].
3. Use [UP] / [DOWN] to select between **LEVEL** and **FLO MONITOR**. Proceed to ***Section 4.3.1.1.10.2, Setpoints: Level (FLO MONITOR)*** if **FLO MONITOR** is selected.

4.3.1.1.9.1 Setpoints: Level (LEVEL)

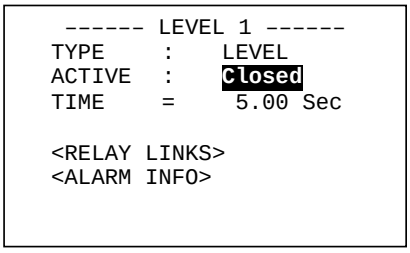
When **TYPE** is set to **LEVEL**, the input is treated as a standard single point drum level. When the input activates (e.g., closes) any relays that are selected in the **<RELAY LINKS>** menu are turned off and the configured alarms are activated.

❖ **Procedure for setting the Setpoints: Level (Level)**

1. Press [SCROLL] to move the prompt to the **ACTIVE** line.

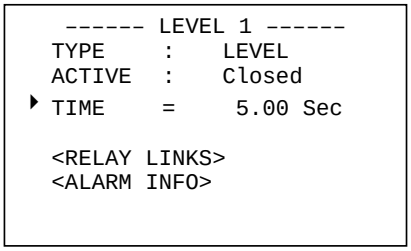


Press [ENTER] and the switch status is highlighted.



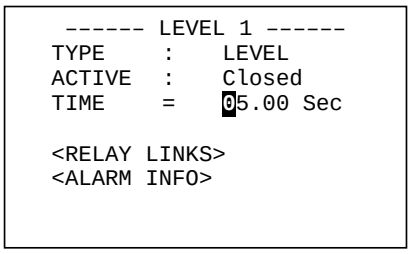
Press [UP] / [DOWN] to alternate between **Closed** or **Open**. The **ACTIVE** setting indicates the non-alarming condition of the switch input. Press [ENTER] to accept your selection.

2. Press [SCROLL] to move the prompt to the **TIME =** line.



Press [ENTER] to enter the **TIME** field.

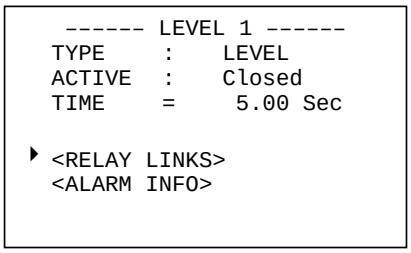
When the **TYPE** field is set to **LEVEL**, the **TIME** field is used to configure the duration of the de-bounce delay. In other words, this field determines how long the contact must remain active before the input is recognized.



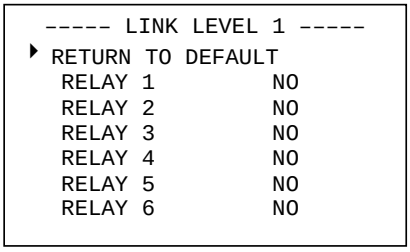
The **TIME =** field is a four-digit field. If a single digit setting was used (5.00 seconds in the example above), when the **TIME** field is entered, a 0 is displayed to the left of the 5. The fourth digit will not "hold" an entered value unless the value is less than 1 second.

3. Use [UP] / [DOWN] and [ENTER] to set each digit in the **TIME =** field. Pressing [ENTER] on the fourth digit enters the de-bounce delay setting into the system.

4. Press [SCROLL] to move the prompt to the **<RELAY LINKS>** line.



5. Press [ENTER] to open the **<RELAY LINKS>** screen.

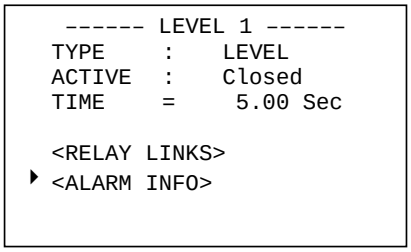


When the field is set to **LEVEL** from the **LEVEL 1** menu, the **<RELAY LINKS>** menu allows you to select relays that the level input will turn off when it activates.

6. Press [SCROLL] to move the prompt. When the prompt is next to the desired relay (e.g., **RELAY 3**), press [ENTER]. Use [UP] / [DOWN] to select between **NO** (do not turn the relay off) and **YES** (turn the relay off). Press [ENTER] to accept your selection. Press [HOME] to return to the **LEVEL 1** menu.

NOTE **To return the LINK page to the default settings, move the prompt to RETURN TO DEFAULT and press [ENTER].**

7. Press [SCROLL] to move the prompt to the **<ALARM INFO>** line



8. Press [ENTER] to open the **<ALARM INFO>** screen.

```
------ ALARM INFO ------
        LEVEL 1

▸ Alarm LED:       YES
  Alarm RELAY:     YES
  Alarm CALLBACK:  YES
```

9. Use [UP] / [DOWN] and [ENTER] to set the values for **Alarm LED**, **Alarm RELAY** and **Alarm CALLBACK** to either **YES** or **NO**.

NOTE **Setting the LED value to NO on the ALARM INFO LEVEL menu will not disable (i.e., turn off) the level LED on the front panel. It will only prevent the Alarm LED from flashing given a LEVEL condition.**

10. Press [HOME]. Follow the on-screen prompt (i.e., **SYSTEM CHANGES HAVE BEEN MADE!** menu).

4.3.1.1.9.2 Setpoints: Level (FLO MONITOR)

When set to **FLO MONITOR**, the input is monitored for the active condition (e.g., closed) over the time interval (e.g., 5 sec.) This condition is checked whenever the relays specified in the **<RELAY LINKS>** are active.

Procedure for setting the Setpoints: Level (FLO MONITOR)

1. Press [SCROLL] to move the prompt to the **ACTIVE** line. Press [ENTER] and the switch status is highlighted.

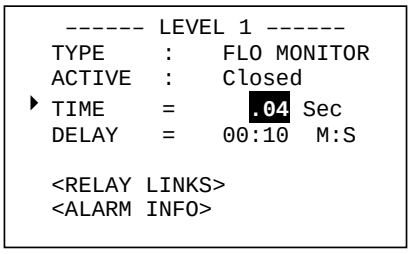
```
------ LEVEL 1 ------
TYPE    :   FLO MONITOR
▸ ACTIVE  :   Closed
TIME    =     .04 Sec
DELAY   =   00:10 M:S

<RELAY LINKS>
<ALARM INFO>
```

Press [UP] / [DOWN] to alternate between **Closed** or **Open**. The **ACTIVE** setting indicates the condition of the switch input that will indicate a flow pulse (e.g., closed means the switch will close every time the pump discharges fluid).

```
------ LEVEL 1 ------
TYPE    :   FLO MONITOR
ACTIVE  :   Closed
TIME    =     .04 Sec
DELAY   =   00:10  M:S

<RELAY LINKS>
<ALARM INFO>
```

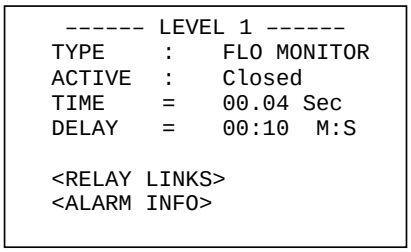
Press [ENTER] to accept your selection.

2. Press [SCROLL] to move the prompt to the **TIME =** line.

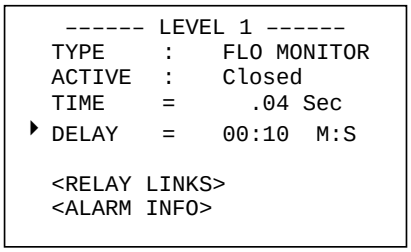


Press [ENTER] to enter the **TIME** field.

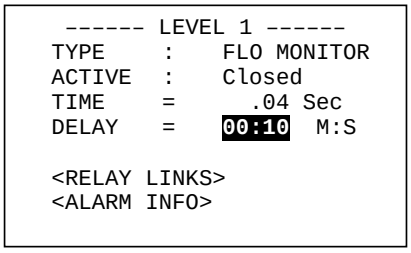
The **TIME =** field sets the amount of time the switch must be active (open or closed) to be recognized. Typically, a flow pulse from a solenoid driven pump can be recognized with the default setting of .04 seconds.



3. Use [UP] / [DOWN] and [ENTER] to set each digit in the **TIME =** field. Pressing [ENTER] on the fourth digit enters the setting into the system.
4. Press [SCROLL] to move the prompt to the **DELAY=** line.



5. Press [ENTER] to enter the **DELAY=** field.



The **DELAY=** field is used to set the amount of time to delay before issuing an alarm. You would normally set this to a time greater than the interval between flow pulses. For example, if you are using a pump with a maximum frequency of 125 SPM and you have its stroke rate setting at 12%, then the pump will stroke every 4 seconds [60/(125 X .12) = 4]. The delay should be set at a value of 4 seconds or greater.

6. Use [UP] / [DOWN] and [ENTER] to set each digit in the **DELAY=** field. Pressing [ENTER] on the fourth digit enters the setting into the system.
7. Press [SCROLL] to move the prompt to the **<RELAY LINKS>** line.

```
 ------ LEVEL 1 ------
TYPE    :   FLO MONITOR
ACTIVE  :   Closed
TIME    =     .04 Sec
DELAY   =   00:10  M:S

▸<RELAY LINKS>
 <ALARM INFO>
```

8. Press [ENTER] to open the **<RELAY LINKS>** screen.

```
 ----- LINK LEVEL 1 -----
▸RETURN TO DEFAULT
 RELAY 1         NO
 RELAY 2         NO
 RELAY 3         NO
 RELAY 4         NO
 RELAY 5         NO
 RELAY 6         NO
```

The **<RELAY LINKS>** menu allows you to select relays that will be monitored. When the selected relay is active the FLO MONITOR input will expect pulses at the specified interval, otherwise it will activate the programmed alarm.

9. Press [SCROLL] to move the prompt. When the prompt is next to the desired relay (e.g., **RELAY 3**), press [ENTER]. Use [UP] / [DOWN] to select between **NO** (do not turn the relay off) and **YES** (turn the relay off). Press [ENTER] to accept your selection. Press [HOME] to return to the **LEVEL 1** menu.

NOTE **To return the LINK page to the default settings, move the prompt to RETURN TO DEFAULT and press [ENTER].**

10. Press [SCROLL] to move the prompt to the **<ALARM INFO>** line

```
 ------ LEVEL 1 ------
TYPE    :   FLO MONITOR
ACTIVE  :   Closed
TIME    =     .04 Sec
DELAY   =   00:10  M:S

 <RELAY LINKS>
▸<ALARM INFO>
```

11. Press [ENTER] to open the **<ALARM INFO>** screen.

```
------ ALARM INFO ------
        LEVEL 1

▸ Alarm LED:       YES
  Alarm RELAY:     YES
  Alarm CALLBACK:  YES
```

12. Use [UP] / [DOWN] and [ENTER] to set the values for **Alarm LED**, **Alarm RELAY** and **Alarm CALLBACK** to either **YES** or **NO**.

NOTE **Setting the LED value to NO on the ALARM INFO LEVEL menu will not disable (i.e., turn off) the level LED on the front panel. It will only prevent the Alarm LED from flashing given a LEVEL condition.**

13. Press [HOME]. Follow the on-screen prompt (i.e., **SYSTEM CHANGES HAVE BEEN MADE!** menu).

4.3.1.1.10 SETPOINTS: Flow

Like **LEVEL #**, **FLOW** can be configured to activate the **Alarm LED**, activate the **Alarm RELAY** and initiate an **Alarm CALLBACK** event. **FLOW** has the added characteristic that it will disable all relay outputs (i.e., turn them off). The flow input can be disabled by setting S1-2 on the Mother Board to OFF (refer to ***Section 7, Diagram 7*** for further information).

❖ **To access the FLOW SETPOINT menu:**

1. From the **SETPOINTS** menu, move the prompt to **FLOW**. Press [ENTER]. The **FLOW** menu is displayed.

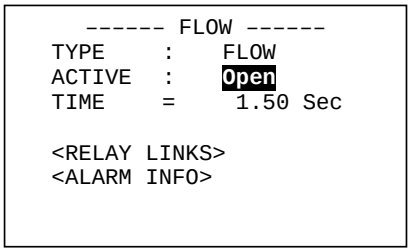
```
------ SETPOINTS ------

 SysCOND      INPUT 4
 MAKEUP       LEVEL 1
 DUAL pH      LEVEL 2
 Sys ORP      LEVEL 3
 INPUT 1      LEVEL 4
 INPUT 2      LEVEL 5
 INPUT 3    ▸ FLOW
```

```
------ FLOW ------

▸ TYPE  :    FLOW
  ACTIVE:    Open
  TIME  =     5.00 Sec


  <RELAY LINKS>
  <ALARM INFO>
```

2. On the second line of the screen, the usage **TYPE** field is displayed. At present this field is not changeable.
3. Press [SCROLL] to move the prompt to the **ACTIVE** line.

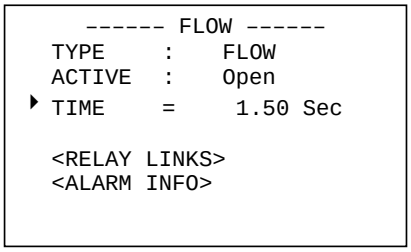
```
------ FLOW ------
  TYPE    :    FLOW
▸ ACTIVE  :    Open
  TIME    =     1.50 Sec

  <RELAY LINKS>
  <ALARM INFO>
```

Press [ENTER] and the switch status is highlighted.

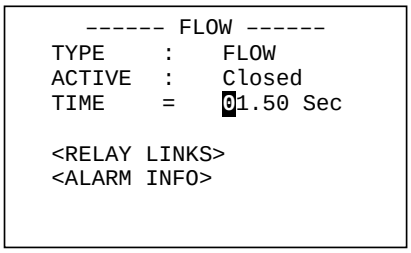


Press [UP] / [DOWN] to alternate between **Open** or **Closed**. Press [ENTER] to accept your selection.

4. Press [SCROLL] to move the prompt to the **TIME =** line.

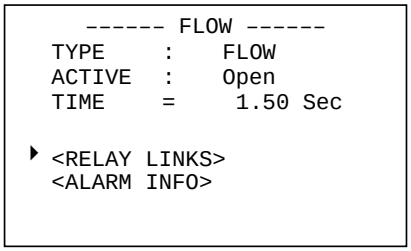


Press [ENTER] to enter the **TIME** field. The **TIME** field is used to configure the duration of the de-bounce delay. In other words this field determines how long the contact must remain active before the input is recognized.



The **TIME =** field is a four-digit field. If a single digit setting was used (1.50 seconds in the example above), when the **TIME** field is entered, a 0 is displayed to the left of the 5. The fourth digit will not "hold" an entered value unless the value is less than 1 second.

5. Use [UP] / [DOWN] and [ENTER] to set each digit in the **TIME =** field. Pressing [ENTER] on the fourth digit enters the setting into the system.
6. Press [SCROLL] to move the prompt to the **<RELAY LINKS>** line.



7. Press [ENTER] to open the **<RELAY LINKS>** screen.

   The **<RELAY LINKS>** menu allows you to select relays that the **FLOW** input will turn off when it activates.

8. Press [SCROLL] to move the prompt. When the prompt is next to the desired relay (e.g., **RELAY 3**), press [ENTER]. Use [UP] / [DOWN] to select between **NO** (do not turn the relay off) and **YES** (turn the relay off). Press [ENTER] to accept your selection. Press [HOME] to return to the **LEVEL 1** menu.

NOTE **To return the LINK page to the default settings, move the prompt to RETURN TO DEFAULT and press [ENTER].**

```
------ LINK FLOW ------
▸ RETURN TO DEFAULT
  RELAY 1         YES
  RELAY 2         YES
  RELAY 3         YES
  RELAY 4         YES
  RELAY 5         YES
  RELAY 6         YES
```

9. Press [SCROLL] to move the prompt to the **<ALARM INFO>** line

```
    ------ FLOW ------
  TYPE    :    FLOW
  ACTIVE  :    Open
  TIME    =     1.50 Sec

  <RELAY LINKS>
▸ <ALARM INFO>
```

10. Press [ENTER] to open the **<ALARM INFO>** screen.

```
 ------ ALARM INFO ------
           FLOW

▸ Alarm LED:       YES
  Alarm RELAY:     YES
  Alarm CALLBACK:  YES
```

11. Use [UP] / [DOWN] and [ENTER] to set the values for **Alarm LED**, **Alarm RELAY** and **Alarm CALLBACK** to either **YES** or **NO**.

NOTE **Setting the LED value to NO on the ALARM INFO LEVEL menu will not disable (i.e., turn off) the FLOW LED on the front panel. It will only prevent the Alarm LED from flashing given a NO FLOW condition.**

12. Press [HOME]. Follow the on-screen prompt (i.e., **SYSTEM CHANGES HAVE BEEN MADE!** menu).

4.4 Timers

Timers are used to protect your water system from the over-feed of chemicals and to dispense chemicals at a specified rate.

4.4.1 Analog Limit Timers

A Limit Timer limits the amount of time a relay is turned on. Every analog input that controls a relay output (i.e., **System Conductivity, pH, ORP**, etc.) includes a limit timer. When the analog input tells the relay to turn ON (e.g., the pH rises above the setpoint), the timer begins to count down from a specified limit (e.g., 1 hour and 30 minutes). If the timer expires (e.g., counts down to 0:00) the relay will be forced off. The limit timer will reset (e.g., go back to 1:30) when the analog input turns the relay OFF (e.g., the pH falls below the setpoint less the differential). The next time the analog input activates the relay, the timer will begin to count down again and the cycle will repeat. The limit time is adjustable in 1 minute increments up to 23 hours and 59 minutes.

NOTE **Exception: The system conductivity limit timer setting is for alarm purposes only. It will not force the relay off.**

Procedure for setting the limit timer:

13. From the **MAIN MENU** move the prompt to **TIMERS** and press [ENTER]. The **TIMERS** menu is displayed.

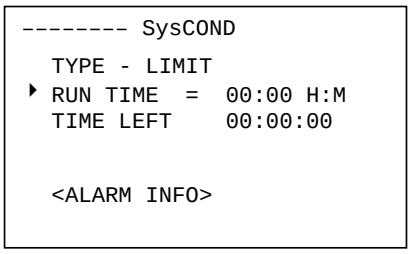
```
====== MAIN MENU ======
    DISPLAY DATA
    CALIBRATION
    SETPOINTS
  ▸ TIMERS
    DATA COLLECT
    CONFIGURE
      ------------
```

14. Move the prompt to **SysCond** (or any other analog input available). Press [ENTER]. The **SysCond** menu is displayed.

```
------ TIMERS ------
▸ SysCOND
  DUAL pH
  Sys ORP
  TIMER    1
  TIMER    2
  W METER  1
  W METER  2
```

```
------ SysCOND ------
  TYPE - LIMIT
▸ RUN TIME = 00:00 H:M
  TIME LEFT  00:00:00


  <ALARM INFO>
```

15. The second line on this menu, **TYPE - LIMIT**, is fixed. Note that the prompt is located to the left of the **RUN TIME =** line. Press [ENTER].



16. Using [UP] / [DOWN] / [ENTER] set the **RUN TIME** variable to the desired limit time. You can set a maximum of 23 hours and 59 minutes. If you enter 00:00 here the Limit Timer will be disabled and the relay will activate without limit. Press [ENTER] to accept your **RUN TIME** entry.

WARNING

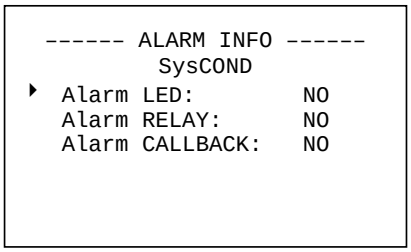
SETTING THE LIMIT TIMER TO 00:00 DISABLES THE LIMIT TIMER. THE RELAY WILL TURN ON WITH THE ANALOG INPUT CROSSING THE SETPOINT AND STAY ON INDEFINITELY UNTIL IT SATISFIES THE DIFFERENTIAL.

17. The fourth line in this display, **TIME LEFT**, indicates the amount of time left until the timer reaches its limit (i.e., 00:00:00). This value will always be between the specified **RUN TIME** and 00:00:00.

NOTE

The time left field will display 00:00:00 until the feed is activated.

18. Move the prompt to the **<ALARM INFO>** sub-menu access line. Press [ENTER] and the **ALARM INFO SysCond** menu is displayed. Using [UP] / [DOWN] / [ENTER] set the **Alarm LED**, **Alarm RELAY** and **Alarm CALLBACK** activities to occur when this limit timer expires. You can set each to either **YES** or **NO**. Press [HOME] to return to the **SysCond** menu. Follow the on-screen prompts if you have made changes.



19. Press [HOME] to return to the **TIMERS** menu. Follow the on- screen prompts if you have made changes.

    Repeat Steps 1 to 7 for any other Analog Limit Timers included with your system.

4.4.2 Selectable Timers

The chemical feed timers for this controller are selectable; you can choose one of seven modes on which to base the addition of chemical. The selection of timer mode is made directly from the **TIMERS** menu.

4.4.2.1 Limit Timer

Also referred to as a lockout timer. The chemical feed pump is actuated 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 a count down style display.

❖ **Setting the Limit Timer**

1. From the **MAIN MENU**, move the prompt to the **TIMERS** line and press [ENTER]. The **TIMERS** menu is displayed.

```
====== MAIN MENU ======
  DISPLAY DATA
  CALIBRATION
  SETPOINTS
▸ TIMERS
  DATA COLLECT
  CONFIGURE
      ------------
```

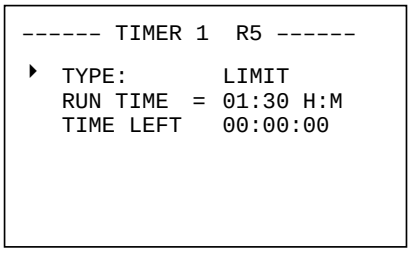
```
------ TIMERS ------
  SysCOND
  DUAL pH
▸ Sys ORP
  TIMER 1
  TIMER 2
  W METER 1
  W METER 2
```

2. Move the prompt to the **TIMER #** (where # is the timer number) line.
   Press [ENTER]. The **TIMER 1 R5** menu is displayed. (**Timer 1 R5** is being used for our example.)

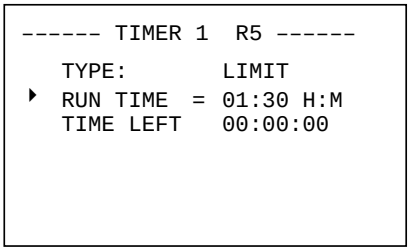
```
------ TIMER 1  R5 ------
▸ TYPE:          disabled
```

3. The second line in the display, **TYPE:**, will display the current timer type. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to display the different timer types: **disabled**, **28 DAY, CYCLE, PULSE, % POST B.D, PERCENT, LIMIT,** and **Slaved to**. As you display the different timer types, the screen will update with the respective parameters.

4. Set the **TYPE** to **LIMIT** and press [ENTER].



5. Move the prompt to the **RUN TIME =** line. Press [ENTER].



6. Use [UP] / [DOWN] / [ENTER] to set the **RUN TIME** variable to the desired limit time. You can set a maximum of 23 hours and 59 minutes. If you enter 00:00 here the Limit Timer will be disabled and the relay will activate without limit. Press [ENTER] to accept your **RUN TIME** entry.
7. The fourth line in this display, **TIME LEFT**, indicates the amount of time left until the timer reaches it's limit (i.e., 00:00:00). This value will always be between the specified **RUN TIME** and 00:00:00.
8. Press [HOME] to return to the **TIMERS** menu. Follow the on- screen prompts if you have made changes.

   Repeat Steps 1 to 7 to configure any additional **Selectable Timers** as **Limit Timers**.

TIP **To reset a limit timer: Satisfy the condition by manually bleeding, feeding, etc. or change the limit time value, and then cycle the power to the controller.**

NOTE **The limit timer is activated with the bleed relay (conductivity controlled). If your controller has multiple conductivity's, the odd numbered limit/post timers (1,3) are activated by the odd numbered conductivity (1). The even numbered timers are activated by the even conductivity's.**

NOTE **The time left field will display 00:00:00 until the feed is activated.**

4.4.2.2 Percent Timer

The **Percent Timer** runs continuously on an adjustable percentage of the time cycle. The percentage is adjustable from 0 to 100% in 1% increments. The cycle time is adjustable from 1 to 255 minutes.

1. From the **MAIN MENU**, press [SCROLL] to move the prompt to the **TIMERS** line. Press [ENTER]. The **TIMERS** menu is displayed.
2. Move the prompt to the **TIMER #** (where **#** represents the **TIMER** number) line. Press [ENTER]. The **TIMER #** menu is displayed. (**Timer 1 R5** is being used for our example.)
3. The second line in the display, **TYPE:**, will display the current timer type. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to display the different timer types: **disabled**, **LIMIT**, **PERCENT**, **% POST B.D**, **PULSE, CYCLE, Slaved to,** and **28 DAY**. As you display the different values the screen will update with the parameters associated with each timer type.

```
-------- TIMER 1  R5

▸ TYPE:       PERCENT
  RUN TIME    00:05:00
  TIME LEFT   00:00:00
  PERCENT:    50 %
  % MINUTES = 10
```

4. Set **TYPE** to **PERCENT** and press [ENTER].
5. The third line, **RUN TIME**, cannot be changed. This line indicates the on time in Hours, Minutes and Seconds. Like wise, the fourth line, **TIME LEFT**, cannot be changed. This line indicates the time remaining for the ON or OFF period of the cycle.
6. Press [SCROLL] to move the prompt to the **PERCENT**: line. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set each digit of the percentage value. This is the percentage of ON time. The value can be set from 0 to 100% in 1% increments. Press [ENTER] to accept your setting.
7. Move the prompt to the **% MINUTES** line. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the number of minutes in the percentage cycle. For example, if you set the **PERCENT** to 75% and the **%MINUTES** to 4, then the relay will turn on for 3 minutes (4 x .75 = 3) and off for 1 minute (4 x .25 = 1).
8. Press [HOME] to return to the **TIMERS** menu. Follow any on screen prompts if you made changes.

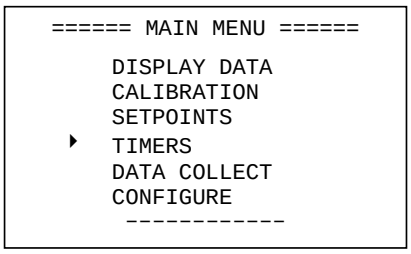
   Repeat Steps 1 to 8 to configure any additional **Selectable Timers** as **Percent Timers**.

4.4.2.3 Percent Post Blowdown Timer

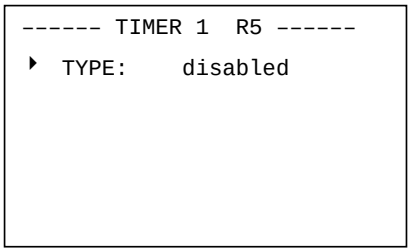
This timer keeps track of the time the bleed relay is turned on. When the bleed shuts off, the timer begins feeding for a percentage of the bleed time. The percentage is adjustable in 1% increments from 0 to 99% of the blowdown time. This timer also includes a limit timer to prevent overfeed.

If the % post blowdown max time value is set to 00:00:00, the limit function will be disabled.

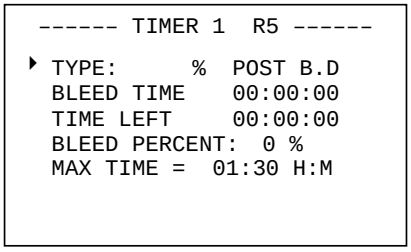
1. From the **MAIN MENU**, move the prompt to the **TIMERS** line and press [ENTER]. The **TIMERS** menu is displayed.



2. Move the prompt to the **TIMER #** (where **#** represents the **TIMER** number) line. Press [ENTER]. The **TIMER #** menu is displayed. (**Timer 1 R5** is being used for our example.)



3. The second line in the display, **TYPE**:, will display the current timer type. Press [ENTER]. Use [UP] / [DOWN] to display the different timer types: **disabled**, **LIMIT, PERCENT, % POST B.D, PULSE, CYCLE, Slaved to,** and **28 DAY**. As you display the different values the screen will update with the parameters associated with each timer type.
4. Set the **TYPE** to **% POST B.D** and press [ENTER].



5. The third line, **BLEED TIME**, cannot be changed. This line indicates the bleed time in Hours, Minutes and Seconds. Like wise, the fourth line, **TIME LEFT**, cannot be changed. This line indicates the time remaining when the timer is running (i.e., when it is feeding).

6. Move the prompt to the **BLEED PERCENT**: line. Press [ENTER]. Use the [UP] / [DOWN] to select the percentage value. This is the Percentage of the bleed time. The value can be set from 0 to 100% in 1% increments. Press [ENTER] to accept your setting.

```
------ TIMER 1  R5 ------
▸ TYPE:       % POST B.D
  BLEED TIME    00:00:00
  TIME LEFT     00:00:00
  BLEED PERCENT: 0 %
  MAX TIME =  01:30 H:M
```

7. Move the prompt to the **MAX TIME =** line. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the number of hours and minutes to limit the feed. For example, if you set the **PERCENT** to 50% and the **MAX TIME** to 01:30 and the system completes a 4 hour blowdown, the timer will calculate a feed time of 02:00 (04:00 x .5 = 02:00), but the feed will only activate for 01:30 — the **MAX TIME** value.

NOTE **The max time setting limits the feed time only. The timer will only reset when the bleed relay cycles or the unit's power is cycled. The max time does not generate an alarm.**

8. Press [HOME] to return to the **TIMERS** menu. Follow any on screen prompts if you made changes.

   Repeat Steps 1 to 8 to configure any additional **Selectable Timers** as **Percent Post Blowdown Timers**.

NOTE **Before Setting up the Pulse Timer you must choose your Water Meter type, Dry Contact or Hall Effect**

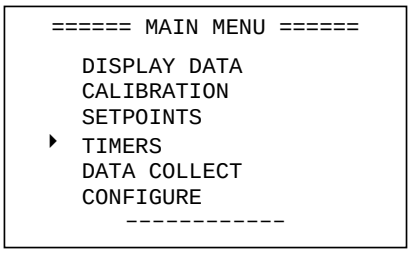
4.4.2.4 Pulse Timer

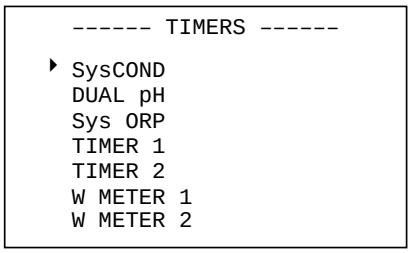
This timer is commonly referred to as a water meter or reset timer. It monitors water usage from a water meter by reading pulse counts from a dry contact type water meter or by reading gallons or liters from a Hall-effect type meter. When the water usage reaches a specified set point, it feeds for an adjustable time interval and then will reset the water usage value (counts or gallons/liters). At the same time it resets the count and recycles. The **RUN TIME** can be set to a maximum of 59 minutes and 59 seconds. The **PULSE SET** cannot be set any higher than 32,000. The water meter input can also be specified. This allows you to run multiple **PULSE** timers from a single water meter input. The timer must be associated with a water meter if multiple water meters are used with the controller and the water meter type and parameters must be configured properly before the timer can be configured.

NOTE **Water meter de-bounce characteristics are set in the TIMERS / W METER# / <SETPOINT> menu. Refer to the *WATER METER INPUT* section.**

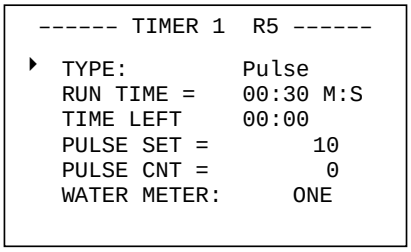
❖ **To configure a timer as a PULSE TIMER:**

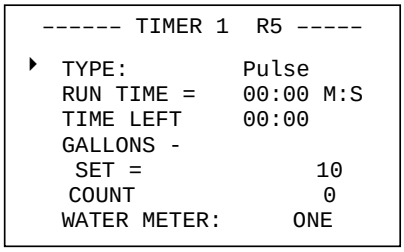
1. From the **MAIN MENU**, move the prompt to the **TIMERS** line and press [ENTER]. The **TIMERS** menu is displayed.



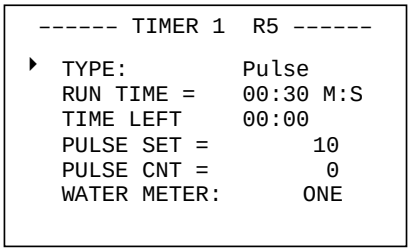


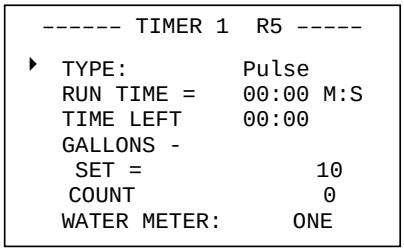
2. Move the prompt to the **TIMER #** (where **#** represents the **TIMER** number) line. Press [ENTER]. The **TIMER 1 R5** menu is displayed. (**Timer 1 R5** is being used for our example.)



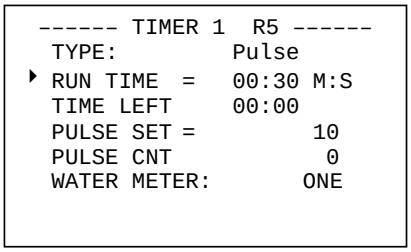


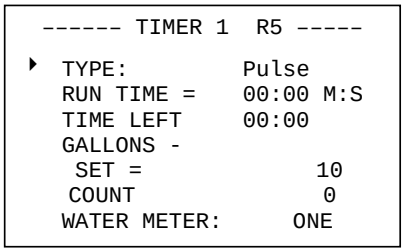
3. The second line in the display, **TYPE:**, will display the current Timer Type. Press [ENTER]. Use [UP] / [DOWN] to display the different timer Types: **disabled**, **LIMIT, PERCENT, % POST B.D, PULSE, CYCLE, Slaved to,** and **28 DAY**. As you display the different values the screen will update with the parameters associated with each timer type.
4. Set the **TYPE** to **PULSE** and press [ENTER].



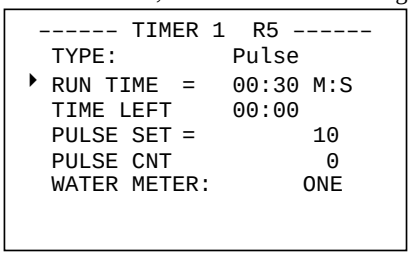


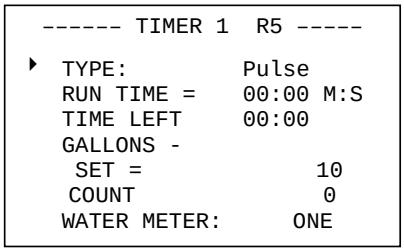
5. The third line, **RUN TIME**, is where you set the number of minutes and seconds you want the feed to activate when the **PULSE SET** is achieved. Use [UP] / [DOWN] / [ENTER] to set the Minutes and Seconds. Press [ENTER] to accept the value you have set.





6. The fourth line in this display, **TIME LEFT**, indicates the amount of time left until the timer reaches it's limit (i.e., 00:00) and shuts off the feed. You cannot change this field. This value will always be between the specified **RUN TIME** and 00:00. It will display 00:00 until the feed is activated, at which time it will begin to count down from the **RUN TIME**.





7. Move the prompt to the **PULSE SET =** line. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the number of pulses that should be counted before the feed is activated. The value can be set between 1 and 32,000. Press [ENTER] to accept your setting.
8. The sixth line in this menu, **PULSE CNT**, displays the current pulse count. You cannot edit this value. When the **PULSE CNT** reaches the **PULSE SET** the feed will activate for the **RUN TIME** interval. The **PULSE CNT** will then reset to zero.
9. Move the prompt to the **WATER METER**: line. Press [ENTER]. Use [UP] / [DOWN] to select a water meter input to operate from. You can select **ONE** or **TWO** to operate from the Water Meter #1 or Water Meter #2 respectively. Press [ENTER] after making your selection.
10. Press [HOME] to return to the **TIMERS** menu. Follow any on screen prompts if you made changes.

    Repeat Steps 1 to 8 to configure any additional **Selectable Timers** as **Pulse Timers**.

4.4.2.5 28 Day Timer

This timer is used to feed chemical on a 28 day-per-month (i.e., 4 week) calendar basis. Each **28 Day Timer** has four individual programs with a wide range of day, week and month setting combinations. A program defines when the timer event is to take place. You specify the start time (**02:00**), the day of the week (**MONDAY**), the week (**ODD**) and the month (**EVERY**). When the conditions of the program are met (for example, today is Monday at 02:00AM, the 3rd week and the 6th month), the feed cycle begins. The feed cycle is composed of 3 phases: pre-bleed, feed, and lock-out. In the pre-bleed phase, if Conductivity control is present on the controller, a pre-bleed cycle begins. Here, the system will pre-bleed

for a user set amount of time and/or until a specified conductivity level has been attained. If ORP control is present, the controller will also check the ORP input and compare it to a maximum value. If the ORP is above this value, the cycle will be canceled. Once the pre-feed conditions are satisfied, the feed phase activates the feed relay for a specified amount of time. It also disables the feed of any other timers that are not configured as **28 Day Timers**. The lock-out phase begins when the feed phase begins. If Conductivity control is present on the controller, the bleed will be locked out for a specified amount of time.

NOTE **The 28 Day Timer is designed to turn off all other non 28-Day timers during the run/feed portion of the program.**

4.4.2.5.1 28 Day Timer: Length of Run/Feed Time

The **RUN TIME** setting represents the length of time that the feed relay will turn on. It is adjustable in one minute increments up to 23 hours and 59 minutes. The **RUN TIME** is common for all four programs.

1. From the **MAIN MENU**, move the prompt to the **TIMERS** line and press [ENTER]. The **TIMERS** menu is displayed.

```
====== MAIN MENU ======

  DISPLAY DATA
  CALIBRATION
  SETPOINTS
▸ TIMERS
  DATA COLLECT
  CONFIGURE
  ------ SER 558 ------
```

```
------ TIMERS ------

▸ SysCOND
  DUAL pH
  Sys ORP
  TIMER 1
  TIMER 2
  W METER 1
  W METER 2
```

2. Move the prompt to the **TIMER #** (where **#** represents the **TIMER** number) line. Press [ENTER]. The **TIMER 1 R5** menu is displayed. (**Timer 1 R5** is being used for our example.)

```
------ TIMER 1  R5 ------

▸ TYPE:        28 DAY
  RUN TIME   = 01:30 H:M
  LOCK OUT   = 00:00 H:M
  PRE Bleed  = 00:00 H:M
  ↑COND MIN  =     0
  ↓ORP MAX   =     0
    <PROGRAMS>
```

3. The second line in the display, **TYPE**:, will display the current Timer Type. Press [ENTER]. Use [UP] / [DOWN] to display the different timer types: **disabled, LIMIT, PERCENT, % POST B.D**, **PULSE**, **CYCLE**, **Slaved to**, and **28 DAY**. As you display the different values the screen will update with the parameters associated with each timer type.
4. Set the **TYPE:** to **28 DAY** and press [ENTER].
5. Move the prompt to **RUN TIME**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the hours and minutes you desire the run time to actuate. Press [ENTER] to accept your changes.

4.4.2.5.2 28 Day Timer: Blowdown Lock-Out

The lock out setting represents the length of time the blowdown relay is to be locked out. This is useful if the added chemical requires a retention time in the system. The lock-out begins to run when the feed starts, NOT when the feed ends. Therefore, if you want the lock out to cover the entire feed period (i.e., **RUN TIME**) you must set the **LOCK OUT** value to the same value as the **RUN TIME**. If you want the lock out to run for the feed time plus one hour you must set the **LOCK OUT** to the **RUN TIME** plus the additional hour. For example, if the **RUN TIME** is set to 01:20 and you want the lock out to cover the **RUN TIME** plus one hour you would set the **LOCK OUT** value to 02:20.

1. Move the prompt to **LOCK OUT**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the hours and minutes you want bleed to be locked out. Press [ENTER] to accept your changes.

```
------ TIMER 1  R5 ------
  TYPE:        28 DAY
  RUN TIME =   01:30 H:M
▸ LOCK OUT =   00:00 H:M
  PRE Bleed=   00:00 H:M
  ↑COND MIN =      0
  ↓ORP MAX  =      0
  <PROGRAMS>
```

4.4.2.5.3 28 Day Timer: PRE Bleed

On systems with conductivity, the optional **PRE Bleed** phase is useful to assure that the system conductivity is maintained throughout the lockout period. Otherwise, added chemical will be blown down or the system conductivity could rise to levels that could cause scaling. A blowdown is forced for a specified period of time in an attempt to bring the system to a minimum conductivity. You make two settings to achieve this: PRE-Bleed time (**PRE Bleed**) and Minimum Conductivity (**COND MIN**). The **PRE Bleed** time can be set for up to 23 hours and 59 minutes. The **COND MIN** can be set between 0 and 20000. If a **PRE Bleed** time is specified, the bleed relay will be activated when the start time is reached (refer to the ***Set Programs*** section). The bleed will stay on until the **PRE Bleed** timer expires or the minimum conductivity level is satisfied.

The minimum conductivity acts on a Falling/LOW setpoint (i.e., when the conductivity drops below the specified limit the PRE Bleed stops).

1. Move the prompt to **PRE Bleed**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the hours and minutes you want the system to pre-bleed. Press [ENTER] to accept your changes.

```
-------- TIMER 1  R5
  TYPE:        28 DAY
  RUN TIME   = 01:30 H:M
  LOCK OUT   = 00:00 H:M
▸ PRE Bleed  = 00:00 H:M
  ↑COND MIN  =     0
  ↓ORP MAX   =     0
  <PROGRAMS>
```

2. Move the prompt to **↑COND MIN**. Press [ENTER]. Use [UP] / [DOWN] to set each digit of the minimum conductivity level. Press [ENTER] to accept each digit and move to the next digit.

   Pressing [ENTER] on the last digit accepts that digit and the overall change.

```
-------- TIMER 1  R5
  TYPE:        28 DAY
  RUN TIME   = 01:30 H:M
  LOCK OUT   = 00:00 H:M
  PRE Bleed  = 00:00 H:M
  ↑COND MIN  = 00000
  ↓ORP MAX   =     0
  <PROGRAMS>
```

   The **↑COND MIN** setting acts in accordance to a set point type (i.e., Rising or Falling) defined in the **CALIBRATION/SysCond** menu. The setting appears in the **SET: TIMER #** window (e.g., rising set point). If you are using a rising set point, **PRE Bleed** will stop when the conductivity falls below the **↑COND MIN** value. If you are using a falling set point, **PRE Bleed** will stop when the conductivity rises above the **↑COND MIN** value.

NOTE **If you set the ↑COND MIN value to 0, the controller will disregard the conductivity and PRE Bleed for the entire PRE Bleed period.**

NOTE **The SysCond setpoint type can only be modified on the Series 560 and Series 570 models. For all other models it is fixed at rising.**

4.4.2.5.4 28 Day Timer: ↓ ORP MAX=

On systems with ORP Control the **↓ORP MAX=** setting is used to abort the feed/lockout cycle if the ORP is above the specified maximum value.

NOTE **Setting the ↓ORP MAX value to 0000 disables the ORP monitoring feature of the 28 Day Timer.**

Move the prompt to **↓ORP MAX=**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set each digit of the maximum ORP level. Press [ENTER] to accept your changes.

```
-------- TIMER 1  R5
  TYPE:        28 DAY
  RUN TIME   = 01:30 H:M
  LOCK OUT   = 00:00 H:M
  PRE Bleed  = 00:00 H:M
  ↑COND MIN  =     0
  ↓ORP MAX   =  0000
  <PROGRAMS>
```

On systems utilizing an ORP (Oxidation Reduction Potential) sensor to monitor the chlorine or bromine level, the **↓ORP MAX=** setting determines whether or not the **28 DAY** timer will activate. If the ORP level (checked only at timer start-up) is above the specified level the **28 DAY** timer will not activate. When the ORP level falls below the **↓ORP MAX=** value, the **28 DAY** timer runs normally. The **↓ORP MAX=** level can be set between 0 – 1000.

4.4.2.5.5 28 Day Timer: Set Programs

Each **28 day Timer** has four programs, each of which defines conditions for activating the timer. The conditions are: **START TIME, MONTH, WEEK** and **DAY**. If your system incorporates a conductivity control, pre bleed will activate when the specified conditions are met. If not, the feed will activate. In addition to standard settings (i.e., **MON, TUE, WED**) you will find entries such as **EVERY DAY** and **ODD DAY.**

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

1. Move the prompt to the **<PROGRAMS>** line. Press [ENTER]. The **PROG: TIMER #** menu is displayed. The second line of this display indicates the program you are editing (ONE (1) in the example).

```
-------- TIMER 1  R5
  TYPE:          28 DAY
  RUN TIME    = 01:30 H:M
  LOCK OUT    = 00:00 H:M
  PRE Bleed   = 00:00 H:M
  ↑COND MIN   =     0
  ↓ORP MAX    =     0
▸  <PROGRAMS>
```

```
-------- PROG:  TIMER  1
▸ PROGRAM:   ONE      (1)
  START =  00:00 H:M
  MONTH:   EVERY MONTH
  WEEK:    EVERY WEEK
  DAY:     NO DAY
```

2. To change to a different program press [ENTER] with the prompt on the **PROGRAM**: line. Use [UP] / [DOWN] to change the program. Press [ENTER] to accept the new program number.
3. Move the prompt to **START =**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to specify the start time for this program. The value is set in a 24 hour time format. Press [ENTER] to accept the new value.

As you move from one program to another the display will update with the information relevant to that program.

4. Move the prompt to **MONTH**: Press [ENTER]. Use [UP] / [DOWN] to change the **MONTH** in which the timer should be active. You can select from: **NO MONTH** (disabled)**, ODD MONTH, EVEN MONTH** and **EVERY MONTH**. Press [ENTER] to accept your change.
5. Move the prompt to **WEEK**: Press [ENTER]. Use [UP] / [DOWN] to change the **WEEK** number that the timer should be active. You can select from: **NO WEEK** (disabled)**, ODD WEEK, EVEN WEEK, EVERY WEEK, 1st WEEK, 2nd WEEK, 3rd WEEK** or **4th WEEK**. Press [ENTER] to accept your change.
6. Move the prompt to **DAY**: Press [ENTER]. Use [UP] / [DOWN] to change the **DAY** that the timer should be active. You can select from: **NO DAY** (disabled)**, MON, TUE, WED, THU, FRI, SAT, SUN,** and **EVERY**. Press [ENTER] to accept your change.
7. Repeat Steps 2 to 6 for the remaining programs.
8. Press [HOME] to return to the **TIMER #** menu. Follow any on-screen prompt that may appear.
9. Press [HOME] to return to the **TIMERS** menu. Follow any on-screen prompts that may appear.

   Repeat the Steps 1 to 9 to configure any additional **Selectable Timers** as **28 day Timers**.

Do not configure more than two 28-day timers (e.g., Timer 1 and Timer 2) to run simultaneously or overlap running times. Doing so will cause at least one of the timers to run shorter intervals than expected.

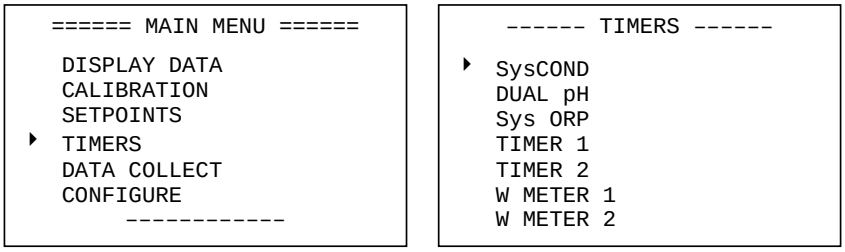
4.4.2.6 disabled

The **TIMER** type **disabled** is available to allow you to disable the Timer. This assures that the timer will not activate the associated feed relay.

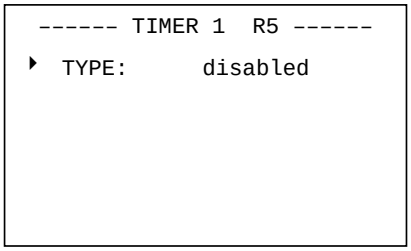
The factory default for Timer Type is disabled.

To set a timer to disabled

1. From the **MAIN MENU**, move the prompt to the **TIMERS** line and press [ENTER]. The **TIMERS** menu is displayed.



2. Move the prompt to **TIMER #** (where # represents the **TIMER** number) line. Press [ENTER]. The **TIMER 1 R5** menu is displayed. (**Timer 1 R5** is being used for our example.)



3. The second line in the display, **TYPE**:, will display the current Timer. Press [ENTER]. Use [UP] / [DOWN] to cycle through the different timer types: **disabled, LIMIT, PERCENT, % POST B.D, PULSE, CYCLE, Slaved to,** and **28 DAY**. As you display the different values the screen will update with the parameters associated with each timer type.
4. When disabled is displayed, press [ENTER] to select it.
5. Press [HOME]. Answer any on-screen prompts if you have made changes.

Repeat Steps 1 to 4 to set any additional **Selectable Timers** to **disabled**.

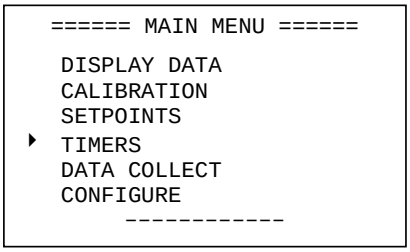
4.4.2.7 Cycle Timer

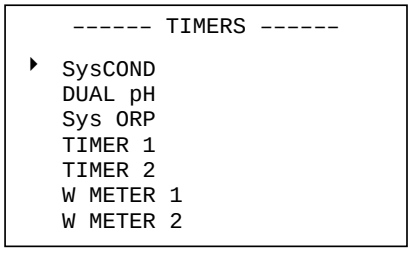
The **Cycle Timer** is used to cycle chemical feed on and off a specified number of times during a 28 day-per-month (i.e., 4 weeks) calendar basis. Each **Cycle Timer** has four

individual programs with a wide range of day, week, and month setting combinations. A program defines when the time event is to take place. You specify the start time (02:00), the day of the week (MONDAY), the week (ODD) and the month (EVERY). When the conditions of the program are met (for example, today is Monday at 02:00AM, the 3rd week and the 6th month), the feed cycle begins. The feed cycle is composed of an on-time and off-time that alternates for a specified number of cycles. The **ON-TIME** setting represents the length of time that the feed relay will turn on per cycle. The **OFF-TIME** setting represents the length of time the feed relay will turn off per cycle. They are adjustable in one second increments up to 59 minutes and 59 seconds. The **ON TIME / OFF TIME** and **CYCLES** settings are common for all four programs.

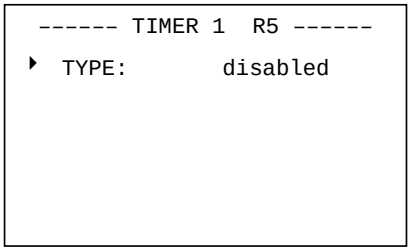
NOTE **While the Cycle Timer is active (e.g., running) a left pointing arrow is displayed to the right of either the OFF TIME or ON TIME setting to indicate which is currently active.**

1. From the **MAIN MENU**, move the prompt to the **TIMERS** line and press [ENTER]. The **TIMERS** menu is displayed.

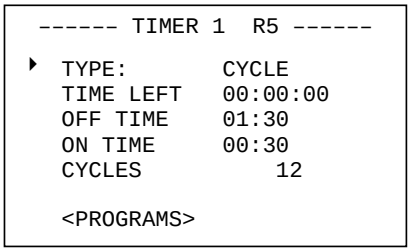




2. Move the prompt to the **TIMER #** (where # represents the **TIMER** number) line. Press [ENTER]. The **TIMER 1 R5** menu is displayed. (**Timer 1 R5** is being used for our example.)



3. The second line in the display, **TYPE:**, will display the current Timer Type. Press [ENTER]. Use [UP/DOWN] to display the different timer types: **disabled, 28 DAY, CYCLE, PULSE, % POST B.D, PERCENT, LIMIT,** and **Slaved to**. As you display the different values the screen will update with the parameters associated with each timer type.



4. Press [UP] / [DOWN] to set the **TYPE** to **CYCLE** and press [ENTER].
5. Use [SCROLL] to move the prompt to **OFF TIME**.

```
------ TIMER 1  R5 ------
  TYPE:       CYCLE
  TIME LEFT   00:00:00
▸ OFF TIME    01:30
  ON TIME     00:30
  CYCLES          12

  <PROGRAMS>
```

Press [ENTER]. Use [UP/DOWN] / [ENTER] to set the minutes and seconds you desire the relay to be shut off per cycle. Press [ENTER] to accept your changes.

6. Use [SCROLL] to move the prompt to **ON TIME**.

```
------ TIMER 1  R5 ------
  TYPE:       CYCLE
  TIME LEFT   00:00:00
  OFF TIME    01:30
▸ ON TIME     00:30
  CYCLES          12

  <PROGRAMS>
```

Press [ENTER]. Use [UP/DOWN] / [ENTER] to set the minutes and seconds you desire the relay to be turned on per cycle. Press [ENTER] to accept your changes.

7. Use [SCROLL] to move the prompt to **CYCLES**.

```
------ TIMER 1  R5 ------
  TYPE:       CYCLE
  TIME LEFT   00:00:00
  OFF TIME    01:30
  ON TIME     00:30
▸ CYCLES          12

  <PROGRAMS>
```

Use [UP] / [DOWN] / [ENTER] to set the number of cycles (e.g., on/off periods). It is adjustable in increments of 1 up to 1440.

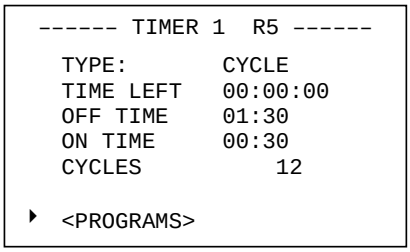
Press [ENTER] to accept your changes.

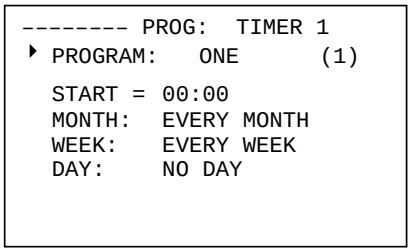
4.4.2.7.1 Cycle Timer: Set Programs

Each **Cycle Timer** has four programs, each of which defines conditions for activating the timer. The conditions are: **START TIME, MONTH, WEEK** and **DAY**. In addition to standard settings (i.e., **MON, TUE, WED**) you will find entries such as **EVERY DAY** and **ODD DAY.**

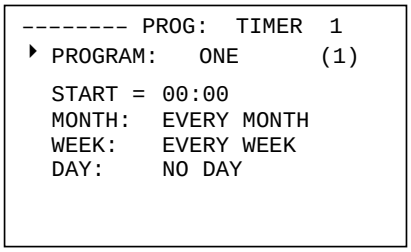
For help with menu locations, please refer to the "Menu Map" supplied with your controller.

1. Move the prompt to the **<PROGRAMS>** line. Press [ENTER]. The **PROG: TIMER 1 R5** menu is displayed. The second line of this display indicates the program you are editing (ONE (1) in the example).





2. To change to a different program press [ENTER] with the prompt on the **PROGRAM**: line. Use [UP] / [DOWN] to change the program. Press [ENTER] to accept the new program number.



3. Move the prompt to **START =**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to specify the start time for this program. The value is set in a 24 hour time format. Press [ENTER] to accept the new value.

NOTE **As you move from one program to another the display will update with the information relevant to that program.**

4. Move the prompt to **MONTH**: Press [ENTER]. Use [UP] / [DOWN] to change the **MONTH** in which the timer should be active. You can select from: **NO MONTH** (disabled)**, ODD MONTH, EVEN MONTH** and **EVERY MONTH**. Press [ENTER] to accept your change.
5. Move the prompt to **WEEK**: Press [ENTER]. Use [UP] / [DOWN] to change the **WEEK** number that the timer should be active. You can select from: **NO WEEK** (disabled)**, ODD WEEK, EVEN WEEK, EVERY WEEK, 1st WEEK, 2nd WEEK, 3rd WEEK** or **4th WEEK**. Press [ENTER] to accept your change.
6. Move the prompt to **DAY**: Press [ENTER]. Use [UP] / [DOWN] to change the **DAY** that the timer should be active. You can select from: **NO DAY** (disabled)**, MON, TUE, WED, THU, FRI, SAT, SUN,** and **EVERY**. Press [ENTER] to accept your change.
7. Repeat Steps 2 to 6 for the remaining programs.
8. Press [HOME] to return to the **TIMER #** menu. Follow any on-screen prompt that may appear.
9. Press [HOME] to return to the **TIMERS** menu. Follow any on-screen prompts that may appear.

   Repeat the Steps 1 to 9 to configure any additional **Selectable Timers** as **Cycle Timers**.

4.4.2.8 Slaved to Timer

This timer turns on its output when one or more selected relays activate. The relays can be "slaved" in any combination. For example, if Timer #1 (Relay #3) is set to PULSE and you would like it to activate two relays, you can set Timer #2 (Relay #4) to "Slave to" with the Slave to relay set to Relay #3. Thus when Relay #3 activates so will Relay #4.

❖ **To configure your Slave to option:**

1. From the **MAIN MENU**, move the prompt to the **TIMERS** line and press [ENTER]. The **TIMERS** menu is displayed.

```
====== MAIN MENU ======
  DISPLAY DATA
  CALIBRATION
  SETPOINTS
▸ TIMERS
  DATA COLLECT
  CONFIGURE
      ------------
```

```
------ TIMERS ------
▸ SysCOND
  DUAL pH
  Sys ORP
  TIMER 1
  TIMER 2
  W METER 1
  W METER 2
```

2. Move the prompt to the **TIMER #** (where # represents the **TIMER** number) line. Press [ENTER]. The **TIMER 1 R5** menu is displayed. (**Timer 1 R5** is being used for our example.)

```
------ TIMER 1  R5 ------
▸ TYPE     disabled
```

The prompt is displayed on the **TYPE** line.

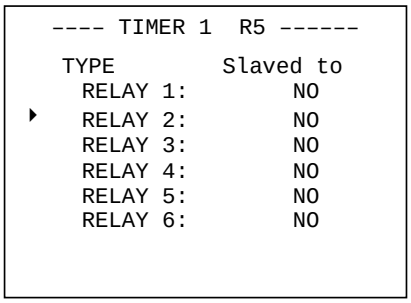
3. Press [ENTER], the prompt disappears and the word **disabled** is highlighted.

```
------ TIMER 1  R5 ------
  TYPE        disabled
```

4. Press [UP] / [DOWN] until **Slaved to** is displayed.

```
---- TIMER 1  R5 ------
   TYPE        Slaved to
    RELAY 1:        NO
    RELAY 2:        NO
    RELAY 3:        NO
    RELAY 4:        NO
    RELAY 5:        NO
    RELAY 6:        NO
```

5. Press [ENTER] to accept your choice.
6. Press [DOWN] to move the prompt to the relay you desire to change.



Press [ENTER]

7. Press [UP] or [DOWN] to change the status from NO to YES. When the status is set to YES the Timer relay will activate with that relay.

NOTE **The Slave to timer relay will activate when any one (not all) of the relays whose status is set to YES activate.**

If you are only going to slave a single relay to this timer press [HOME] and follow the on screen prompts to save your change, or if you desire to slave additional relays to this timer:

8. Press [ENTER], the prompt is displayed to the left of the **RELAY 2** line.
9. Press [DOWN] to move the prompt to desired relay.
10. Follow Steps 6, 7, 8, and 9 to slave additional relays to this timer.

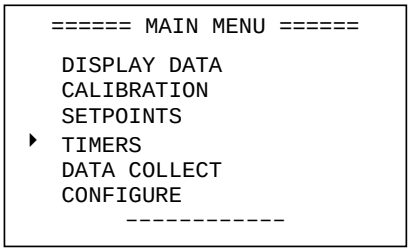
4.4.3 Water Meter Inputs

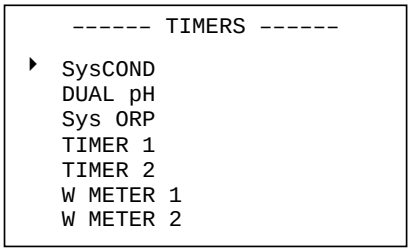
The Water meter input menu allows you to view accumulated water meter counts and the amount of water that has passed with those counts. You can use this information to track your water usage. In this menu, you enter the flow per water meter pulse (e.g., gallons per pulse) in the **MULTIPLIER =** field. The menu also allows you to reset the count. The last reset date is displayed at the bottom of the menu.

NOTE **Once you have configured your Water Meter Type you will need to do a Factory Reinit and reconfigure you controller to change the Water Meter type again.**

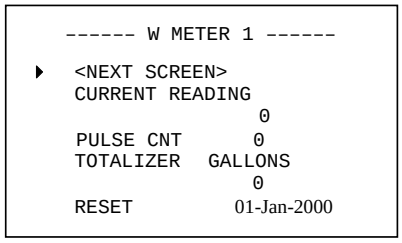
To configure your water meter inputs:

1. From the **MAIN MENU**, move the prompt to the **TIMERS** line and press [ENTER]. The **TIMERS** menu is displayed.





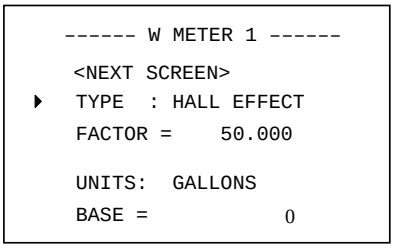
2. Move the prompt to the **W METER #** (where # is either 1 or 2) line. Press [ENTER]. The **W METER 1** menu is displayed. (**W Meter 1** is being used for our example.) The prompt is displayed on the <**NEXT SCREEN**> line.



3. The third line in the display, **PULSE CNT**, displays the current pulse count for the water meter input. This value can be re-set through the **RESET COUNT** line described in a later step.
4. The line below the label **TOTALIZER** displays the totalized flow. The controller arrives at this number by multiplying the **PULSE CNT** by the **MULTIPLIER**. For example, 21 counts times 100 gallons per count equals 2100 gallons.

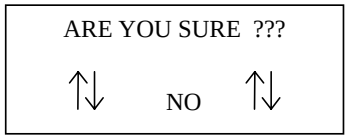
NOTE **The water meter PULSE CNT field can display 999999 pulses. It will roll to 0 with the next pulse. The totalizer can display a maximum of 999999000.**

5. Press [SCROLL] to position the prompt next to the **TYPE:** line



6. Press [ENTER]. Use [UP] / [DOWN] to select between **DRY CONTACT** or **HALL EFFECT**. Press [ENTER].

7. Press [UP] / [DOWN] to select "NO" to "YES". Press [ENTER] to accept selection.



8. If **DRY CONTACT** is selected

```
   ------ W METER 1 ------
  <NEXT SCREEN>
▶ TYPE   :   DRY CONTACT
  ACTIVE:    Closed
  TIME   =   20.00 Sec
  MULTIPLIER =     100
  UNITS:   GALLONS
  BASE =               0
```

9. Press [SCROLL] to position the prompt next to the **ACTIVE:** line. Press [ENTER]. Use [UP] / [DOWN] to select between **Open** or **Closed**. If **Closed** is selected then the water meter will count when the input is closed.

```
   ------ W METER 1 ------
  <NEXT SCREEN>
  TYPE   :   DRY CONTACT
▶ ACTIVE:    Closed
  TIME   =   20.00 Sec
  MULTIPLIER =     100
  UNITS:   GALLONS
  BASE =               0
```

Press [ENTER] to set the value.

10. Press [SCROLL] to position the prompt on **TIME:**. The **TIME:** entry is used to set the amount of time the water meter contact must be closed (or open) before it is recognized. You can set a value between 20.00 and 0.02 seconds.

```
   ------ W METER 1 ------
  <NEXT SCREEN>
  TYPE   :   DRY CONTACT
  ACTIVE:    Closed
▶ TIME   =   20.00 Sec
  MULTIPLIER =     100
  UNITS:   GALLONS
  BASE =               0
```

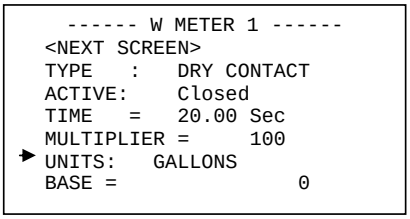
Press [UP] / [DOWN] to set each digit, pressing [ENTER] to move to the second and subsequent digits. When the time value has been set, press [ENTER] and the prompt will re-appear next to **TIME**.

11. Press [SCROLL] to move the prompt to the **MULTIPLIER=** line.

```
   ------ W METER 1 ------
  <NEXT SCREEN>
  TYPE   :   DRY CONTACT
  ACTIVE:    Closed
  TIME   =   20.00 Sec
▶ MULTIPLIER =     100
  UNITS:   GALLONS
  BASE =               0
```

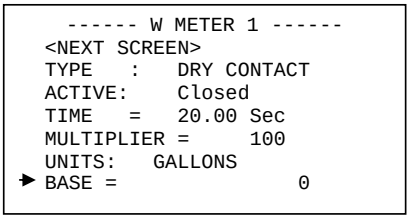
12. Press [ENTER]. Use [UP] / [DOWN] to set the ratio of volume units per pulse. For example, if your water meter registers 1 pulse for 100 gallons of water measured, you would enter 100 here. Likewise, if your water meter registers 1 pulse for 12 liters you would enter 12 here. The value can be set between 1 and 1000. Press [ENTER] to accept your entry.

13. Press [SCROLL] to move the prompt to the **UNITS:** line.

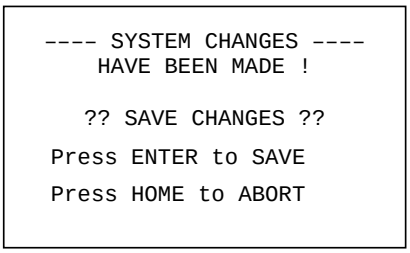


14. Press [ENTER]. Use [UP] / [DOWN] to select between **GALLONS** and **LITERS**. Press [ENTER].

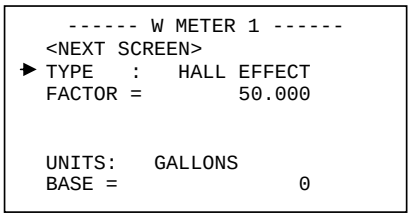
15. Press [SCROLL] to move the prompt to the **BASE =** line.



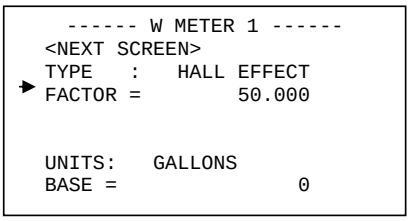
Press [ENTER]. Use [UP] / [DOWN] to set **BASE**. Press [ENTER]. The value can be set between 1 and 90,000,000. Press [HOME] . To accept your changes, press [ENTER]. To reject your changes press [HOME].



16. If **HALL EFFECT** is selected

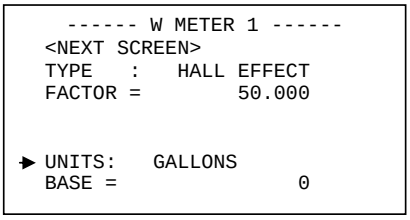


17. Press [SCROLL] to position the prompt next to the **FACTOR =** line. Press [ENTER]. Use [UP] / [DOWN] to set the "K" FACTOR. Press [ENTER] to set the value. The value can be set between .001 and 90,000.000.



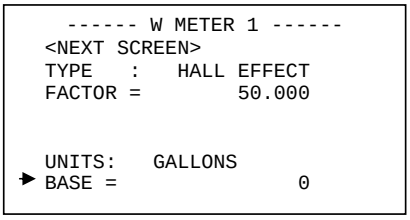
Press [ENTER] until the prompt is positioned next to **FACTOR =**

18. Press [SCROLL] to move the prompt to the **UNITS:** line.

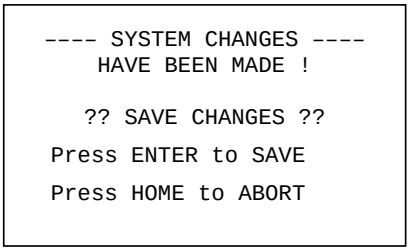


19. Press [ENTER]. Use [UP] / [DOWN] to select between **GALLONS** and **LITERS**. Press [ENTER].

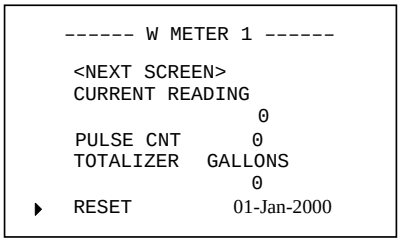
20. Press [SCROLL] to move the prompt to the **BASE =** line.



Press [ENTER]. Use [UP] / [DOWN] to set **BASE**. Press [ENTER]. The value can be set between 1 and 90,000,000. Press [HOME] . To accept your changes, press [ENTER]. To abort your changes press [HOME]. If the changes have been aborted the water meter menu will appear again. If the changes were saved the timers menu will appear.

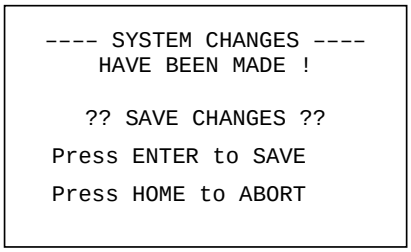


21. To reset the Pulse Count the water meter menu must appear on the screen.
22. Press [SCROLL] to move the prompt to the **RESET** line.



Press [ENTER] and the **PULSE COUNT** line will indicate **0**. The **Reset on** line will indicate the date the reset occurred.

23. Press [HOME]. Follow the on-screen prompt (i.e., **SYSTEM CHANGES HAVE BEEN MADE!** menu).



5. Sensor Calibration/Information

5.1 Introduction

Calibration adjusts the reading on your controller to some known standard -- be it a hand held meter or a standard solution sample. A number of different calibration techniques are offered on this controller. Some techniques are more sophisticated and time consuming than others. You should choose the technique that best fits your requirements. To make controller calibration easier, all of the calibration menus look the same. For example, once you know how to calibrate **System Conductivity**, you can use the same technique (and comparable menus) to calibrate **pH**.

NOTE **Controllers are shipped from the factory pre-calibrated. In most cases you can simply perform a TUNE after installation.**

5.1.1 How To Use This Section

If you are unfamiliar with calibrating equipment, read the next section ***"CALIBRATION: Q & A."*** Then follow these steps:

1. Skip to the section labeled with the input name you are calibrating (for example, **CONDUCTIVITY**)
2. Choose your calibration technique -- A simple **CAL-TUNE,** a **ONE-POINT** or a more sophisticated **TWO-POINT**. Skip down to the associated sub-heading.
3. Follow the step-by-step instructions.

5.2 Calibration: Q & A

5.2.1 What does calibration do?

Calibration lets the controller display and control a value that is meaningful to you and conforms to some standard (like your hand held conductivity meter). So, when you put your pH sensor in 10pH buffer, the unit displays a value of 10pH.

5.2.2 How do you calibrate?

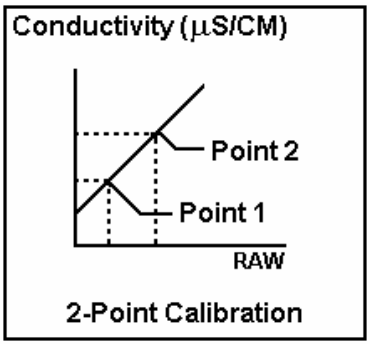
To calibrate an input, place the sensor in a known solution, allow the reading to stabilize (usually 30 seconds), then enter the value into the program through the front panel. Depending on the type of calibration you are doing, you may repeat the process for a second solution or reading.

5.2.3 How does calibration work?

To display a value like conductivity, the controller converts a “Raw” reading into a scaled reading. An equation is used to perform this scaling. At the end of the calibration process, the constant values used in this equation are calculated. A minimum of two calibration points are required. You can either enter both points (**2-Point Calibration**) or enter one point (**1-Point Calibration**) and have the controller assume the second point.

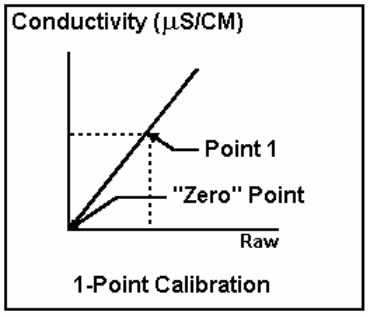
5.2.3.1 2-Point Calibration

In a **2-Point Calibration**, you need two solutions with known values. You place the sensor in one solution, wait for the signal to stabilize, then enter the value. You then rinse the sensor and move it to the second solution, wait for the reading to stabilize (usually 30 seconds) then enter the second value. Each time you enter a value the controller reads the “Raw” value and correlates it to the value you input.



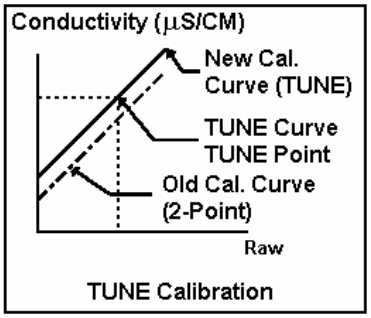
5.2.3.2 1-Point Calibration

In a **1-Point Calibration**, you need one solution with a known value. You place the sensor in the solution, wait for the signal to stabilize (usually 30 seconds), then enter the value. When you enter the value the controller reads the “Raw” value and correlates it to the value you input. The second point is assumed by the controller by setting the “Raw” zero to the input zero.



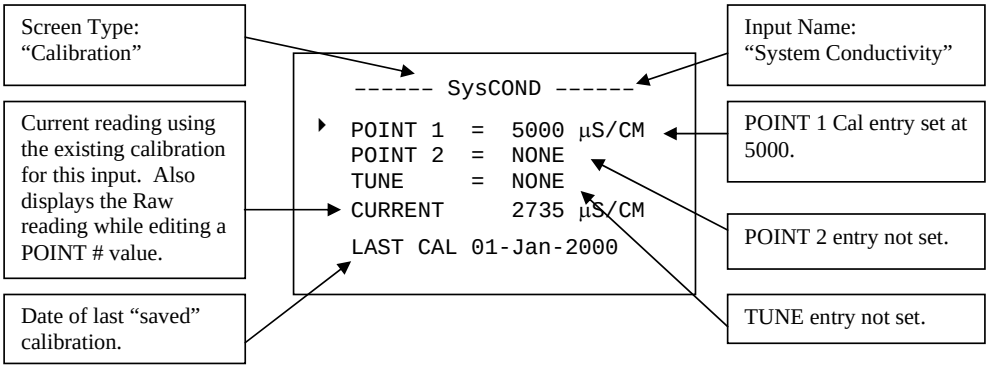
5.2.4 What is TUNE?

The **TUNE** entry in the calibration menu is similar to a **1-Point Calibration** with the exception that the controller does not assume the second point. A **TUNE** maintains previous calibration information while "offsetting" the reading. This allows you to accommodate for system changes -- fouling, fluid velocity -- without performing a calibration with solutions.



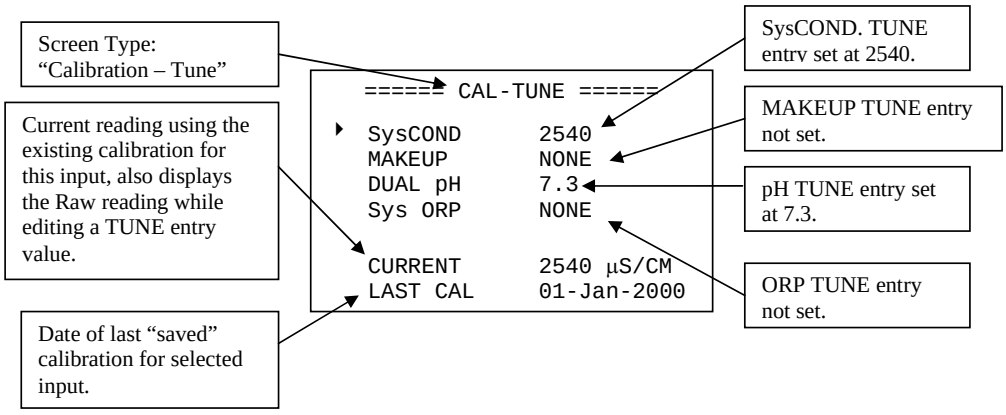
5.2.5 How do I enter the calibration information into the controller?

The calibration of all system inputs (like Conductivity) is performed from a calibration menu. The menu format is basically the same for all inputs (4-20mA inputs and outputs are slightly different). The following diagram labels the major components of the calibration menu:



With your sensor in the standard solution, wait for the reading to stabilize. With the prompt on the **POINT 1** line press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the value to the value of the standard. Press [ENTER] on the last position to return the prompt to the left side of the screen. If you make a mistake, just re-enter the value. If necessary, repeat the process for the second point with the sensor in a different solution.

There may be situations where you want to "tune-up" your system by performing only **TUNE** calibrations. The **CAL-TUNE** button on the front panel takes you directly to a menu that allows you to **TUNE** each of your System Inputs without having to navigate the menu structure. The menu is formatted as follows:



With your sensor in the flow assembly, take a sample of the system water and read its value with a calibrated tester. Press **CAL-TUNE** to access the **CAL-TUNE** menu. Move the prompt to the input you want to **TUNE** (e.g., **SysCond**) and press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the value to the value you read from your tester. Press [ENTER] on the last position to return the prompt to the left side of the screen. If you make a mistake, just re-enter the value. You can then repeat the process for a different input.

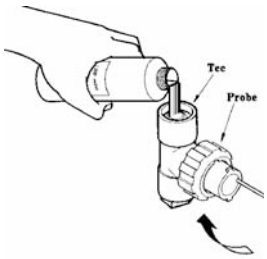
5.2.6 How can I tell when my readings have stabilized?

Most sensors require a period of time to stabilize to a given solution. Performing a calibration before a sensor has stabilized will cause the calibration to give erroneous results and make the reading appear to "drift." When you edit a **POINT 1 = XXXXX** entry by moving the prompt to that line and pressing [ENTER], the **CURRENT** line will change from a calibrated display (one that shows the reading using the current calibration with associated units) to a "Raw" reading. The Raw value will read between 0 and 1023. You should observe this value for approximately 10 seconds. If the value is steadily climbing or falling, wait until it stops changing. Typically, once the sensor has stabilized, this value will float between two readings. For example, it may alternate between a reading of 513 and 515. At this point the reading has adequately stabilized and you can finish editing your **POINT** entry.

5.3 Calibration

5.3.1 Conductivity Function Calibration Notes

Whenever possible, calibrate one or more points on system water with flow turned on. When this is not possible use a Calibration Kit, (*CalKit*, included with controller) to assist in proper calibration of conductivity sensors. The *CalKit* provides the same physical area for a sample chamber as your on-line sample stream assembly and three standard calibration solutions.



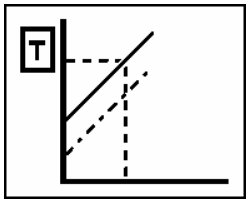
Conductivity sensor shown installed in CalKit tee with water being added.

In a hurry? Start Here ...

5.3.1.1 System Conductivity Calibration: TUNE

TIP **Refer to the calibration guide shipped with your controller for a simplified "visual" version of these instructions.**

One of the fastest ways to get your controller on-line without the need to remove the sensor and use calibration solutions is to perform a calibration "**TUNE**". The **TUNE** takes one point that you enter and using your last calibration (the one done at the factory if new) adjusts the display to show your reading.



Example: The controller has just been installed and it is reading 1250µS/CM for system conductivity. You sample the water and your meter reads 1100µS/CM. You enter a TUNE value of 1100µS/CM. You accept your changes and now the controller reads 1100µS/CM. That's all there is to it!

NOTE **While you are entering a calibration value, if the Raw Value (i.e., CURRENT value displayed without units) is reading near 1000, then the controller will not display any value greater than your entry. If the reading is near 0, the controller will not display any value less than your entry.**

For best results, you should **'TUNE'** as close to your setpoint as possible. Remember, you can **TUNE** at any time without removing the sensor from the system. So you can easily re-**TUNE** as the system gets closer and closer to the actual setpoint.

To TUNE your conductivity input:

1. Assure that your conductivity daughter card is configured properly. Refer to ***Section 7, Diagram 5,*** for switch settings. If you expect to operate within the factory defaults and factory supplied sensors, you do not need to make any changes.
2. From the **MAIN MENU** move the prompt to **CALIBRATION** and press [ENTER]. The **CALIBRATE** menu is displayed.

```
------ CALIBRATE ------

▸ SysCOND      INPUT 4
  MAKEUP       OUTPUT 1
  DUAL pH      OUTPUT 2
  Sys ORP      OUTPUT 3
  INPUT 1      OUTPUT 4
  INPUT 2
  INPUT 3
```

3. Press [ENTER]. The **SysCond** menu is displayed.

```
------ SysCOND ------

▸ POINT 1 = 5000 µS/CM
  POINT 2 = NONE
  TUNE    = NONE
  CURRENT   4276 µS/CM

  LAST CAL  01-Jan-2000
```

4. Press [SCROLL] to move the prompt to **TUNE** and press [ENTER]. Note that the **CURRENT** line will change from a reading with units (e.g., 4276 µS/CM) to one without units (e.g., 0910). This new current value represents a raw (un-calibrated) reading of the channel (e.g., System Conductivity). Its range is 0 to 1023. If this reading is stable then the input is stable. If this reading is changing, then the input is changing.

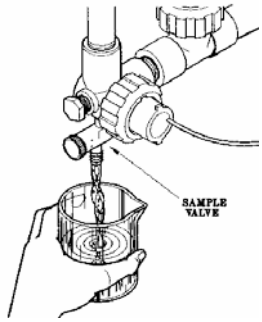
```
------ Sys COND ------

POINT 1  = 5000 µS/CM
POINT 2  = NONE
TUNE     = 00000
CURRENT    0910

LAST CAL   01-Jan-2000
```

NOTE **In some systems conductivity fluctuates rapidly. 'Stable' may mean the reading changes only +/- 2 counts from an average value.**

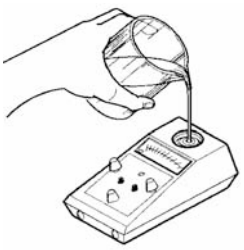
5. With flow to the system, wait for the Raw reading to stabilize.

NOTE **If you have a 4-20mA output slaved to the conductivity input you are calibrating and your calibration will create a large swing in the conductivity (i.e., the conductivity is currently 100 µS/CM and you are re-calibrating to 10000 µS/CM), the calibration value will appear to drift immediately after the point is entered. This is due to the 4-20mA trying to follow the rapid change (i.e., instantly going from 4 to 20mA's output). Re-entering the point will compensate for the drift caused by the 4-20mA output.**

6. Sample the water. Test the sample with a reliable, calibrated tester. Read the current value from your tester and enter the value into the controller's **TUNE** field using [UP] / [DOWN] / [ENTER]. Press [ENTER] on the last position to accept your value.



Taking the sample



Testing the sample

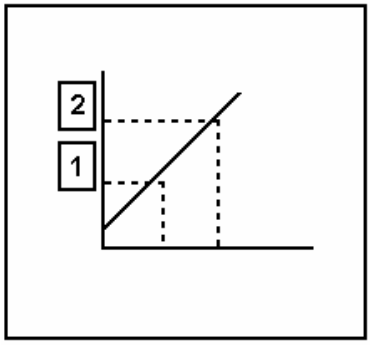
7. Sample and check the water again. Verify the controller's reading (i.e., **CURRENT**) matches the sample. If necessary repeat Step 6.
8. Press [HOME] to exit the **SysCond** menu. Follow the on- screen prompts to either accept or reject your calibration.

5.3.1.2 Tune Technical Notes:

The **TUNE** function re-calculates the y-intercept using the new point and the current slope. The slope is defined using the factory default, or by performing a 1 or 2 point calibration. You can improve the accuracy of the **TUNE** over a wider operating range by first performing a 1 or 2 point calibration — effectively calculating a slope that is specific to the installation.

5.3.1.2.1 System Conductivity Calibration: 2-Point Method – Use with: Stainless Steel, Carbon-Graphite or Platinum Black Sensors.

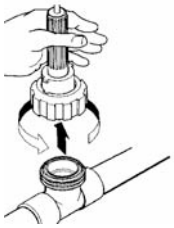
1. Assure that your conductivity daughter card is configured properly. Refer to ***Section 7, Diagram 5***, for switch settings. If you expect to operate within the factory defaults (defined in ***Section 9 – Factory Default Values***), and use factory supplied sensors, you do not need to make any changes.



2. If you are installing a new sensor or a sensor that has not been in service, condition the sensor by soaking it in water (system water is OK) for 5 minutes before proceeding with calibration. Skip to Step 4.

TIP **The performance of conductivity sensors can be affected by oil from your skin. Do not touch the metal or graphite surfaces at the sensors tip.**

3. Close the isolation valves and relieve the pressure on the system by opening the sample valve. Remove the sensor. If deposits are present, clean the sensor per the instructions provided in ***Section 11, Maintenance***.



4. Place the sensor into the Cal-Tee (see ***Section 5***) with a 'low' solution. Ideally, this solution would be system water that is at or near either the low alarm or set point. If necessary use make-up (i.e., tap or potable) water. Test the sample with a reliable, calibrated tester and make a note of the reading.
5. From the **MAIN MENU** move the prompt to **CALIBRATION** and press [ENTER]. The **CALIBRATE** menu is displayed.

```
------ CALIBRATE ------

▸ SysCOND       INPUT 4
  MAKEUP        OUTPUT 1
  DUAL pH       OUTPUT 2
  Sys ORP       OUTPUT 3
  INPUT 1       OUTPUT 4
  INPUT 2
  INPUT 3
```

6. With the prompt next to **SysCond** press [ENTER]. The **SysCond** menu is displayed.

```
   ------ SysCOND ------

▸ POINT 1 =   5000 µS/CM
  POINT 2 =   NONE
  TUNE    =   NONE
  CURRENT      434 µS/CM

  LAST CAL 01-Jan-2000
```

7. With the prompt next to **POINT 1** press [ENTER]. Note that the **CURRENT** line will change from a reading with units (e.g., 4276 µS/CM) to one without units (e.g., 0910). This new current value represents a raw (un-calibrated) reading of the channel (e.g., System Conductivity). Its range is 0 to 1023. If this reading is stable then the input is stable. If this reading is changing, then the input is changing.

```
   ------ SysCOND ------

  POINT 1    =  5000 µS/CM
  POINT 2    =  NONE
  TUNE=         NONE
  CURRENT       0910

  LAST CAL   01-Jan-2000
```

If you are using the standard conductivity sensor (stainless steel) you can use 'air' as your '0' conductivity low point. If you choose to do so, you should make the 'air' point the Point 1 value as Point 2 will not accept an entry of 0000 as a valid point.

8. Using [UP] / [DOWN] / [ENTER], enter the value recorded in Step 4. **Do NOT** press [ENTER] on the last position.

While you are entering a calibration value, if the Raw Value (i.e., CURRENT value displayed without units) is reading near 1000, then the controller will not display any value greater than your entry. If the reading is near 0, the controller will not display any value less than your entry.

9. Wait for the Raw reading to stabilize.

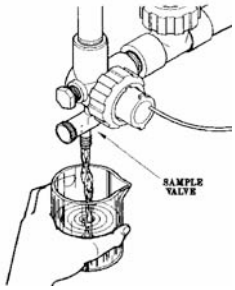
Stable may mean that the value changes +/- 1 count. This is normal. Watch the value for at least 30 seconds to determine its state.

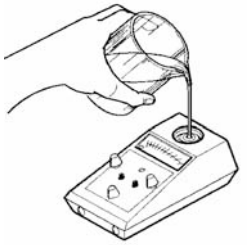
10. Press [ENTER] on the last position of the value you entered in Step 8 to accept your calibration point and associated Raw data value.
11. Reinstall the conductivity sensor into the flow assembly. Close the sample value and slowly open the isolation valve.

12. Move the prompt to **POINT 2** and press [ENTER]. Watch the **CURRENT** value field while in the Raw mode (i.e., no units are displayed). Note the stability of the value there. Some systems fluctuate rapidly. Try to assess how stable the system under calibration is by observing the value for approximately 30 seconds. For example, you may find that the system oscillates around an average +/- 5 counts. This is normal provided the average is not changing.

```
------ SysCOND ------

POINT 1  =   5000 µS/CM
POINT 2  =   NONE
TUNE     =   NONE
CURRENT      3528 µS/CM

LAST CAL 01-Jan-2000
```

13. Obtain a sample of system water and test the sample with the tester (see below). Make note of the reading.

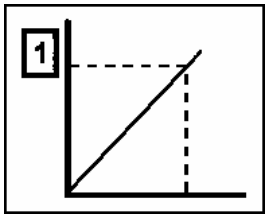




14. Using [UP] / [DOWN] / [ENTER], enter the value obtained in Step 13. **Do NOT** press [ENTER] on the last position.
15. Wait for the system to stabilize as defined by Step 12. Once stabilized press [ENTER].
16. Sample and check the water again. Verify the controller's reading (i.e., **CURRENT**) matches the sample. If necessary repeat Steps 12 to 15.
17. Press [HOME] to exit the **SysCond** menu. Follow the on- screen prompts to either accept or reject your calibration.

5.3.1.2.2 System Conductivity Calibration: 1-Point Method – Use with: Stainless Steel, Carbon-Graphite or Platinum Black Sensors

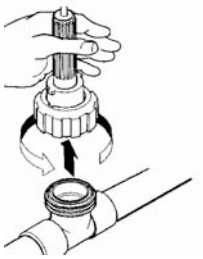
1. Assure that your conductivity daughter card is configured properly. Refer to ***Section 7, Diagram 5***, for switch settings. If you expect to operate within the factory defaults (also defined in ***Section 9, Factory Default Values.***) and use factory supplied sensors, you do not need to make any changes.



2. If you are installing a new sensor or a sensor that has not been in service, condition the sensor by soaking it in water (system water is OK) for 5 minutes before proceeding with the calibration. Skip to Step 4.

TIP **The performance of conductivity sensors can be affected by oil from your skin. Do not touch the metal or graphite surfaces at the sensors tip.**

3. Close the isolation valves and relieve the pressure on the system by opening the sample valve. Remove the sensor. If deposits are present or the sensor is fouled, clean the sensor following the instructions provided in ***Section 11, Maintenance***.



4. Install the conductivity sensor into the flow assembly. Close the sample value and slowly open the isolation valve.
5. From the **MAIN MENU** move the prompt to **CALIBRATION** and press [ENTER]. The **CALIBRATE** menu is displayed.

```
  ====== MAIN MENU ======

    DISPLAY DATA
  ▸ CALIBRATION
    SETPOINTS
    TIMERS
    DATA COLLECT
    CONFIGURE
        ------------
```

6. With the prompt next to **SysCond** press [ENTER]. The **SysCond** menu is displayed.

```
------ CALIBRATE ------
▸ SysCOND      INPUT 4
  MAKEUP       OUTPUT 1
  DUAL pH      OUTPUT 2
  Sys ORP      OUTPUT 3
  INPUT 1      OUTPUT 4
  INPUT 2
  INPUT 3
```

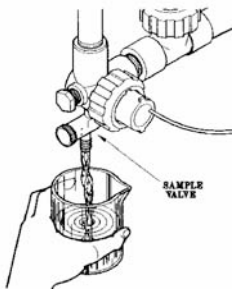
7. Move the prompt to **POINT 1** and press [ENTER]. Note that the **CURRENT** value will change from a reading with units (e.g., 4276 µS/CM) to one without units (e.g., 0910). This new current value represents a raw (un-calibrated) reading of the channel (e.g., System Conductivity). Its range is 0 to 1023. If this reading is stable then the input is stable. If this reading is changing, then the input is changing.

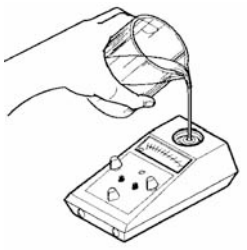
```
------ SysCOND ------

POINT 1  =  5000 µS/CM
POINT 2  =  NONE
TUNE     =  00000
CURRENT     0910

LAST CAL    01-Jan-2000
```

8. Watch the **CURRENT** value field while in the Raw mode (i.e., no units are displayed). Note the stability of the value there. Some systems fluctuate rapidly. Try to assess how stable the system under calibration is by observing the value for approximately 30 seconds. For example, you may find that the system oscillates around an average of +/- 5 counts. This is normal provided the average is not changing.

NOTE **While you are entering a calibration value, if the Raw Value (i.e., CURRENT value displayed without units) is reading near 1000, then the controller will not display any value greater than your entry. If the reading is near 0, the controller will not display any value less than your entry.**

9. Obtain a sample of system water and test the sample with the tester. (See below) Make note of the reading.





10. Using [UP] / [DOWN] / [ENTER], enter the value obtained in Step 9. Do NOT press [ENTER] on the last position.
11. Wait for the system to stabilize as defined by Step 8. Once stabilized press [ENTER].
12. Sample and check the water again. Verify the controller's reading (i.e., **CURRENT**) matches the sample. If necessary repeat Steps 7 to 11.
13. Press [HOME] to exit the **SysCond** menu. Follow the on- screen prompts to either accept or reject your calibration.

5.3.2 pH and ORP Calibration

The pH and ORP calibration utilize the same calibration techniques used for the Conductivity calibration. It is more common to use standard solutions in the calibration process. The step by step instructions here are written for pH. ORP calibration is exactly the same only the units are different — mV instead of pH — and the screens read **Sys ORP** instead of **DUAL pH**.

5.3.2.1 pH Function Calibration Notes

1. The most common buffers are 4, 7 and 10. Any pH buffer will work if there is at least 3 pH units difference between solutions.
2. If **2 Point Calibration** is used, always use two buffers that are most representative of the operating conditions. For example: if monitoring around 8 pH, use a 4 buffer for the low point and 10 for the high point; if monitoring around 6 pH, use a 4 buffer for the low and 7 for the high.
3. Between each sample, rinse the sensor with the buffer to be sampled.

BE CAREFUL WHEN REMOVING PROTECTIVE LIQUID FILLED BOOT OR BOTTLE FROM SENSOR TIP. FOR BOTTLE TYPE, TWIST BOTTLE OFF CAP THEN PULL CAP OFF TIP.

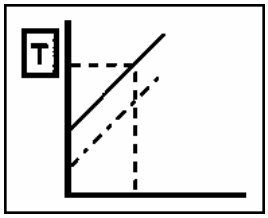
5.3.2.2 ORP Function Calibration Notes

1. The most common mV solutions are 100 and 465. Any mV calibration solution will work.
2. Between each sample, rinse the sensor with the buffer to be sampled.

NEVER EXPOSE SENSOR TIP TO THE AIR FOR MORE THAN 45 SECONDS.

5.3.3 pH/ORP Calibration: Tune

One of the fastest ways to get your controller on-line without the need to remove the sensor and use calibration solutions is to perform a calibration "**TUNE**". The **TUNE** takes one point that you enter and using your last calibration (the one done at the factory if new) adjusts the display to show your reading.



Example: The controller has just been installed and it is reading 6.7pH. You sample the water and your meter reads 6.8pH. You enter a **TUNE** value of 6.8pH. You accept your changes and now the controller reads 6.8pH. That's all there is to it!

For best results, you should '**TUNE'** as close to your set point as possible. Remember, you can **TUNE** at any time without removing the sensor from the system. So you can easily re-**TUNE** as the system gets closer and closer to the actual set point.

In a hurry? Start Here...

To TUNE your pH input:

1. From the **MAIN MENU** move the prompt to **CALIBRATION** and press [ENTER]. The **CALIBRATE** menu is displayed.

```
------ CALIBRATE ------
▸ SysCOND      INPUT 4
  MAKEUP       OUTPUT 1
  DUAL pH      OUTPUT 2
  Sys ORP      OUTPUT 3
  INPUT 1      OUTPUT 4
  INPUT 2
  INPUT 3
```

2. Move the prompt to **DUAL pH** and press [ENTER]. The **DUAL pH** menu is displayed.

```
------ DUAL pH ------

  POINT 1  =  14.0  pH
  POINT 2  =  NONE
▸ TUNE     =  NONE
  CURRENT     11.4  pH

  LAST CAL 01-Jan-2000
```

3. Move the prompt to **TUNE** and press [ENTER]. Note that the **CURRENT** line will change from a reading with units (e.g., 11.4pH) to one without units (e.g., 0826). This new current value represents a raw (un-calibrated) reading of the channel (e.g., pH). Its range is 0 to 1023. If this reading is stable then the input is stable. If this reading is changing, then the input is changing.

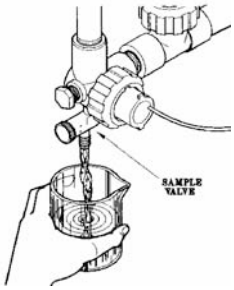
```
------ DUAL pH ------

POINT 1  =   10.0  pH
POINT 2  =   NONE
TUNE     =   NONE
CURRENT      0826

LAST CAL     01-Jan-2000
```

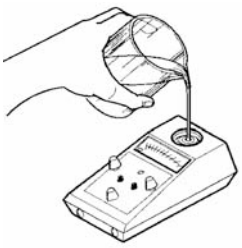
4. With flow to the system, wait for the Raw reading to stabilize. 'Stable' may mean the reading changes only +/- 1 counts from an average value.

NOTE **While you are entering a calibration value, if the Raw Value (i.e., CURRENT value displayed without units) is reading near 1000, then the controller will not display any value greater than your entry. If the reading is near 0, the controller will not display any value less than your entry.**

5. Sample the water. Test the sample with a reliable, calibrated tester (see below). Read the current value from your tester and enter the value into the controller's **TUNE** field using [UP] / [DOWN] / [ENTER]. Press [ENTER] on the last position to accept your value.

NOTE **If you have a 4-20mA output slaved to the pH input you are calibrating and your calibration will create a large swing in the pH (i.e., the pH is currently 4.1pH and you are re-calibrating to 8.2pH), the calibration value will appear to drift immediately after the point is entered. This is due to the 4-20mA trying to follow the rapid change (i.e., instantly going from 4 to 20mA's output). Re-entering the point will compensate for the drift caused by the 4-20mA output.**

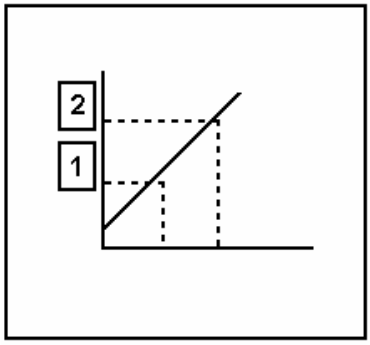




6. Sample and check the water again. Verify the controller's reading (i.e., **CURRENT**) matches the sample. If necessary repeat Step 5.
7. Press [HOME] to exit the **DUAL pH** menu. Follow the on- screen prompts to either accept or reject your calibration.

5.3.3.1 Tune Technical Notes:

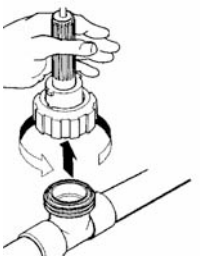
The **TUNE** function re-calculates the y-intercept using the new point and the current slope. The slope is defined as a factory default, or by performing a 1 or 2 point calibration. You can improve the accuracy of the **TUNE** over a wider operating range by first performing a 1 or 2 point calibration — effectively calculating a slope that is specific to the installation.



5.3.4 pH/ORP Calibration: 2-Point Method

❖ **pH/ORP Calibration Procedure: 2-Point Method**

1. Close the isolation valves and relieve the pressure on the system by opening the sample valve. Remove the sensor. If deposits or fouling is present, clean the sensor per the instructions provided in ***Section 11, Maintenance***. If deposits are excessive or the sensor is damaged, replace the sensor.



WARNING **BE CAREFUL WHEN REMOVING PROTECTIVE LIQUID FILLED BOOT OR BOTTLE FROM SENSOR TIP. FOR BOTTLE TYPE, TWIST BOTTLE OFF CAP THEN PULL CAP OFF TIP.**

2. Place the sensor into the sample container with a 'low' buffer. Ideally, this solution would be system water that is at or near either the low alarm or set point. If necessary use standard calibration solutions. Test the sample with a reliable, calibrated tester and make a note of the reading.

WARNING **NEVER EXPOSE SENSOR TIP TO THE AIR FOR MORE THAN 45 SECONDS.**

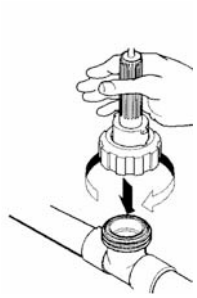
3. From the **MAIN MENU** move the prompt to **CALIBRATION** and press [ENTER]. The **CALIBRATE** menu is displayed.
4. Move the prompt to **DUAL pH** and press [ENTER]. The **DUAL pH** menu is displayed.

```
   ------ DUAL pH ------

▸ POINT 1  =  14.0  pH
  POINT 2  =  NONE
  TUNE     =  NONE
  CURRENT     11.4  pH

  LAST CAL    01-Jan-2000
```

5. With the prompt next to **POINT 1** press [ENTER]. Note that the **CURRENT** line will change from a reading with units (e.g., 11.3pH) to one without units (e.g., 0334). This new current value represents a raw (un-calibrated) reading of the channel (e.g., **DUAL pH**). Its range is 0 to 1023. If this reading is stable then the input is stable. If this reading is changing, then the input is changing.

NOTE **While you are entering a calibration value, if the Raw Value (i.e., CURRENT value displayed without units) is reading near 1000, then the controller will not display any value greater than your entry. If the reading is near 0, the controller will not display any value less than your entry.**

6. Using [UP] / [DOWN] / [ENTER], enter the value recorded in Step 5. Do NOT press [ENTER] on the last position.
7. Wait for the Raw reading to stabilize.
8. Press [ENTER] on the last position of the value you entered in Step 6 to accept your calibration point and associated Raw data value.
9. Reinstall the pH sensor into the flow assembly. Close the sample value and slowly open the isolation valve.



10. Move the prompt to **POINT 2** and press [ENTER]. Watch the **CURRENT** value field while in the Raw mode (i.e., no units are displayed). Note the stability of the value there. Some systems fluctuate rapidly. Try to assess how stable the system under calibration is by observing the value for approximately 30 seconds. For example, you may find that the system oscillates on the average of +/- 5 counts. This is normal provided the average is not changing.

```
------ DUAL pH ------

POINT 1  =  10.0  pH
POINT 2  =  4.0
TUNE     =  NONE
CURRENT     0296

LAST CAL    01-Jan-2000
```

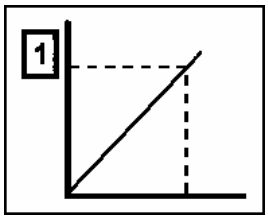
11. Obtain a sample of system water and test the sample with the tester (see below) make a note of the reading.

12. Using [UP] / [DOWN] / [ENTER], enter the value obtained in Step 11. Do NOT press [ENTER] on the last position.
13. Wait for the system to stabilize as defined by Step 10. Once stabilized press [ENTER].

NOTE **Stable may mean that the value changes +/- 1 count. This is normal. Watch the value for at least 30 seconds to determine its state.**

14. Sample and check the water again. Verify the controller's reading (i.e., **CURRENT**) matches the sample. If necessary repeat Steps 10 to 13.
15. Press [HOME] to exit the **DUAL pH** menu. Follow the on- screen prompts to either accept or reject your calibration.

5.3.5 pH/ORP Calibration: 1-Point Method



❖ **pH/ORP Calibration Procedure: 1-Point Method**

1. Close the isolation valves and relieve the pressure on the system by opening the sample valve. Remove the sensor. If deposits are present or the sensor is fouled, clean the sensor per the instructions provided in ***Section 11, Maintenance***. If deposits are excessive or sensor is damaged, replace.

WARNING

BE CAREFUL WHEN REMOVING PROTECTIVE LIQUID FILLED BOOT OR BOTTLE FROM SENSOR TIP. FOR BOTTLE TYPE, TWIST BOTTLE OFF CAP THEN PULL CAP OFF TIP.

2. Install the pH sensor into the flow assembly. Close the sample value and slowly open the isolation valve.

WARNING

NEVER EXPOSE SENSOR TIP TO THE AIR FOR MORE THAN 45 SECONDS.

3. From the **MAIN MENU** move the prompt to **CALIBRATION** and press [ENTER]. The **CALIBRATE** menu is displayed.
4. Move the prompt to **DUAL pH** and press [ENTER]. The **DUAL pH** menu is displayed.
5. Move the prompt to **POINT 1** and press [ENTER]. Note that the **CURRENT** value will change from a reading with units (e.g., 11.3 pH) to one without units (e.g., 0890). This new current value represents a raw (un-calibrated) reading of the channel (e.g., System pH). Its range is 0 to 1023. If this reading is stable then the input is stable. If this reading is changing, then the input is changing.

```
------ DUAL pH ------
POINT 1  =    14.0 pH
POINT 2  =    NONE
TUNE     =    NONE
CURRENT       11.4 pH

LAST CAL      01-Jan-2000
```

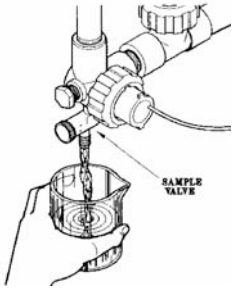
NOTE

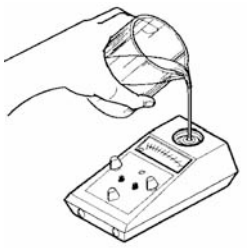
While you are entering a calibration value, if the Raw Value (i.e., CURRENT value displayed without units) is reading near 1000, then the controller will not display any value greater than your entry. If the reading is near 0, the controller will not display any value less than your entry.

6. Watch the **CURRENT** value field while in the Raw mode (i.e., no units are displayed). Note the stability of the value there. Some systems fluctuate rapidly. Try to assess how stable the system under calibration is by observing the value for approximately 30 seconds. For example, you may find that the system oscillates around an average +/- 1 count. This is normal provided the average is not changing.

```
------ DUAL pH ------

POINT 1  =  10.0  pH
POINT 2  =  NONE
TUNE     =  NONE
CURRENT     0826

LAST CAL  01-Jan-2000
```

7. Obtain a sample of system water and test the sample with the tester (see below). Make note of the reading.





8. Using [UP] / [DOWN] / [ENTER], enter the value obtained in Step 7. **Do NOT** press [ENTER] on the last position.
9. Wait for the system to stabilize as defined by Step 6. Once stabilized press [ENTER].
10. Sample and check the water again. Verify the controller's reading (i.e., **CURRENT**) matches the sample. If necessary repeat Steps 5 to 10.
11. Press [HOME] to exit the **DUAL pH** menu. Follow the on- screen prompts to either accept or reject your calibration.

5.3.6 4-20mA Input (Continuous Drum Level)

The 4-20mA Input function is primarily for use with continuous drum level monitor equipment and can be configured to accept a wide variety of sensors with 4-20mA outputs.

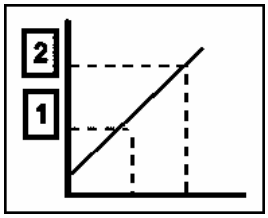
5.3.6.1 4-20mA Input Function Calibration Notes

The 4-20mA input loop must be powered by the transmitter (typically 24 VDC).

1. To calibrate the 4-20mA input, attach the 4-20mA transmitter to the input terminals on the cable provided (refer to ***Section 7, Diagram 6*** and ***Diagram 11A***).
2. During the calibration process, you will have to cause the transmitter to output at least 2 values. Depending on the type of transmitter you are using you may have to adjust the drum level during the calibration process. An easy way to do this is to remove the sensor from the drum for the low point.

   Due to the un-controlled nature of the 4-20mA transmitters used in conjunction with your controller, the **2 Point Calibration** technique is the only one covered. While the **1 POINT** and **TUNE** calibration options are available, they are not recommended.

5.3.7 4-20mA Input Calibration: 2-Point Method



4-20mA Input Calibration Procedure: 2-Point Method

1. From the **MAIN MENU**, move the prompt to **CALIBRATION**. Press [ENTER]. The **CALIBRATE** menu is displayed.
2. Move the prompt to **INPUT #** (where # represents the input number — from 1 to 4). Press [ENTER]. The **INPUT #** menu is displayed.

```
   ------ INPUT 1 ------
▸ UNITS:       none
```

3. With the prompt next to **UNITS**, press [ENTER]. Use [UP] / [DOWN] to set the units to use with this input. You may select from: **none, µM/YR, Mil/Y, µS/CM, pH, mV, GAL, Liter, °C, °F, PPM, PSI, %,** and **mA**. For example, if the 4-20mA transmitter is measuring drum level, then set the units to **'GAL'**. If it is measuring pressure, set the units to **'PSI'**. Note that as you cycle through the units the **SCALE** value will change. You cannot edit the **SCALE** value. When you have made your selection, press [ENTER].

```
------ INPUT 1 ------
▸ UNITS:       GAL
  SCALE:       0-10000
  POINT 1   =  10000  GAL
  POINT 2   =  NONE
  TUNE      =  NONE
  CURRENT      8155  GAL
  LAST CAL   01-Jan-2000
```

4. Move the prompt to **POINT 1** and press [ENTER]. Note that the **CURRENT** line will change from a reading with units (e.g., 3831 GAL) to one without units (e.g., 0017). This new **CURRENT** value represents a raw (un-calibrated) reading of the channel (e.g., **INPUT**). Its range is 0 to 1023. If this reading is stable, then the input is stable. If this reading is changing, then the input is changing.

```
------ INPUT 1 ------
▸ UNITS:      GAL
  SCALE:      0-10000
  POINT 1  =  10000  GAL
  POINT 2  =  NONE
  TUNE     =  NONE
  CURRENT     3831
  LAST CAL    01-Jan-2000
```

5. Apply a known condition to the transmitter. For example, in the drum level example, put the sensor in a full 55 gallon drum.

NOTE **If you need to calibrate a point with a value of zero, use the Point 1 entry. If you use the Point 2 entry for zero, the display will change to none and your entry will be discarded.**

6. Using [UP] / [DOWN] / [ENTER] set each digit in the **POINT 1** value. In the drum level example, we would enter the value '0055' here as the sensor is currently transmitting a signal that represents '55' gallons.

```
------ INPUT 1 ------
  UNITS:       GAL
  SCALE:       0-10000
  POINT 1  =   00055  GAL
  POINT 2  =   NONE
  TUNE     =   NONE
  CURRENT      0043
  LAST CAL  01-Jan-2000
```

7. Wait approximately 30 seconds for the transmitter and signal to stabilize (the wait time is primarily transmitter dependent). Once stabilized, press [ENTER] to exit the active selection field, activate the value entered and return to the prompt.
8. Move the prompt to **POINT 2**. Press [ENTER].
9. Change the output of the transmitter to a known value.
10. Using [UP] / [DOWN] / [ENTER] set the **POINT 2** value to match the input. If it is a continuous drum level transmitter, pull the level sensor out of the drum to simulate the empty or '0' condition.

```
------ INPUT 1 ------

UNITS:       GAL
SCALE:       0-10000
POINT 1  =   00055  GAL
POINT 2  =   00000
TUNE     =   NONE
CURRENT      0043
LAST CAL  01-Jan-2000
```

11. Wait for the input to stabilize and press [ENTER] on the last position.
12. Vary the output of the transmitter to confirm proper calibration. In our example, we would move the drum level up and down and verify that the **CURRENT** value was reading correctly. If it is not, re-calibrate one or both points.

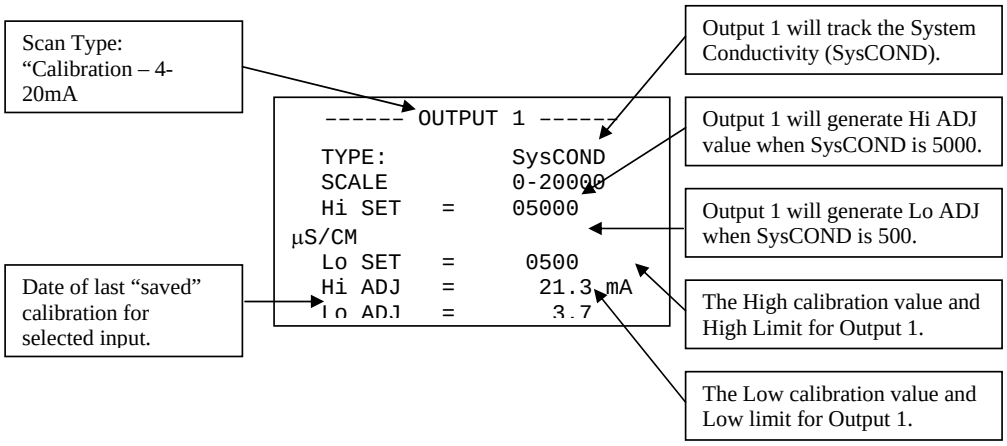
```
------ INPUT 1 ------

UNITS:       GAL
SCALE:       0-10000
POINT 1  =   00055  GAL
POINT 2  =   00000
TUNE     =   NONE
CURRENT      0043  GAL
LAST CAL  01-Jan-2000
```

13. Press [HOME] to return to the **CALIBRATION** menu. Follow any on-screen prompts if you made changes to the calibration.

5.3.8 4-20mA Outputs (Energy Management Outputs)

The 4-20mA Output function is primarily for use with Energy Management Systems or chart recorders.

The following diagram labels its major components:

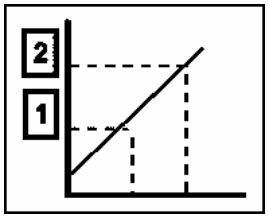


NOTE **4-20mA outputs maintain their readings even with loss of flow. Be aware that the reading may not represent the condition of the system - chemical backup, air bound sensors etc. can cause inaccurate readings when the flow is off.**

5.3.8.1 4-20mA Output Function Calibration Notes

1. To calibrate the 4-20mA output, attach the 4-20mA receiver (i.e., Energy Management System) to the output terminals on the cable provided (see ***Section 7, Diagram 6***).
2. During the calibration process, you will have to read the value from the receiver. For example, the controller will output a value that it thinks is 20mA. You will have to look at the receiver (i.e., Energy Management System) and see how it interprets the controller's output. If the receiver reads 19.5mA, you will have to re-set the controllers output to 20.5.
3. Due to the un-controlled nature of the 4-20mA receivers used in conjunction with your controller, the **2 Point Calibration** technique is the only one available.

5.3.8.2 4-20mA Output Calibration: 2-Point Method



4-20mA Output Calibration Procedure: 2-Point Method

1. From the **MAIN MENU**, move the prompt to **CALIBRATION**. Press [ENTER]. The **CALIBRATE** menu is displayed.
2. Move the prompt to the **OUTPUT #** (where # represents the number of the output, a value from 1 to 4). Press [ENTER]. The **OUTPUT #** menu is displayed.
3. Move the prompt to **TYPE** and press [ENTER]. Using [UP] / [DOWN] select an output **TYPE**. You can chose from: **SysCond, MAKEUP, Dual pH, Sys ORP, INPUT 1, INPUT 2, INPUT 3,** or **INPUT 4.** Use the **TYPE** value to specify which input the **OUTPUT** should track. For example, if you want the output to track the System Conductivity you would select **SysCond**. After making your selection press [ENTER].

```
------ OUTPUT 1 ------
▸ TYPE:        SysCOND
  SCALE        0-20000
  Hi SET   =   20000 µS/CM
  Lo SET   =     0000
  Hi ADJ   =     20 .0 mA
  Lo ADJ   =      4 .0
  LAST CAL     01-Jan-2000
```

4. Move the prompt to **Hi SET**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the High Limit for the selected signal. When the signal reaches this value, the controller will output the maximum current (i.e., **Hi ADJ**). For example, when the system conductivity reaches 5000 µS/CM we want the 4-20mA output to send 20mA, then we would enter 5000 here. Press [ENTER].

```
------ OUTPUT 1 ------
  TYPE:        Sys COND
  SCALE        0-20000
▸ Hi SET   =   05000 µS/CM
  Lo SET   =    0000
  Hi ADJ   =    20.0 mA
  Lo ADJ   =     4.0
  LAST CAL     01-Jan-2000
```

TIP **If you would like the output to be reverse acting, set the Hi ADJ value to 4.0 and the Lo ADJ value to 20.0.**

5. Move the prompt to **Lo SET**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the Low Limit for the selected signal. When the signal reaches this value, the controller will output the minimum current (i.e., **Lo ADJ**). For example, when the system conductivity falls to 500 µS/CM, we want the 4-20mA output to send 4mA, then we would enter 500 here.

```
------ OUTPUT 1 ------
  TYPE:        SysCOND
  SCALE        0-20000
  Hi SET   =   05000 µS/CM
▸ Lo SET   =    0500
  Hi ADJ   =    20.0 mA
  Lo ADJ   =     4.0
  LAST CAL     01-Jan-2000
```

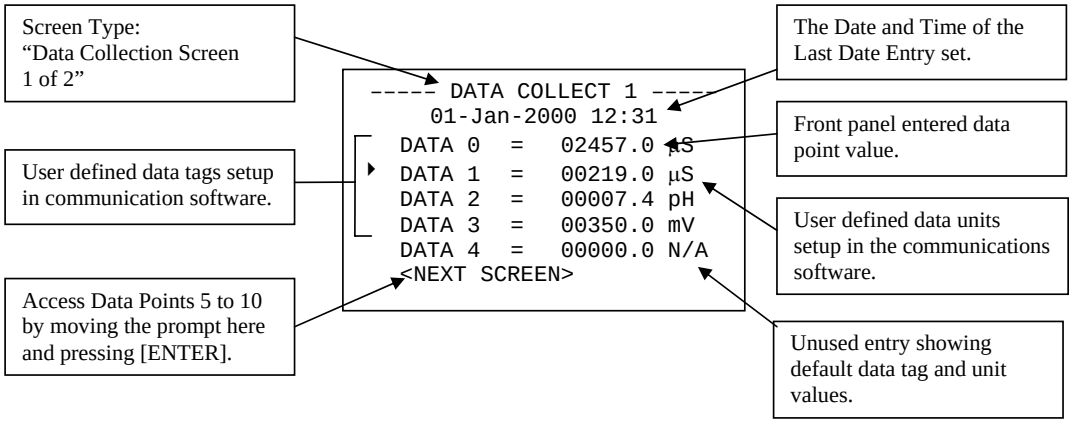
6. Move the prompt to **Hi ADJ**. Press [ENTER]. Using [UP] / [DOWN] / [ENTER], set the current (i.e., mA) value that you would like output when the **Hi SET** value is achieved. Note, while editing this field the **OUTPUT** will be forced to the high level defined by this field. Observe the reading on the remote equipment (i.e., Energy Management System). If the output is reading low on the remote equipment, increase the value. If it is reading high, decrease the value. For example. If the **Hi ADJ** value is currently set at 20.0mA and the remote equipment is reading the output as 19.7mA, then increase the **Hi ADJ** value to 20.3mA. Repeat this process until the remote equipment reads the High output properly. Press [ENTER].
7. Move the prompt to **Lo ADJ**. Press [ENTER]. Use [UP] / [DOWN] / [ENTER] to set the low (i.e., 4mA) value. Repeat the process outlined in Step 6.
8. Press [HOME] to exit the **OUTPUT #** menu. Follow the on- screen prompts if you made any calibration changes.

```
------ OUTPUT 1 ------
TYPE:         SysCOND
SCALE         0-20000
Hi SET    =   05000 µS/CM
Lo SET    =    0000
▸Hi ADJ   =    20.3 mA
Lo ADJ    =     3.3
LAST CAL      01-Jan-2000
```

5.3.9 Data Collection

The Data Collection system is designed to capture manual test data taken on site. When used in conjunction with the serial communications package, the data can later be captured and graphed along side normal controller history.

The following diagram describes the data collection window's major components:



5.3.10 Data Collection: Point Entry

The Data Collection system will hold up to 32 sets of data. Each set can contain a maximum of 10 data items. The descriptive name for each item (the default is "DATA 0") and unit (default is "N/A") can be changed via the Serial Communications option.

❖ **To make a Data Collection Entry:**

1. From the **MAIN MENU**, select **DATA COLLECT**. Press [ENTER]. The **DATA COLLECT 1** menu is displayed.

```
====== MAIN MENU ======

 DISPLAY DATA
 CALIBRATION
 SETPOINTS
 TIMERS
▸DATA COLLECT
 CONFIGURE
      ------------
```

2. Move the prompt to the first entry (e.g., **DATA 0**) and press [ENTER]. Note the date time stamp line will change to **"NEW RECORD"** when you begin making a change.

```
----- DATA COLLECT 1 -----

      01-Jan-2000   12:34
▸DATA 0 =  00000.0   N/A
 DATA 1 =  00000.0   N/A
 DATA 2 =  00000.0   N/A
 DATA 3 =  00000.0   N/A
 DATA 4 =  00000.0   N/A
 <NEXT SCREEN>
```

```
----- DATA COLLECT 1 -----

        NEW RECORD
 DATA 0 =  00000.0   N/A
 DATA 1 =  00000.0   N/A
 DATA 2 =  00000.0   N/A
 DATA 3 =  00000.0   N/A
 DATA 4 =  00000.0   N/A
 <NEXT SCREEN>
```

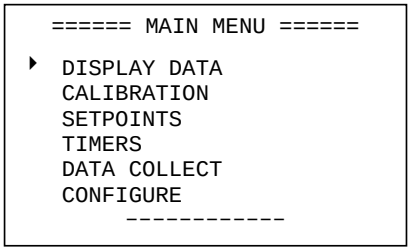
3. Use [UP] / [DOWN] / [ENTER] to enter the data point value. Press [ENTER] on the last position to accept the value.
4. Move the prompt to the next entry and repeat Step 3 until all entries have been filled.
5. Move the prompt to **<NEXT SCREEN>** and press [ENTER] to move to the next 5 data points.
6. Repeat Steps 3 and 4 for the remaining 5 data points.

NOTE **When adding a new DATA ENTRY record, the previous values are retained in all items. This reduces the amount of data entry required and results in improved graphing. If you do not desire this feature, you should manually set all UN-recorded data to 0.**

7. To review the entries in the first 5 data points, use the **<NEXT SCREEN>** menu item.
8. When you have completed entering your data points, press [HOME] to return to the **MAIN MENU**. If you have made changes, you will be prompted accept or reject them. Press [ENTER] to accept, and press [HOME] to abort.
9. After accepting your changes, you can review the settings by re-entering the **DATA COLLECT** menu. As long as you do not make any changes, your last data entry will be retained.

5.3.11 Display Data: Auto Scroll Mode

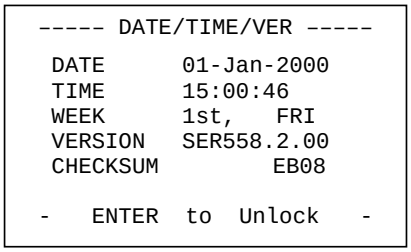
Whenever the system is idle (no one presses any keys on the keyboard) for approximately 5 minutes, the display will enter an AUTO SCROLL mode. The screens in **DISPLAY DATA** will automatically cycle every 5 seconds.



The **DISPLAY DATA** screens are as follows:

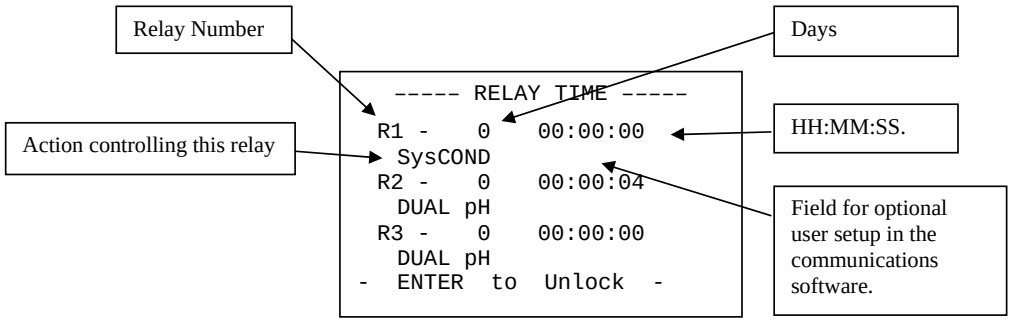
5.3.12 Date/Time/Version

Here you will find information relative to the data/time of the controller as well as version information.



5.3.12.1 Relay Time

This screen displays the accumulated relay on-times. The time is formatted as: DD:HH:MM:SS. Where D = Day, H = Hour, M = Minute and S = Seconds.




```
----- RELAY TIME -----
R1 -    0    00:00:00
  SysCOND
R2 -    0    00:00:04
  DUAL pH
R3 -    0    00:00:00
  DUAL pH
 -- ENTER  to  Unlock --
```

```
----- RELAY TIME -----
R4 -    0    00:00:00
  Sys ORP
R5 -    0    00:00:00
  TIMER 1
R6 -    0    00:00:00
  TIMER 2
 -- ENTER  to  Unlock --
```

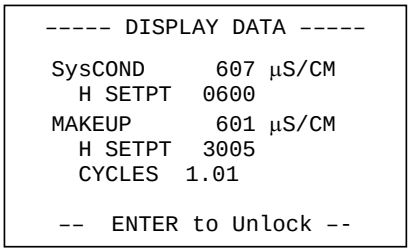
5.3.12.2 Alarms

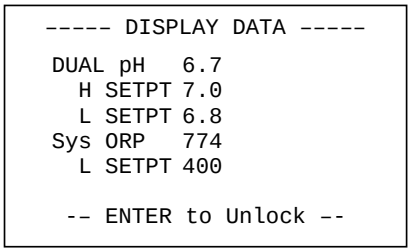
Indicates current alarms.

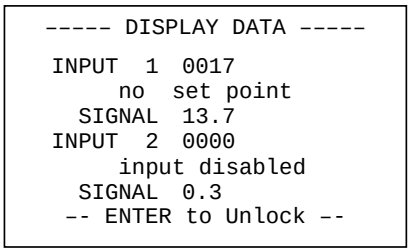
```
------ ALARMS ------
Sys ORP   HIGH ALARM
SysCOND   LOW ALARM
DUAL pH   LIMIT ALARM


-- ENTER  to  Unlock --
```

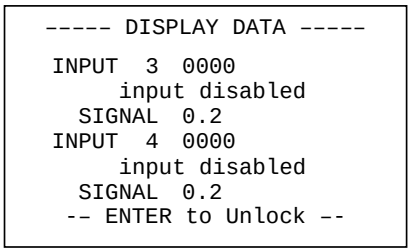
5.3.12.3 Analog Inputs

Indicates current values and associated set points.









6. Series 9560/9570 Operation

6.1 Introduction

The Series 9560 and Series 9570 controllers are designed to control two systems (for example, two cooling towers) at the same time. Because of this, they operate slightly differently than the standard series. This section defines those differences. For items not covered in this section, please refer to the base manual text.

6.1.1 Model Definition

6.1.1.1 Series 9560

The Series 9560 is a controller designed for use in systems that have a Open (tower) cooling loop and a Closed (chiller) loop. Often, the closed loop system operates on a falling (low) conductivity setpoint (e.g., for the monitor and control of Nitrate addition).

6.1.1.2 Series 9570

The Series 9570 is a dual cooling tower controller.

6.1.2 Electrical Wiring

The Series 9560 and 9570 are slightly different from the other 9500 series models. Some inputs and outputs are associated with one cooling system (e.g., Tower#1) and the others are associated with the second cooling system (e.g., Tower#2). Refer to the following sections for further details.

6.1.2.1 Flow Switch or Interlock

It is recommended that a flow switch or auxiliary dry contact from the control panel be used to make the outputs inoperative when the cooling tower is shut down. To use the interlock feature, connect the flow switch or auxiliary dry contact from another device to the appropriate positions on the terminal block. Refer to ***Section 7, Diagram 4,*** for flow switch or interlock connection location. Please read the note specific to the Series 9560/9570 regarding the second flow input. To activate the flow option, disconnect the controller's power and locate the S1 switch bank on the mother board. (Refer to ***Section 7, Diagram 7.***) To activate the switch input for Tower#1 control (Sys Cond1), turn S1-"2" ON. To activate the flow switch input for Tower#2 control (Sys Cond2), turn S1-"3" ON.

6.1.2.2 Level

The Series 9560/9570 controller has 4 single level inputs. These correspond to J11 positions 1 to 8 as depicted in ***Section 7, Diagram 4***. These inputs are not specifically assigned to one control side or the other (i.e., Tower#1 or Tower#2).

6.1.2.3 Receptacles (Conduit Wiring)

The controller offers a unique pre-wired package as standard. Each cord is clearly marked and readily accessible for connecting external electrical devices. Refer to ***Section 7, Diagram 4*** for wiring information, as well as ***Section 10, Relay Assignment***. The important thing to remember is that the odd numbered relays go together and the even numbered relays go together. Therefore, if the Flow#1 input is activated and the #1 flow switch detects a flow loss, then the relays numbered 1, 3, 5 (as labeled on the overlay) will be disabled. Likewise, if the Flow#2 input is activated and the #2 flow switch detects a loss of flow, then the relays numbered 2, 4, and 6 will be disabled.

6.1.2.4 Hardware Settings

The default hardware settings for your controller will satisfy a majority of installations. Review the default operating ranges listed in the table below. If you expect to operate outside of the stated range, check the 'User Setting?' column to see if you can change the setting. If you can (YES), refer to the associated page listing for jumper / switch setting diagrams and instructions.

Input / Output Description	Default Settings	User Setting?	Main Manual Page Ref.
System#1 Conductivity	0-5000µS/CM	YES	106
System#2 Conductivity	0-5000µS/CM	YES	106
4-20mA Input	0-20mA	NO	107, 114
4-20mA Output	0-20mA	YES	107
Power Supply (In)	90-250VAC, 50/60 Hz	No	112
Flow#1 Switch	ON (if flow assembly supplied)	YES	97
Flow#2 Switch	ON (if flow assembly supplied)	YES	97
Serial Communications	RS-232	NO	109-111
Single Point Drum Level	Closed - Low Level	YES	113

6.2 Operation

The Series 9560 and Series 9570 are identical from a software and controller (internal) hardware standpoint. Therefore, we will use the term Series 9560/9570 to refer to both models.

The Series 9560/9570 primary purpose is to control the conductivity level in a given water system. It uses two sensors and has two independently operating systems for control that include the selectable feed of inhibitors or biocide. The following sections are in some manner unique for the Series 9560/9570 models: Setpoints and Alarms, Flow and Selectable Timers.

6.2.1 Setpoints And Alarms

6.2.1.1 Setpoints: SysCond

Rising/High or Falling/Low

A Setpoint is a setting at which the controller activates an output, such as a solenoid valve. The type - Rising/High or Falling/Low defines which side of the set-point the relay activates. A Rising/High type means that the output activates when the input goes above the setpoint. A Rising/High setpoint is commonly used in conductivity control where you want to keep the conductivity below a certain value. A Falling/Low type activates the output when the value goes below the setpoint. A common example of this is in Nitrite addition in a closed loop cooling system.

The setpoint type is configured from the **SETPOINTS / SysCond** menu.

❖ **Use the following instruction to change the setpoint type:**

1. Use [SCROLL] to move the prompt in the **MAIN MENU** to **SETPOINTS**. Press [ENTER] and the **SETPOINTS** menu is displayed.
2. Use [SCROLL] to move the prompt to **SysCond**. Press [ENTER]. The **SysCond** menu is displayed.

```
------ SysCOND  R1 ------
▸ ↑ or ↓:  Rising/High
  SETPT     =  1500 µS/CM
  DIFF      =     50
  HiALRM    =  1700 µS
  LoALRM    =  1300
  CURRENT      1143 µS/CM
  <ALARM INFO>
```

3. Use [SCROLL] to move the prompt to the **↑ or ↓: Rising/High** selection. This value indicates the type of setpoint. To change the value press [ENTER].
4. Use [UP] / [DOWN] / [ENTER] to select between the values **Rising/High** and **Falling/Low**. Press [ENTER] to accept your selection. Follow the on- screen prompts if you have made changes.
5. Press [HOME] repeatedly to return to the **MAIN MENU**.

6.2.1.2 SETPOINTS: Flow

Like Drum Levels, System **FLOW** can be configured to activate the **Alarm LED**, and the **Alarm RELAY** and initiate an **Alarm CALLBACK**. **FLOW** has the added benefit that it will disable the associated relay outputs (i.e., turn them off). The Series 9560/9570 models have two flow inputs. **FLOW1** affects the odd relays (Bleed1, Timer1, Timer3), **FLOW2** affects the even relays (Bleed2, Timer2, Timer4). Each of the two flow inputs can be disabled. To disable **FLOW1** set S1-2 on the Mother Board to the OFF position (see ***Section 7, Diagram 7***). To disable **FLOW2** set the S1-3 to the OFF position. The flow inputs are independently programmable. Therefore, you can enable/disable the **Alarm LED**, **Alarm RELAY** or **Alarm CALLBACK** items for each.

6.2.2 Timers

The important thing to keep in mind with regard to **TIMERS** on the Series 9560/9570 models, is that the **ODD** numbered **TIMERS** are influenced by the **ODD** numbered System Conductivity and Flow inputs (i.e., **SysCOND1** and **FLOW1**). The **EVEN** number **TIMERS** are influenced by the **EVEN** numbered **System Conductivity** and **FLOW** inputs (i.e., **SysCOND2** and **FLOW2**). The following chart shows the association.

Timer #'s	Type	Influenced by	Notes
1,3	Slaved to	R1-R6 FLOW1	
1,3	Limit	SysCOND1 FLOW1	
1,3	Percent	FLOW1	
1,3	% Post B.D	SysCOND1 FLOW1	
1,3	Pulse	FLOW1 W METER1	**W METER 2** can be selected from the **SET** menu.
1,3	Cycle	FLOW1	
1,3	28-Day	SysCOND1 FLOW1	When in the **FEED** mode, will disable the other Timer when it is setup as **LIMIT, PERCENT, POST,** or **PULSE**.

Timer #'s	Type	Influenced by	Notes
2,4	Slaved to	R1-R6 FLOW2	
2, 4	Limit	SysCOND2 FLOW2	
2, 4	Percent	FLOW2	
2, 4	% Post B.D	SysCOND2 FLOW2	
2, 4	Pulse	FLOW2 W METER2	**W METER 1** can be selected from the **SET** menu.
2,4	Cycle	FLOW2	
2, 4	28-Day	SysCOND2 FLOW2	When in the **FEED** mode, will disable the other Timer when it is setup as **LIMIT, PERCENT, POST,** or **PULSE**.

For example, if **TIMER1** is setup as a **LIMIT** type, then it will activate with System Conductivity #1 (**SysCOND1**). If **TIMER2** is setup as a **PERCENT**, it will cycle continuously according to its program as long as the **FLOW2** is active (i.e., it detects flow). If **TIMER3** is setup as a **POST** type, then it will activate with System Conductivity #1 (**SysCOND1**). If **TIMER4** is setup as a **PULSE** type, it will run according to its program as long as **FLOW2** is active. If **TIMER4** is setup as a **28-DAY** type, it will prebleed **SysCOND2** (i.e., activate relay 2). When it begins feeding, it will lockout the **SysCOND2** relay as well as the **TIMER2** relay (i.e., relay 4).

7. Diagrams: Installation, Component, And Electrical

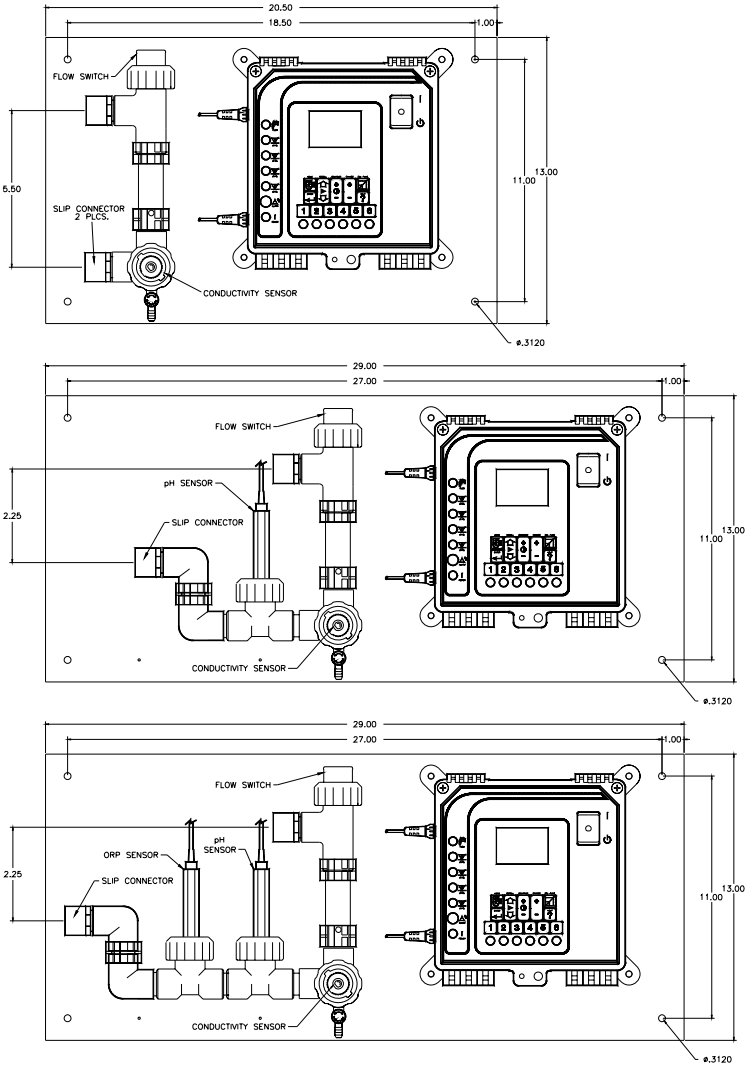


DIAGRAM 1 – ENCLOSURE DIMENSIONAL DATA

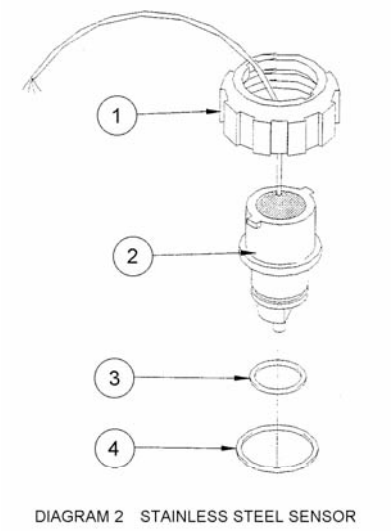


DIAGRAM 2 STAINLESS STEEL SENSOR

STAINLESS STEEL SENSOR SPECIFICATIONS

Pressure Rating ..... 125 PSI (8.6 BAR)
Temperature Rating ..... 125º F (51.7º C)
Temperature Compensation ..... 45ºF (7.2ºC) to 105ºF (40.6ºC)
Construction .....Glass Filled Polypropylene Stainless Steel
Cell Constant..... 0.5

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 1	Part No. 03-005-04-E	Gasket, O-Ring 2-029

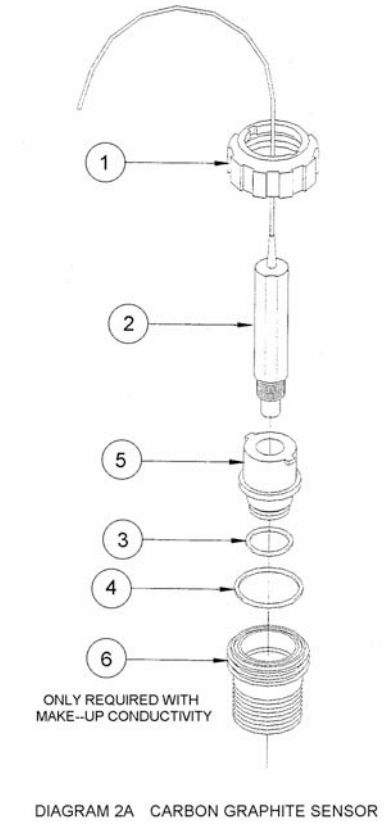


DIAGRAM 2A CARBON GRAPHITE SENSOR

CARBON GRAPHITE SENSOR SPECIFICATIONS

Pressure Rating ..... 125 PSI (8.6 BAR)
Temperature Rating ..... 125º F (51.7º C)
Temperature Compensation ..... 45ºF (7.2ºC) to 105ºF (40.6ºC)
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 Adapter

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 Temp. Range .... 23º F (-5º C) to 176º F (80º C)
Operating Pressure Range .....100 psi (6.8 BAR)

MATERIALS

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

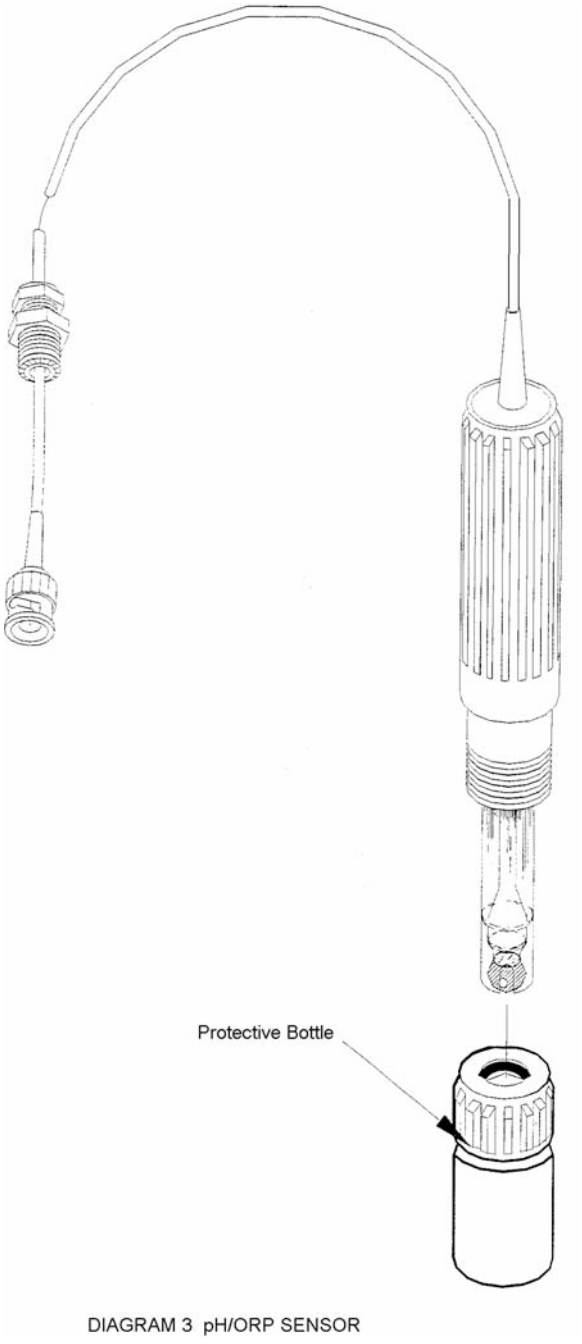


DIAGRAM 3 pH/ORP SENSOR

IMPORTANT

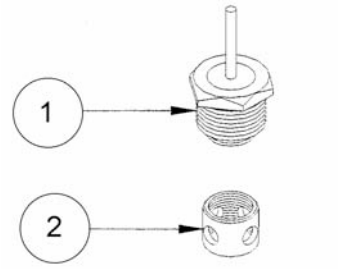
REMOVE PROTECTIVE BOTTLE FOR OPERATION, KEEP BOTTLE IN SAFE PLACE FOR LATER USAGE.

ORP SPECIFICATIONS

ORP Range .....0-1000 mV
Response Time ..... < 20 Sec. (95% Response)
Operating Temp. Range ... 23º F (-5º C) to 176º F(+80º C)
Operating Pressure Range .. 50 psi (3.4 BAR) @ 176º F (80ºC)
..... 100 psi (6.8 BAR) @ 77º F (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

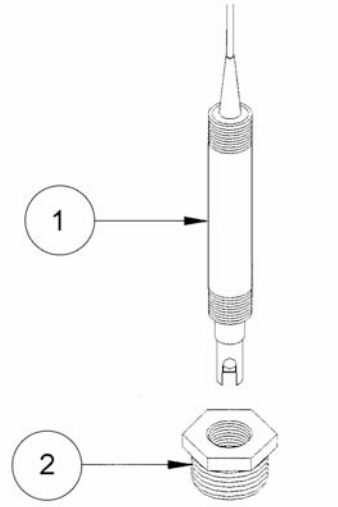


HI-PRESSURE CONDUCTIVITY SENSOR SPECIFICATIONS

Pressure Rating .....250 PSI (17.3 BAR)
Temperature Rating .....32º F to 212º F (0º C to 100º C)
Temperature Compensation .....45ºF to 105ºF (7º C to 40ºC)
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

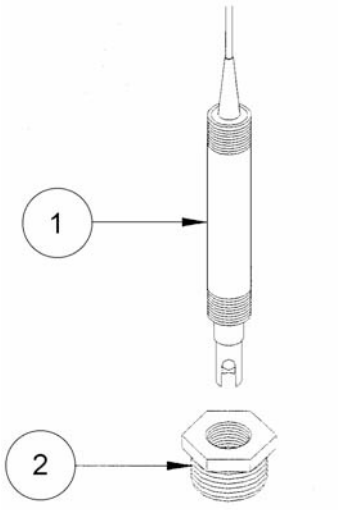


HI-PRESSURE pH SENSOR SPECIFICATIONS

pH Range .....pH 0 to 14 (Na+ < 0.1N)
Accuracy .....+ 0.1 pH Unit
Response Time .....< 10 sec. (95% response)
Operating Temperature .....23º F (-5º C) to 248º F (120º 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 .....0 - 1000mV
Response Time .....< 20 sec. (95% response)
Operating Temperature .....23º F (-5º C) to 248º F (120º 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

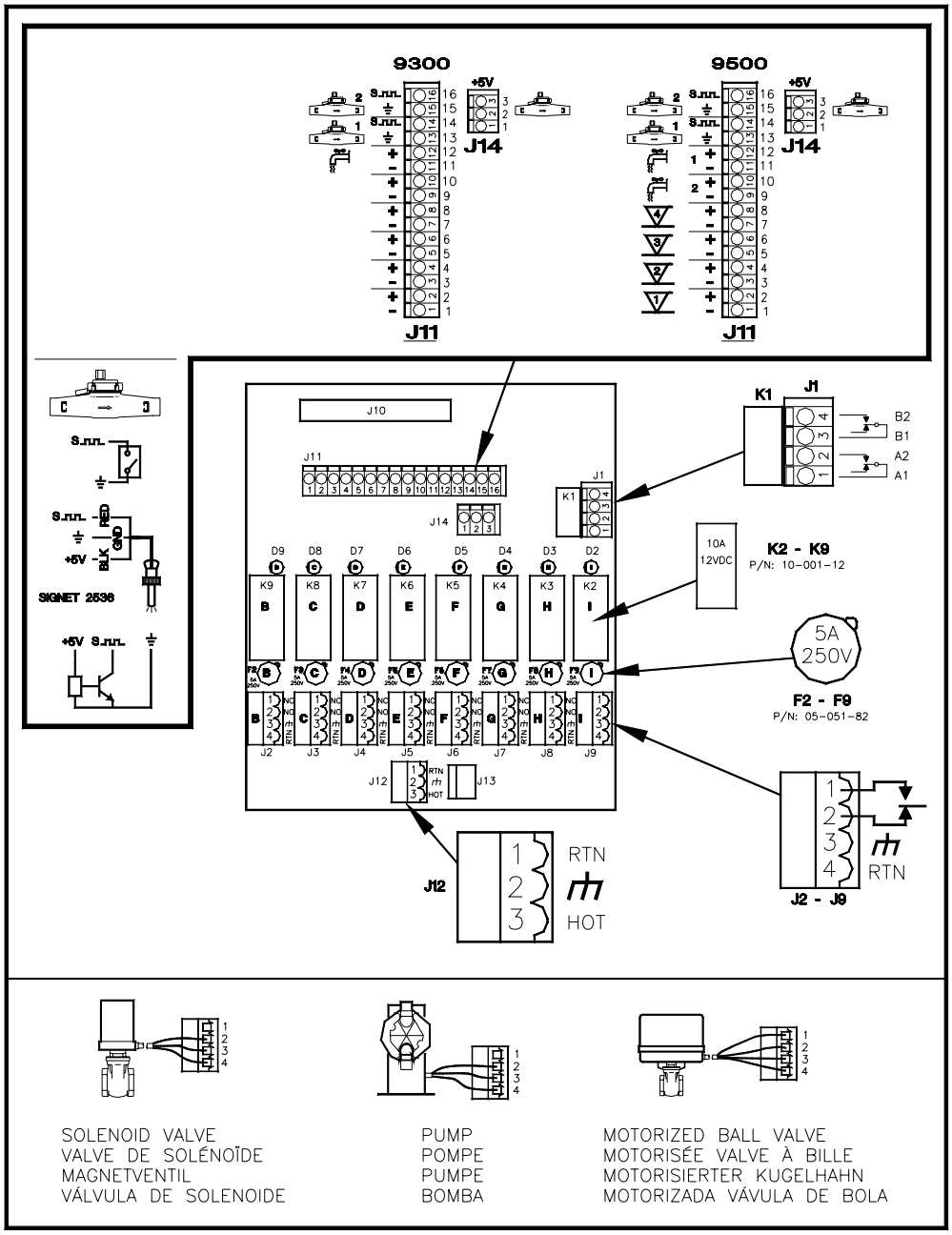
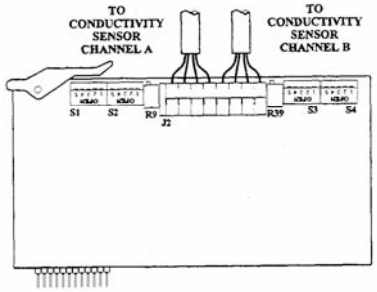


DIAGRAM 4 RELAY BOARD CONNECTIONS TO PUMP, SOLENOID, & BALL VALVE (9300/9500)

CONDUCTIVITY DAUGHTER BOARD



SENSOR CABLE WIRE CODE

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

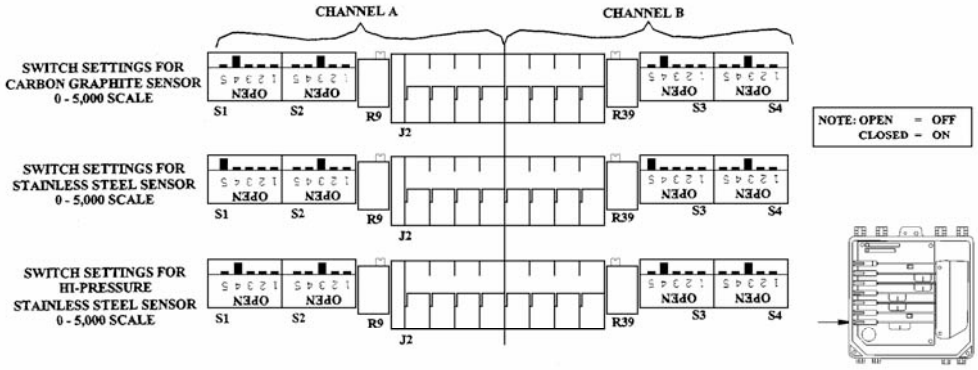
NOTE: CLEAR WIRE MAY BE GREEN OR WHITE

	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	OPEN
*	S1/S3	5	SELECT 0.5 CELL CONSTANT	CLOSED

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.



pH / ORP DAUGHTER BOARD

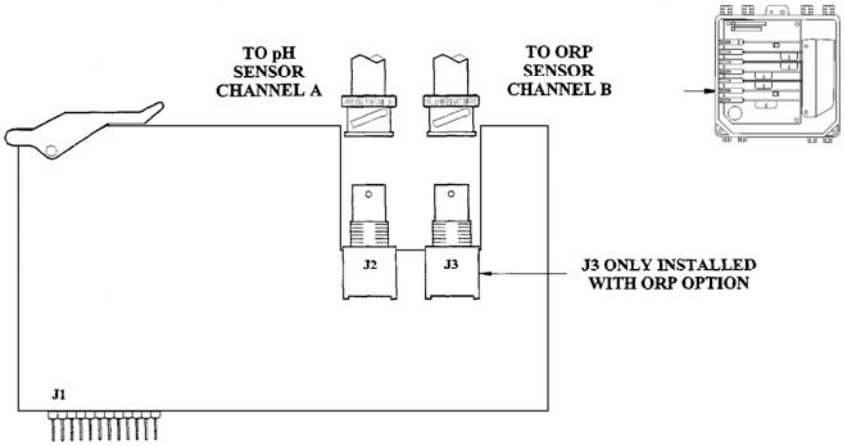


DIAGRAM 5 CONDUCTIVITY / pH / ORP DAUGHTER BOARD

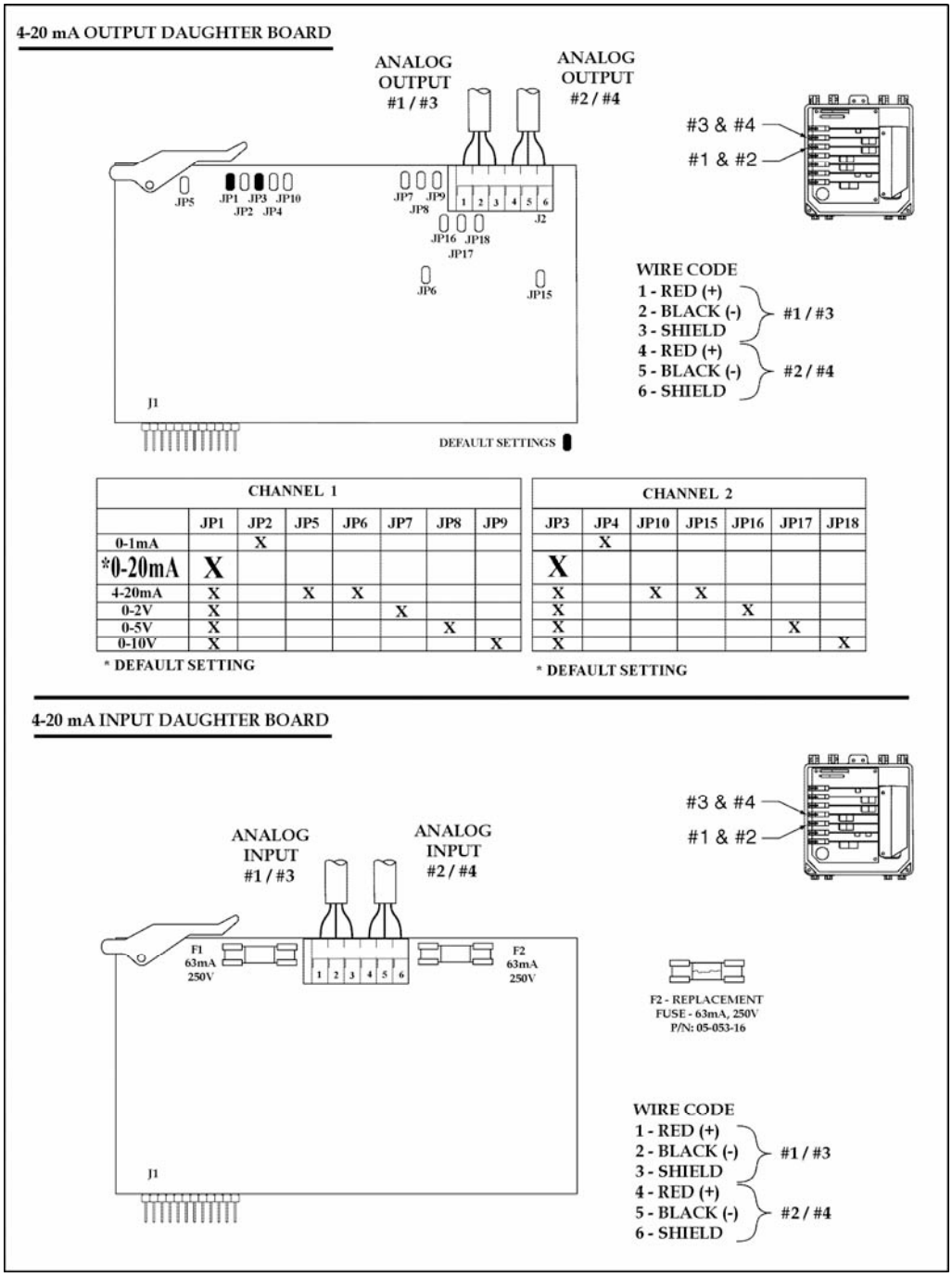


DIAGRAM 6 ANALOG OUTPUT / ANALOG INPUTS DAUGHTER BOARDS

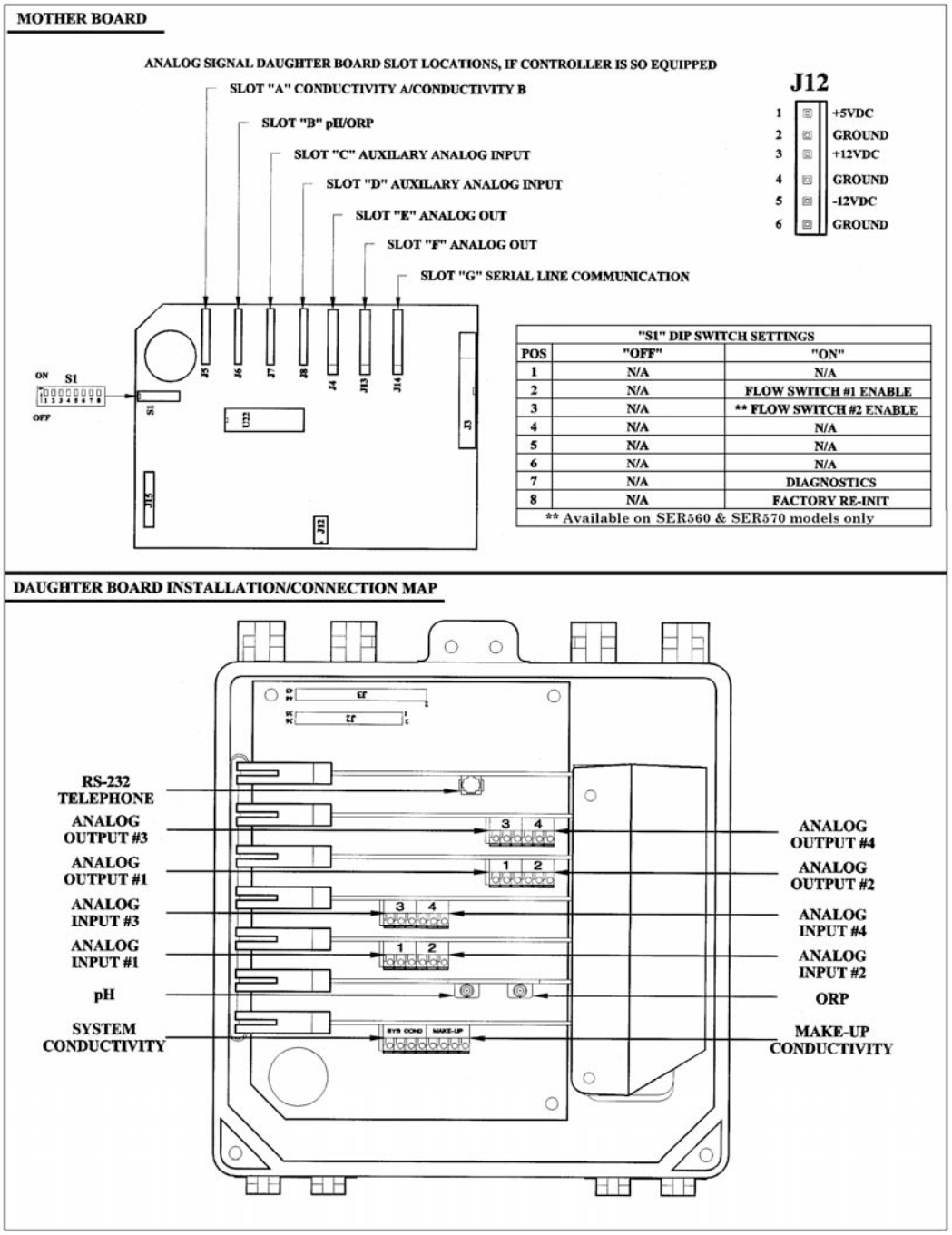
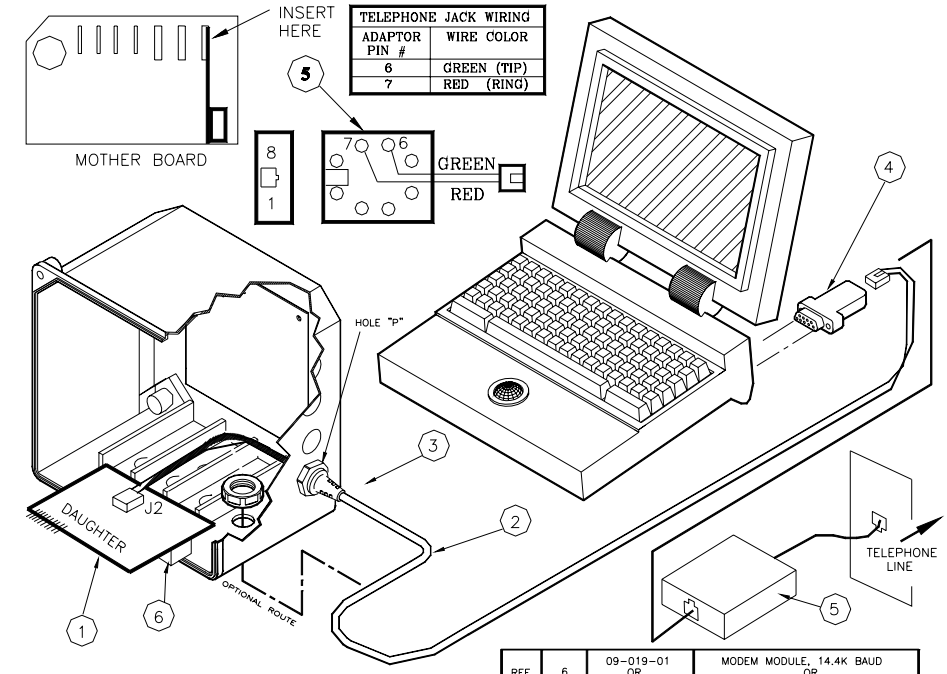
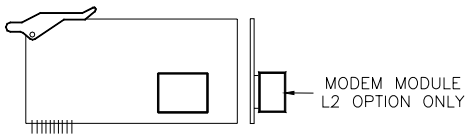


DIAGRAM 7 MOTHER BOARD / INSTALLATION CONNECTION MAP

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

1. Insert free plug on cable 2 into either adaptor 4 (direct conn) or adaptor 5 (phone line)
2. Attach adaptor to appropriate interface: 1) The serial port on your PC, or 2) A telephone line jac
3. Re-connect power at main.





QTY	ITEM #	PART NUMBER	DESCRIPTION
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
	3		
1	2	13-476-73 OR * 13-475-75	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

BILL OF MATERIALS

* NOT SHOWN

DIAGRAM 9 – SERIAL COMMUNICATIONS OPTION, FIELD INSTALLATION

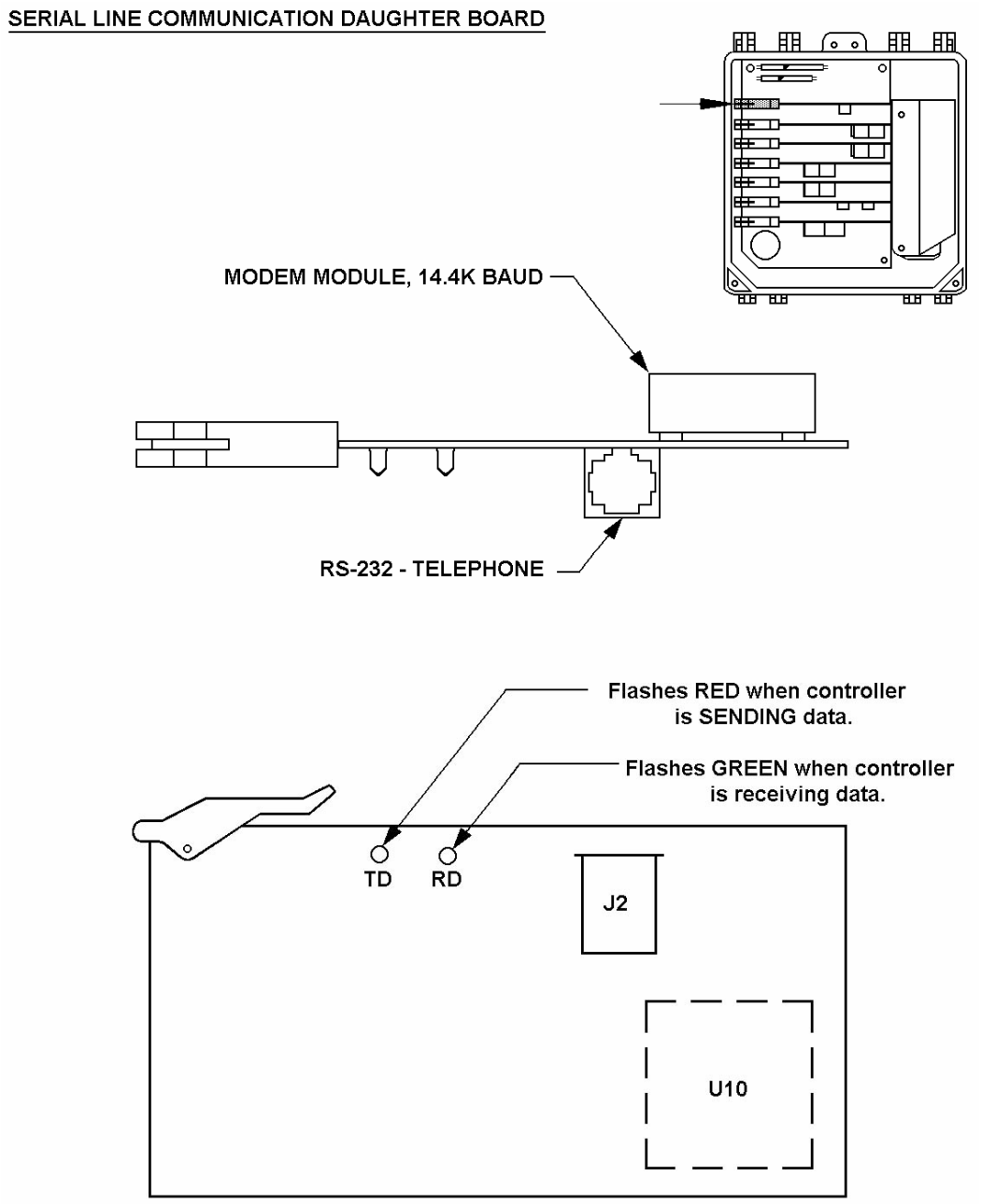
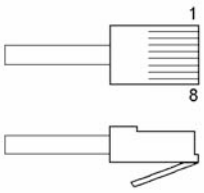


DIAGRAM 9A – SERIAL / INTERNAL MODEM COMMUNICATIONS DAUGHTER BOARD

CABLE * PIN-OUT

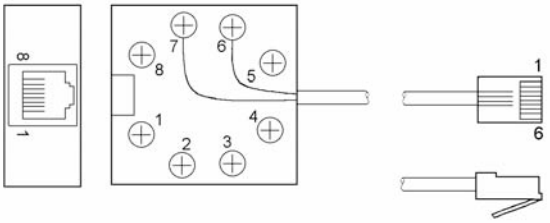
* CABLE IS WIRED STRAIGHT THROUGH, PIN #1 TO PIN #1, ETC.



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 ADAPTER

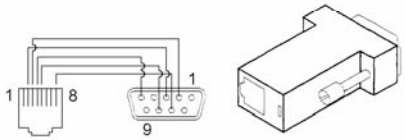
RJ-45	
POS.	POS.
1	NC
2	NC
3	NC
4	NC
5	NC
6	RING
7	TIP
8	NC



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

SERIAL PORT ADAPTER

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 adapter into the serial line adapter.

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 9B – SERIAL / INTERNAL MODEM ADAPTER PIN-OUTS

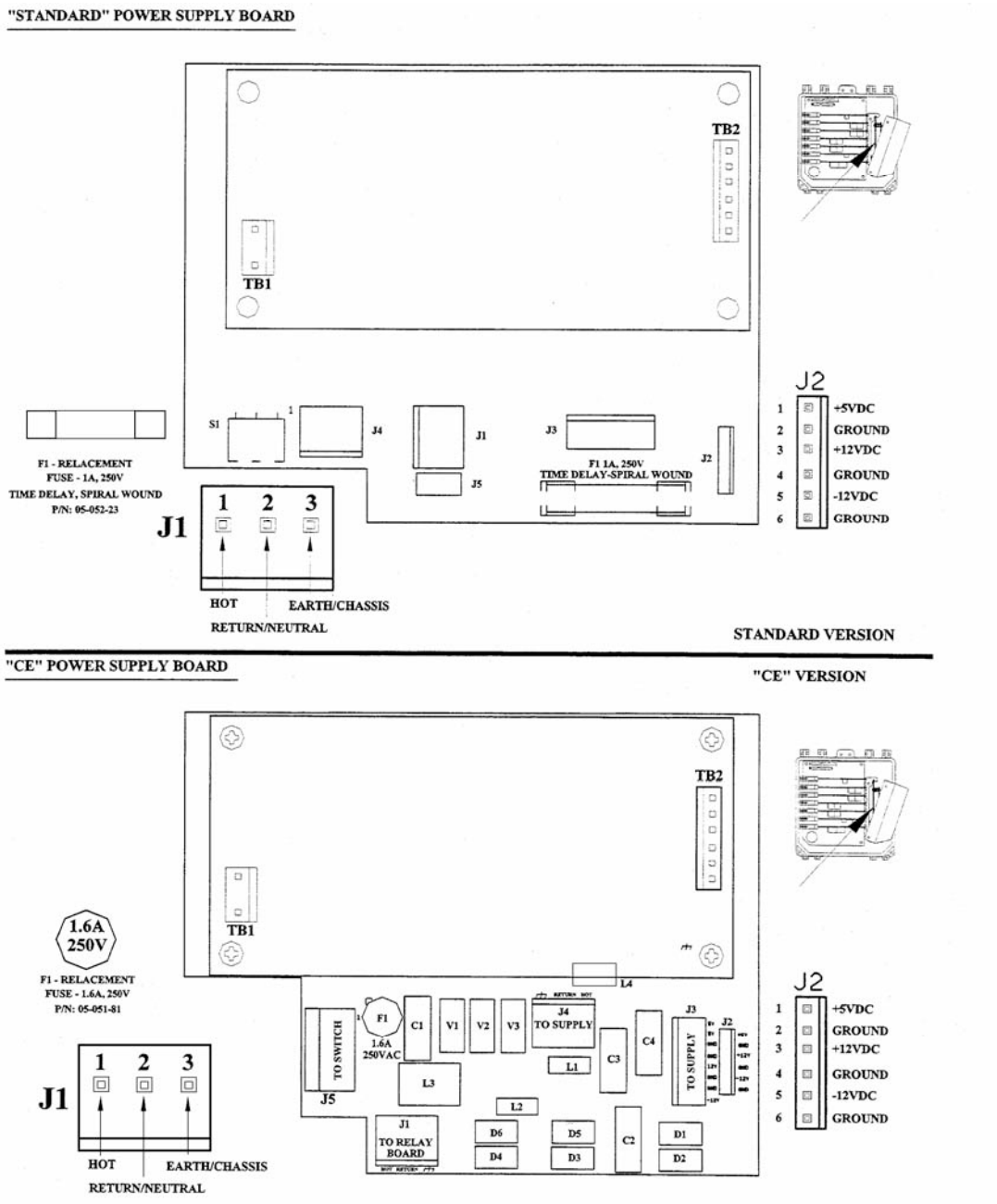


DIAGRAM 10 – POWER SUPPLY STANDARD / CE

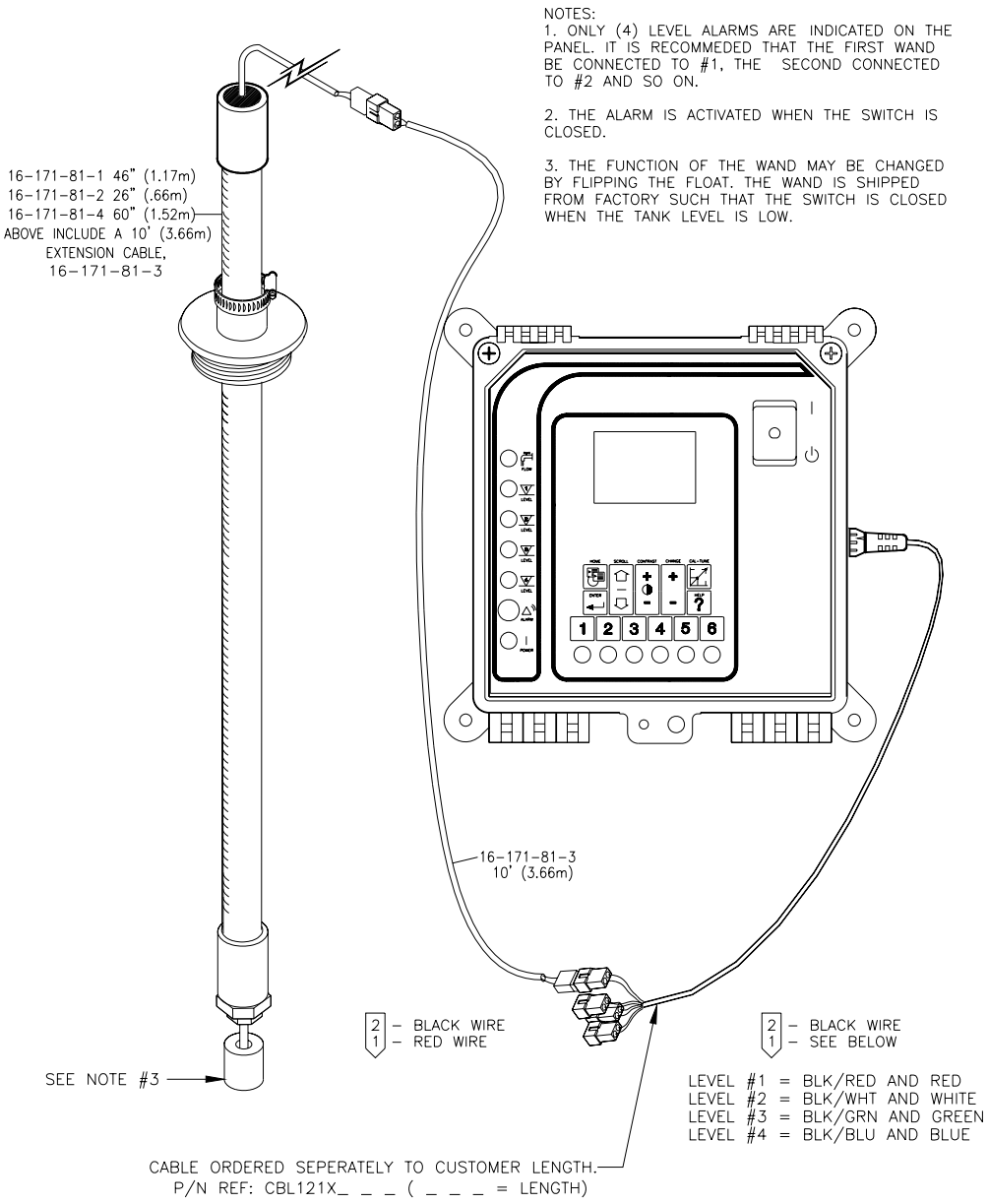
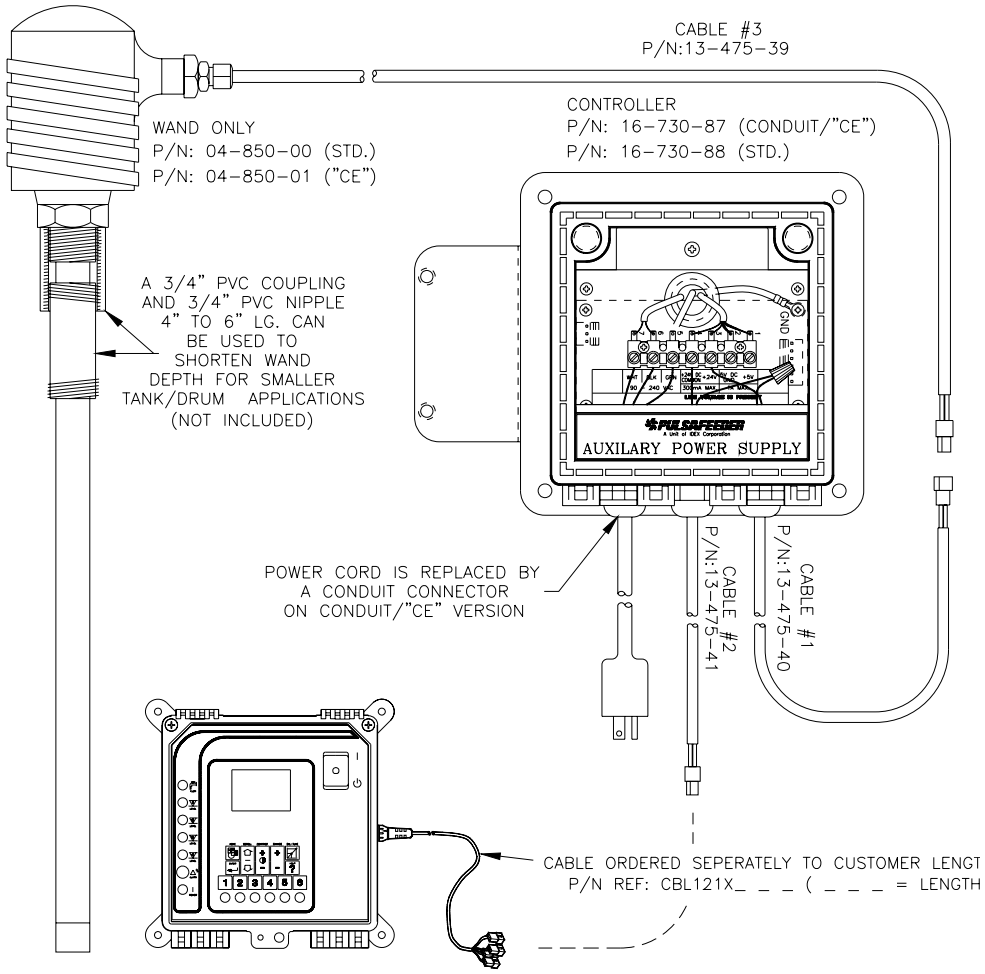


DIAGRAM 11 – SINGLE POINT DRUM LEVEL WAND

CONTINUOUS DRUM LEVEL WAND
COMPLETE KITS: 45-500-10, 45-500-11 "CE"



CUST. HOOK-UP		EXISTING CABLE CONNECTION REFERENCE		
CABLE	MATES WITH	PIN #	FROM	TO
#1	CABLE #3	#2	BLACK	WIRE NUT TO CABLE #2 RED
		#1	RED	TERM. BLOCK +24V
#2	CONTROLLER 4-20mA INPUT	#2	BLACK	TERM. BLOCK 24V DC COM
		#1	RED	WIRE NUT TO CABLE #1 BLK
#3	CABLE #1	#2	BLACK	SENSOR (-)
		#1	RED	SENSOR (+)

DIAGRAM 11A – CONTINUOUS DRUM LEVEL WAND

8. Specifications

(Factory settings are default values)

General

Power Input	90-250 VAC @ 50/60 Hz 100 VA.
Control Output	Line voltage @ 600 VA (5 amps @ 120 VAC) per relay.
Enclosure Pre-wired	High impact resistant Polystyrene™ designed to NEMA 4X (IP65), with convenient molded receptacle cords and power cord with molded plug for electrical connections.
Enclosure Conduit	High impact resistant Polystyrene designed to NEMA 4X (IP65), factory predrilled with easily accessible terminals for hard wiring.
Display	64 X 128 pixel dot matrix backlit display (8 line by 20 characters).
Logic Power Switch	Recessed front panel.
H/O/A Switches	Front panel keypad.
Contrast Adjustment	Front panel keypad.
Lockable Viewing Window	Standard
Security Code	Multiple standard.
Environment	Ambient temp. 0°F (-17.8°C) to 122°F (50°C); relative humidity 0 to 95%.
Dimensions	Width 10” (25.40 cm) X height 10” (25.40 cm) X depth 7.08” (17.98)
Controller Weight	18 lbs. (8.16 kg)
Shipping Weight	22 lbs. (9.98 kg)
Flow Switch or Interlock	Connection provided. Function activated by dip switch if mounted flow switch or remote flow switch not ordered with controller.
Inputs	8 analog and 8 digital (max - depends on model).
Outputs	4 analog and 7 relays (max - depends on model).

Conductivity Function

Sensor	Temperature compensated from 45°F (7.2°C) to 105°F (40.6°C), quick-release 3/4” (19.05 mm) glass filled polypropylene flow tee. Pressure 125 psi (8.6 BAR) @ 125°F (51.7°C).
Setpoint	Factory set rising @ 1500 µS/CM, rising.
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 @ 50 µS/CM.
High/Low Alarm	Independently adjustable high and low.

Limit Timer.....Adjustable in 1 minute increments up to 23:59. Alarm function only.

pH Specifications

Sensor.....Sealed combination type; KCl-AgCl reference with 3/4" (19.05 mm) glass filled polypropylene flow tee, 100 psi (6.8 BAR) @ 176° F(80° C).

Setpoint .....Dual setpoint with independent relays for acid and caustic. Factory set Hi 7.8 pH, Lo 6.8 pH.

Range .....0 to 14 pH.

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

Differential.....Adjustable from 0.0 to 14.0; factory setting 0.2 pH.

High/Low Alarm.....Independently adjustable high and low.

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

ORP Specifications

Sensor.....Sealed combination type; Polysaccharide Gel reference with KC1- AgC1 outer. Provided with 3/4" (19.05 mm) glass filled polypropylene flow tee 100 psi (6.8 BAR) @ 77ºF (25ºC).

Setpoint .....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.....Independently adjustable high and low.

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 displayed menu back one level in menu structure.

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

Scroll Up .....Used to move prompt to line above current line.

Scroll Down .....Used to move prompt to line below current line.

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

Arrow Keys.....Used to increase/decrease numerical settings, select between list items.

Cal-Tune .....Used to access Calibration-Tune menu directly.

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 until power is cycled or key pressed; LED color red.

THREE times - Returns control to automatic; LED off if within setpoint, green if out of setpoint.

Summary Of LED Indicator Lights

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

Flow Indicator.....Illuminates when flow is present through flow switch.

.....GREEN - Indicates flow
.....RED - Indicates no flow
.....OFF - Indicates disabled

Level Indicator.....GREEN if level OK (switch open).

.....RED if level low (switch closed).

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.

9. Factory Default Values

NOTE **Your controller may not include all of these features**

	DEFAULT
SYSTEM CONDUCTIVITY SCALE	**0-5000 (Hardware) µS/CM**
Setpoint Type	RISING/HI
Setpoint	1500 µS/CM
Setpoint Differential	50 µS/CM
High Alarm	1700 µS/CM
Low Alarm	1300 µS/CM
Alarm LED/RELAY/CALLBACK	BOTH/BOTH/BOTH
Alarm Delay	00 Sec.
Limit Timer	00:00 (disabled)
Limit Timer Alarm LED/RELAY /CALLBACK	BOTH/BOTH/BOTH
MAKE-UP CONDUCTIVITY SCALE	**0-2000 (Hardware) µS/CM**
Setpoint Format	CYCLES
Setpoint Scale	0-2000 µS/CM
Setpoint Ranges	0-400 / 401-800 / 801-1200 / 1201-1600 / 1601
Setpoint Range Setpoints	6.0 / 5.0 / 4.0 / 3.0 / 2.0 Cycles
Setpoint Differential	40 µS/CM
High Alarm	840 µS/CM
Low Alarm	360 µS/CM
Alarm LED/RELAY/CALLBACK	BOTH/BOTH/BOTH
Alarm Delay	00 Sec.
SYSTEM pH SCALE	**0-14 pH**
Setpoint Type	DUAL
Hi Setpoint	7.8 pH
Lo Setpoint	6.8 pH
Setpoint Differential	0.2 pH
High Alarm	8.3 pH
Low Alarm	6.3 pH
Alarm LED/RELAY/CALLBACK	BOTH/BOTH/BOTH
Alarm Delay	00 Sec.
Limit Timer	01:30
Limit Timer Alarm LED/RELAY/CALLBACK	BOTH/BOTH/BOTH
SYSTEM ORP SCALE	**0-1000 mV**
Setpoint Type	FALLING/LOW
Setpoint	400 mV
Setpoint Differential	50 mV
High Alarm	500 mV
Low Alarm	300 mV
Alarm LED/RELAY/CALLBACK	BOTH/BOTH/BOTH
Alarm Delay	00 Sec.
Limit Timer	01:30
Limit Timer Alarm LED/RELAY/CALLBACK	BOTH/BOTH/BOTH

4-20mA INPUT	**NONE**
Units	NONE
High Alarm	0
Low Alarm	0
Alarm LED/RELAY/CALLBACK	BOTH/BOTH/BOTH
Alarm Delay	00 Sec
4-20mA OUTPUT	**0-20 mA**
Type	Input 1
Scale	None
LEVEL INPUT	
Type	Level
Active	Closed
Time	5 Seconds
Relay Links	NO / NO / NO / NO / NO / NO
Alarm LED/RELAY/CALLBACK	YES / YES / YES
FLOW INPUT	
Type	Flow
Active	Closed
Time	1.5 Seconds
Relay Links	YES / YES / YES / YES / YES / YES
Alarm LED/RELAY/CALLBACK	YES / YES / YES
TIMER	
Type	DISABLED
TIMER: LIMIT	
Run Time	01:30 HH:MM
TIMER: PERCENT	
Percent	0%
Percent Minutes	10
TIMER: PERCENT POST BLEED	
Bleed Percent	0%
Maximum Time	01:30 HH:MM
TIMER: PULSE	
Run Time	00:30 MM:SS
Pulse Set	10
Water Meter	One
TIMER: 28-DAY	
Run Time	01:30 HH:MM
Lock Out	00:00 HH:MM
Pre Bleed	00:00 HH:MM
↓ORP Maximum	0mV
Conductivity Minimum	0 µS/CM
Program: Start Time	00:00 HH:MM
Program: Month	EVERY MONTH
Program: Week	EVERY WEEK

Program: Day	NO DAY

TIMER: CYCLE

Off Time	01:30
On Time	00:30
Cycles/Day	12
Program: Start Time	00:00 HH:MM
Program: Month	EVERY MONTH
Program: Week	EVERY WEEK
Program: Day	NO DAY
Timer:	Slaved to
Relay Links	NO / NO / NO / NO / NO / NO

WATER METER

Active	CLOSED
Time	.80 sec
Relay Links	NO / NO / NO / NO / NO / NO
Gallons per Pulse	100

SECURITY

Master Password	(NONE)
User Password	(NONE)
Calibration	NO
Setpoints	NO
Timers	NO
Data Collection	NO

COMMUNICATIONS

Baud Rate	19200
Interval	1 minute
Event Driven	Off
Modem Setup String	&FE0V0X4S0=1&D0
Alarm LED/RELAY/CALLBACK	NO / NO / YES
Callback: Active	OFF
Callback: Device ID	DEVICE0
Callback: Remote Number	(NONE)
Callback: Pager Number	(NONE)
Callback: Pager ID	,1,2,3,4,*001*?*#

FACTORY INITIALIZE

Alarm LED/RELAY/CALLBACK	YES / YES / NO

10. Trouble Shooting Guide

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

Mother Board

Symptom	Probable Cause	Possible Solution
Keypad Sluggish / Locked Up.	Serial communications in progress.	• Wait for response. • Discontinue serial communications/disable alarm callback. • Cycle power.
No Display (See Power Supply first).	Improper contrast.	Adjust using [CONTRAST UP] / [CONTRAST 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 cable from power supply. Check power supply.
	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.	Replace.
	Power applied to digital input.	Disconnect ribbon cable from relay board to mother board – check digital inputs with volt meter.
	Mother board failure.	Run diagnostics. Turn mother board S1 - 7 & 8 'ON' (see ***Section 7, Diagram 7***) then cycle power. Replace mother board and software.
	Bad EPROM.	Replace EPROM.
	Power surge.	Factory re-initialize. Turn mother board S1 - 8 'ON' (see ***Section 7, Diagram 7***) and cycle power.
	Loop powered outputs from 4-20mA card.	Remove input.
Display too dark or light.	Contrast off due to temperature fluctuation.	Adjust contrast. Control ambient temperature.
Display backlit, but not working.	Mother board/EPROM failure.	Re-initialize. Replace mother board.
	Power supply voltage out of specification.	Replace.
Erratic Readings.	Improperly grounded power.	Assure power and ground integrity. Shields of all sensors should be connected at controller end only.
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 ***Section 7, Diagram 7***. TURN POWER ON.
Flow Light Stays On (Green) in No Flow	Flow switch stuck up.	Clean flow sensor (see ***Section 11, Maintenance***).
	Flow switch cap bad.	Check for wire integrity or replace flow cap.

Condition.		Check relay board positions 11 and 12 on J11 for installed jumper. Refer to ***Section 7, Diagram 4***.
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 (3.8 l/m) minimum.
	Bad shuttle.	Replace shuttle. Refer to ***Section 11, Maintenance***.
	Bad flow cap.	Replace cap.
	Wiring loose or incorrect.	Check flow switch wiring connections on relay board. Refer to ***Section 7, Diagram 4***.
Level Lights remain Green with Low/No Level Input.	Level switch dirty or stuck.	Clean level.
	Level magnet in wrong orientation.	Reverse magnet orientation.
	Bad/wrong switch type.	Assure dry contact (reed switch) type.
	Wiring loose or incorrect.	Check level wiring to quick connect. Refer to ***Section 7, Diagram 4***, then to ***Section 7, Diagram 11***.
	Float bouncing.	Contact must continuously be closed for 15 seconds for the controller to recognize.

Power Supply Board

Symptom	Probable Cause	Possible Solution
NO POWER LIGHT.	Power switch off.	Turn power switch ON.
	Blown fuse.	Replace fuse on Power Supply board. See ***Section 7, Diagram 10***, for replacement information.
	No power supplied.	Check power source.
	Interconnecting cables loose.	Check connections.
Use the Following Procedure to Diagnose Power Related Problems: **CAUTION – MAIN VOLTAGE WILL EXIST AT THE CONNECTIONS YOU TEST!**	1. Check power at source (into relay board at J12 Phoenix connector). If power is there, proceed, if not, check supply power. 2. Check for power to the power supply at J13 on relay board. If power is there, proceed, if not, replace relay board. 3. Check power after the wire cable from J13 to the power supply J1 (see ***Section 7, Diagram 10***). 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. See ***Section 7, Diagram 10*** for replacement information. 5. Check voltages at output of power supply J2 (see ***Section 7, Diagram 10***). If okay, proceed, if not, check power switch is turned on. If still no voltage, replace power supply. 6. Check voltages at mother board J12 (see ***Section 7, Diagram 7***). 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 the ***Mother Board*** section of trouble shooting guide.	

Relay Board

Symptom	Probable Cause	Possible Solution
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. Runs between J10 on relay board and J3 on mother board (see ***Section 7, Diagram 4 and Diagram 7***). 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. See ***Section 7, Diagram 4***, for replacement information.
	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	Possible Solution
Front Panel Blowdown LED Stays On.	Conductivity of water is above setpoint, 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 setpoint number below system setpoint.	Check cycles setting. Adjust if required.
Conductivity of Controller Decreases while System Con–ductivity Increases.	Fouled sensor.	Clean sensor.
Conductivity of System Stays Lower Than Setpoint, Never Or Rarely Blows Down.	Uncontrolled blowdown.	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. Close manual blowdown valve. Fix leaks in cooling system.
Conductivity Reading Drifts Lower than Sample Tested.	Sensor fouled. Calibration procedure not carefully followed.	Clean sensor. Re-calibrate. Perform calibration. Follow stabilization time cautions. If decrease continues, necessitating frequent cleanings, try calibrating without cleaning. Slight coatings can be compensated for with re-calibration.
	Calibration point not near setpoint.	Re-calibrate with solution near setpoint.
	Poor grounding of water sample.	Tie flow assembly near sensor to earth ground.

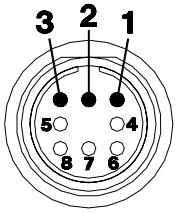
(NOTE: A zero or low makeup conductivity reading will cause cycles to sky rocket! Refer to conductivity section of troubleshooting)

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 Setpoint.	Setpoint 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.
Chemical Pump Not Activating.	Fuse bad.	Replace fuse.
	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 ***Section 7, Diagram 5***.
	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 ***Section 7, Diagram 5***.
	Flow Assembly improperly grounded.	Check wiring. Install grounding clamp on stainless nipple near conductivity sensor.
Conductivity is 0.	Scale settings incorrect or no scale switch selected.	Check switch settings on daughter card and scale in software selection.
	Air lock.	Review plumbing.
	Corroded sensor.	Replace.
	Wiring connections loose.	Check and rewire if necessary, sensor connection on conductivity board.
	Improper calibration.	Review procedures.

	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 ***Section 7, Diagram 5***.
	Reading is over scale selected.	Change to a higher scale.
	Failed temperature compensation network in the sensor.	Check sensor. See note below. 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' (15.25 m).
	Serial line integrity damaged.	Replace wiring or cord.

NOTE: RE-INITIALIZATION RETURNS ALL SCALES TO DEFAULTS. DON'T FORGET TO CHANGE SWITCHES ON CONDUCTIVITY CARD OR SCALES AFTER RE-INITIALIZATION.

Check a conductivity sensor using a volt meter readings ohms:



Pin #1 Red Lead ↔ Should read an open circuit

Pin #2 Black Lead

Pin #3 White/Clear Lead ↔ Should read 10K (Temp. comp.)

Short across conductivity sensor → Display should read full scale for cooling towers

Cooling Tower pH

Symptom	Probable Cause	Possible Solution
Inability To Calibrate pH.	Fouled pH sensor.	Clean sensor. Refer ***to Section 11, Maintenance***.
	Faulty pH sensor.	Replace sensor.
	Incorrect calibration.	Review procedures. Refer to ***Section 5***.
Front Panel pH Feed LED Off and: • **pH Above Rising Setpoint** • **pH Below Falling Setpoint**	Limit timer timed out.	Change the limit timer value. If the Limit Timer has timed out a alarm will show-up on the alarms screen.
		Verify: pump setting chemical drum level
		Check for leaks.

Front Panel pH Feed LED Stays On, and: • **pH Above Rising Setpoint** • **pH Below Falling Setpoint**	Restriction in sample line.	Check for flow in sample stream and: • Clean strainer. • Clean sample line.
	Pump lost prime.	Prime pump.
	Chemical drum empty.	Replenish chemical supply.
		Reset Timer: 1) Interrupt flow through flow assembly if installed. 2) Satisfy the condition by manually feeding, etc. 3) Change limit timer setting.
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.

4-20 mA INPUT

Symptom	Probable Cause	Possible Solution
No Reading	Input disabled.	Select unit other than 'NONE'.
Not Responding Reads 0.	Sensor not supplying power.	Add power supply to current loop.
	Loop fuse blown.	Change fuse. See ***Section 7, Diagram 6***.
	Sensor malfunction.	Check output of sensor with multimeter.
	Connection polarity.	Reverse connection.
	Improper calibration.	Re-calibrate. See ***Section 5***.
	Improper settings.	Check mode selection.
	No water meter input.	Check meter and wiring.

4-20mA OUTPUT

Symptom	Probable Cause	Possible Solution
Not Responding Improper Response.	Incorrect input selected.	Correct input selection.
	Connection polarity.	Reverse connection.
	Improper calibration.	Re-calibrate. See ***Section 5***.
Signal at Max.	Connected device supplying loop power.	Disable power supply to loop on remote device

TIMER

Symptom	Probable Cause	Possible Solution
Timer Does Not Activate.	No flow.	Restore flow.
	Improper settings.	Check type selection.
	No water meter input	Check meter and wiring.
	Timer locked out during biocide feed.	Wait for biocide to finish.
	Timer exceeded.	Reset by interrupting flow, satisfying the condition, cycling power, or changing setting.
	Improper settings.	Check type selection settings.
No Output for a Particular Function.	Timer exceeded.	Interrupt flow if flow switch included. Cycle power or satisfy control parameters.

TIME, SETTINGS, HISTORY

Symptom	Probable Cause	Possible Solution
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 ***Section 7, Diagram 4***.
	Experiencing data changes with brownouts when it falls below 90V.	Perform factory Re-Init located in Configure menu. Install surge suppressor. Refer to ***Factory Re-Installation.***

Serial/Modem Communications: Modem will not answer a phone call.

Symptom	Probable Cause	Possible Solution
You have purchased the Serial Communications Option and attached the controller to the phone line with the cables provided. You dial the controller's telephone number with a voice phone (i.e., the type of phone that you would use to call your mother) and the extension rings but the controller's modem does not answer (i.e., the line continues to ring).	Modem option not installed.	Open controller and verify installation of Modem Module. See ***Section 7, Diagram 9A***. If necessary, purchase upgrade.
	Digital Phone System.	The phone line your controller is attached to must be analog. Contact your telephone service provider to determine if the line is digital. Digital phone lines are common in newer PBX systems. Digital phone systems tend to have special phones that all look similar. Analog service is installed in most residential locations. Digital phone lines can damage the modem module and void your warranty.
	Phone line adapter not used.	The cord that exits the controller with the RJ-45 connector is NOT wired in accordance with standard telephone wiring conventions. If you are installing the controller without the telephone line adapter, the RJ-45 outlet box must be wired in accordance with the Telephone line adapter. See ***Section 7, Diagram 9B***.
	Modem setup string problem.	The modem setup string must contain the command S0=1 to tell the modem to pick up the line. If this command is missing the modem will not pick up the line. If you are attempting to use an external modem with the controller, it is possible that the modem is rejecting the setup string and disregarding the S0=1 command. Use the **QUICK TESTS, Initialize MODEM** selection to verify setup string acceptance.

	Incorrect BAUD rate setting	If you are attempting to use an external modem with the controller, it is possible that the modem is rejecting the setup string due to the selection of an unsupported BAUD rate. Consult your modem documentation to determine the supported baud rate. The standard 14.4K BAUD internal modem will support all BAUD rate options. The non-standard 2400 BAUD internal modem will only support baud rates of 2400 and below.
	Cable/Connection problem.	If one of the cables or connections is faulty, the modem may fail to pick-up the phone line. To verify the connections, open the controller and observe the Red and Green LED's near the ejector latch on the Serial Communications Daughter Card. Use a voice phone to dial the controller's phone number. Observe the Green LED. It should flash briefly every time the phone rings. If it does not, check the cable connections. Use ***Section 7, Diagram 9B*** to verify conductivity between the TIP and Ring lines for the telephone line to the controller.

Serial/Modem Communications: Modem answers and synchronizes, but will not communicate.

Symptom	Probable Cause	Possible Solution
You have purchased the Serial Communications Option and attached the controller to the phone line with the cables provided. You dial the controller's telephone number with your communications package. At your PC, you hear the line ring, the controller answer and the remote modem's carrier (a sound similar to the squealing of truck brakes). The carrier tone stops, but your communications package reports a communications error.	Modem setup string problem.	Use the **QUICK TESTS, Initialize MODEM** selection to verify setup string acceptance. Follow the Quick Tests trouble shooting item in the Trouble Shooting Guide section of this addendum. If you are attempting to use an external modem with the controller (a non-standard configuration), it is possible that you are not using the correct setup string. Some modems will communicate across the phone line at one baud rate (modem-to-modem), then communicate to the attached equipment at another (modem-to-controller). The standard internal modem works in this fashion. Other modems will carry the baud rate through the entire connection (modem-to-modem and modem-to-controller). These modems need to be told to use the modem-to-controller baud rate through the entire connection (modem-to-modem and modem-to-controller). To do this, try adding the &B1 command to the end of the setup string as follows: **"&FE0V0X4S0=1&D0&B1"**. Then set the controller's BAUD rate to a known good BAUD rate for the modem (9600 or 19200 BAUD tend to be widely supported). Consult your modem documentation for further setup-string information.
	Incorrect BAUD rate setting at controller.	In the **COMM SETTINGS** menu, select the baud rate at which you plan to communicate. For example, if you have a 2400 baud modem on your PC, set the BAUD rate to 2400. Typically, you can improve performance by selecting a BAUD rate that is higher than the communications rate (that is why the default for the internal modem is 19.2K even though the modem is only capable of 14.4K). Once you get your connection working you can try higher BAUD rates to determine if you can increase performance. **The standard 14.4K BAUD internal modem will support all BAUD rate options. The non-standard 2400 BAUD internal modem will only support baud rates of 2400 and below**. Follow the solutions for the 'Modem Setup String Problem' Probable cause in this section.

Incorrect BAUD rate setting at the PC.	While many modems claim to be Hayes compatible, it only means that they conform to the Hayes command set. It does not mean that the modem defaults conform to the Hayes standard. Therefore, it is possible that a given modem will not work with your communications setting. Begin by setting your PC communications package modem connection to the same rate set in the **COMM SETTINGS** menu and one that is within the capacity of your modem (at or below the publicized baud rate of the modem - if you are using a 14.4KBAUD modem try 9600). Try updating your serial communications package. Due to this problem, newer communications software will automatically adjust its baud rate to conform to the modems baud rate.
Serial Communications daughter card not installed properly.	Assure that the serial communications daughter card is firmly seated in the connector and that all pins mate properly. Note that the connector has a double row of pins. Assure that the pins are not offset from the connector by one row.

Quick Tests: Initialize Modem / Quick CALLOUT / Quick PAGE Time Out Error.

Symptom	Probable Cause	Possible Solution
When performing a **Quick Test** (**Init MODEM, Quick CALLOUT** or **QUICK PAGE**) the following message sequence displays: **'Initializing...'** followed by **'Time Out ERROR !!!**'. This typically means that the controller was not able to communicate with your modem.	Internal/External modem cannot communicate at the selected baud rate.	In the **COMM SETTINGS** menu, change the BAUD rate to one that works with your modem. Refer to ***Section 4, Controller Set up*** for further information.
	Internal/External Modem is busy. (e.g., it has the phone line off the hook and is ignoring commands).	Wait 60 seconds and try the test again.
	Internal Modem not installed / damaged.	Disconnect power. Open controller and examine installation of modem module. Assure module is firmly seated and all pins meet with socket (2 pins are missing from this device - this in normal). Refer to ***Section 7, Diagram 9A***.
	External Modem cable not configured properly.	If you are using an External modem, it is possible that the cable has a bad connection. Refer to ***Section 7, Diagram 9B*** for cable pin outs.
	Dial-up also not functioning.	Refer to the ***Section 10, Trouble Shooting – Serial/Modem Communications***: Modem will not answer a phone call for further diagnostic steps.
When performing a **Quick CALLOUT,** or **Quick PAGE** the following message sequence displays: **'Initializing... 'OK' 'Dialing XXXXXXX'** then possibly **'CONNECT'** and finally **'Time Out ERROR !!!'** or **'No Dial Tone'**. This	The phone line is not correctly attached to the Communications Daughter Card.	Verify correct wiring. Make sure all connections are tight and protected from water. Refer to ***Section 7, Diagram 9B*** for further wiring information.
	The phone number is not configured properly.	Check the **CALLOUT** and **PAGE** phone numbers in the **ALARM CALLBACK** setup menu. If you are dialing out through a PBX system, do not forget the outside line access code (e.g., you must dial 90 to gain access to an outside line**). Note: If you are calling a local number, do not enter an area code in the dialing prefix**.
	The remote computer is not turned on and running your communications package.	Check the number. Using a voice phone near the controller's location, dial the number of the remote computer or pager service. You should hear either the modem carrier or pager prompt when the remote system picks up the line.

typically means that the controller was able to communicate with your modem, but could not communicate with the remote device.	Local phone line extension is digital.	The internal modem will not operate on a digital phone line. Check with your phone service provider to determine if the line is analog (OK) or digital (BAD). If necessary, upgrade the service.

Quick Tests: Message Definitions

Symptom	Probable Cause	Possible Solution
Initializing	The controller is attempting to talk to the modem.	None. Good response.
Dialing XXXXXXX	The controller is dialing the phone number.	None. Good response. Do not be alarmed if the end of the dial string is cut off. The length is limited by the display. The controller will still issue the entire dial string to the modem.
Operation complete!	Test has completed successfully.	None. Normal response.
No number available.	You are attempting to perform a dial test (i.e., **CALLBACK** or **PAGE**), but do not have a phone number configured.	Go to the **CALLBACK** setup menu and enter the required phone number.
Time Out ERROR!!!	The controller timed out while waiting for a response from an attached piece of equipment.	Refer to **QUICK TESTS** trouble shooting section.
OK	The modem accepted the string that was sent to it.	None. Normal response.
CONNECT	The modem connected to another modem.	None. Normal response.
RING	The phone line is ringing.	None. Normal response
NO CARRIER	The modem dialed the number, the remote system answered, but it did not issue a carrier used to synchronize baud rates.	Check the modem on the remote system. Check the cabling. Normal response at the end of the **Quick CALLOUT** test.
NO DIALTONE	The modem attempted to dial the phone number but could not detect a dial tone first.	Check the telephone jack cabling. Refer ***to Section 7, Figure 9B***.
BUSY	The modem dialed the designated number and received a busy signal.	Repeat the test later. Check the number with a voice phone (the phone number could be incorrect).
NO ANSWER	The modem dialed the designated number. The line was not answered after the limit number of rings (typically 10).	Check the status of the remote system. Confirm that the phone number is entered correctly.

REINTIALIZATION

If the above troubleshooting steps fail to explain or solve condition, perform a factory re-initialization (refer to ***Factory Initialize***). If condition still exists, contact factory for customer service assistance. A Return Authorization (RA) number is required for any return.

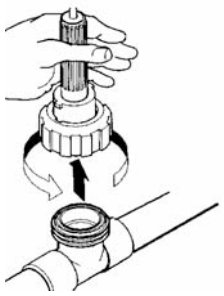
11. Maintenance

The only maintenance required on your controller 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.

11.1 Conductivity Sensor removal and cleaning

11.1.1 To remove the conductivity sensor from its tee for cleaning:

1. Remove power to the system.
2. Remove pressure from the system prior to unscrewing the sensor by closing the 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).



11.1.2 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.

11.1.3 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.

   Some fouled sensors might require dipping in a mild solution of muriatic acid in order to remove fouling.

USE PROPER HANDLING PROCEDURES INCLUDING RUBBER GLOVES, EYE PROTECTION AND PROTECTIVE CLOTHING, WHEN HANDLING ANY ACID SOLUTION.

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.

11.1.4 To clean the Carbon Graphite sensor:

1. Immerse 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.

11.2 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 or bottle filled with a junction wetting agent.

11.2.1.1 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.

11.2.1.2 Sensor Storage

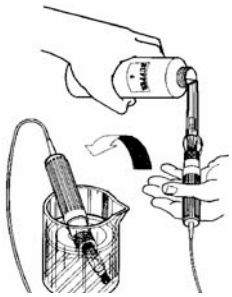
To maintain response, sensors should always remain wet. The preferred storage solution is pH 4.0 buffer with saturated KCl added. Tap water will suffice for short term storage.

Do not soak in distilled water. The supplied storage boot or bottle will provide an ideal chamber for lengthy storage.

11.2.1.3 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 60-80°C (139-176°F). 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.

11.3 ORP Sensor Information

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

11.3.1 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.

11.3.2 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 satisfactory readings are obtained, install sensors and make measurements of liquid in question.

USE PROPER HANDLING PROCEDURES INCLUDING RUBBER GLOVES, EYE PROTECTION AND PROTECTIVE CLOTHING, WHEN HANDLING ANY ACID SOLUTION.

11.4 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 the 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 the post that the 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.

12. Make-Up Conductivity: Understanding Cycles Operation

12.1 Operation

If your controller is equipped with make-up conductivity, the blowdown valve is controlled by the lower of the two setpoints. One setpoint is specified normally as the System Conductivity Setpoint, the other is calculated from the Make-up Conductivity.

The System Conductivity Setpoint is simple to understand. If you enter a Setpoint of 1,000 µS/CM, the blowdown 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 Setpoint in the Make-up Conductivity setup, you enter a Setpoint 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 Setpoint, the blowdown valve will activate. But, don't forget, the System Conductivity Setpoint is active at the same time! Whichever Setpoint 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 Setpoint is 2800, the Make-up Setpoint 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 Setpoint (2000 is less than the Setpoint of 2800), and the System Cycles are below the Make-up Setpoint (4.00 is less than the Setpoint 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 blowdown valve will open because the Make-up Conductivity Setpoint of 5.00 Cycles has been exceeded (5.20 is greater than the Setpoint of 5.00). The System Conductivity Setpoint is ignored (2600 is less than the Setpoint 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 blowdown valve will be opened because of the Make-up Conductivity Setpoint of 5.00 Cycles (10.00 is greater than the Setpoint of 5.00). The System Conductivity Setpoint is ignored (2000 is less than the Setpoint 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 blowdown valve will be opened because of the System Conductivity Setpoint of 2800 µS/CM (3000 is greater than the Setpoint of 2800). The Make-up Setpoint is ignored (4.00 is less than the Setpoint of 5.00).

Your controller offers 5 Cycle Setpoints. Each Cycle Setpoint is effective over a given range of Make-up Conductivity. 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	Setpoint
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 Setpoint is 6 Cycles. If the Make-up Conductivity is 1,100 µS/CM, the Setpoint is 4 Cycles.

12.2 Factory Setting For Make-Up Conductivity Cycle of Concentration

12.2.1 0-2,000 µS/CM Scale Factory Configured

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	6 cy	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	& over	2 cy	1601	& over	2 cy	4001	& over	2 cy	8001	& over	2 cy	16001	& over	2 cy
Hi - 210/Lo - 90			Hi - 840/Lo - 360			Hi - 2100/Lo - 900			Hi - 4200/Lo - 1800			Hi – 8400/Lo - 3600		

12.3 Factory Setting For Make-Up Conductivity Setpoint

12.3.1 0-2,000 µS/CM Scale Factory Configured

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	400	0	400	1000	0	1000	2000	0	2000	4000	0	4000	8000
101	200	800	401	800	2000	1001	2000	4000	2001	4000	8000	4001	8000	16000
201	300	1200	801	1200	3000	2001	3000	6000	4001	6000	12000	8001	12000	20000
301	400	1600	1201	1600	4000	3001	4000	8000	6001	8000	16000	12001	16000	20000
401	& over	2000	1601	& over	5000	4001	& over	10000	8001	& over	20000	16001	& over	20000
Hi - 210/Lo - 90			Hi - 840/Lo – 360			Hi - 2100/Lo - 900			Hi - 4200/Lo - 1800			Hi - 8400/Lo – 3600		

12.4 Make-Up Conductivity Specifications

Setpoint	Rising Setpoint or Cycles of Concentration. See tables on the proceeding page.
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 High/Low Alarm	Adjustable; factory set at 40 µS/CM. Adjustable; independent setpoint of high and low alarm. See tables on the proceeding page.

12.5 Make-Up Conductivity accessories

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

1. Isolation Valves, to isolate for maintenance.

13. External Modem Setup v1.1

13.1 Background

The controllers are designed to communicate with an external modem. The following gives guidance for configuring your controller and external modem for use.

13.2 Modem Programming

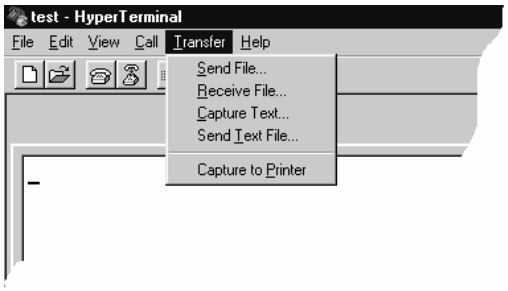
This step is only required if your modem defaults to the DTR Active setting. This means the modem must see an attached terminal to accept commands. The controller does not support DTR. Therefore, you must pre-configure the modem to work with the controller. To do this, you will need to attach the modem to a PC and run a Terminal program. If you have access to Microsoft Windows 95 or 98, you can use the included program called HYPERTRM.EXE (located in the C:\Program Files\Accessories\HyperTerminal directory). The following instructions detail the use of this program:

1. Install the controller's communications program on the computer. The installation directory includes several files that will be used by the HyperTerminal program.
2. Start Explorer. Navigate to the installation directory.
3. Connect the modem to the COM port on the computer using the cable that was provided with the modem (usually a gray cable approximately 50cm in length with a 9 pin female connector on the PC end and a 25 pin male on the modem end).
4. Plug the modem in and turn it on.

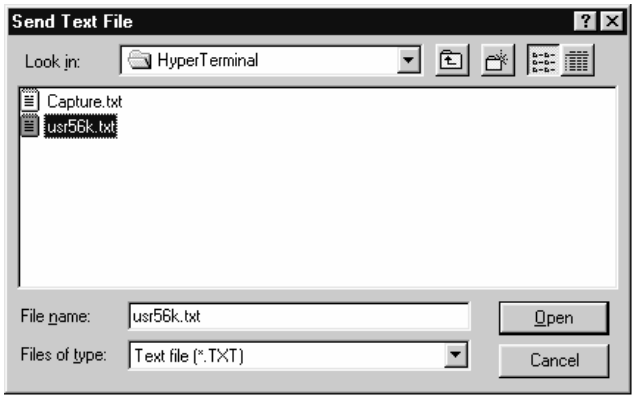
5. Note the COM port number (usually COM1). Using this information select a file name from the following table:

COM	File Name
COM1	COM1.ht
COM2	COM2.ht

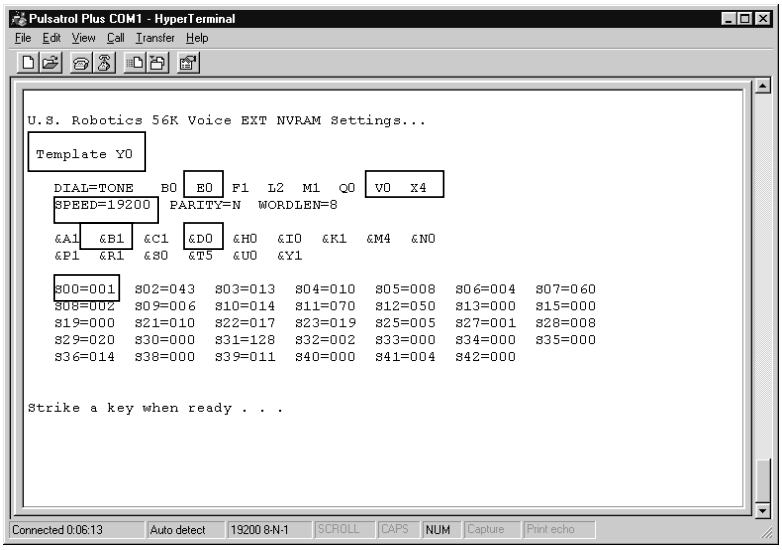
6. Locate the selected file (e.g., COM1.ht) in the controller communication software's installation directory. Double click on the file to start the HyperTerminal Program.
7. After the initial HyperTerminal 'splash' screen, the terminal window will open. If you receive any error message (e.g., Unable to open COM1), do not proceed. This message indicates that there is either another program (e.g., fax software, etc.) or conflicting hardware (e.g., the mouse is using the COM1 port). Either close the conflicting program or remove the conflicting device.
8. Send the configuration string to the modem. Click on Transfer then Send Text File.



9. The Send Text File dialog is displayed. Navigate to the controller's communications software installation directory and locate the **usr56k.txt** file. Select it and click on Open.



10. The **usr56k.txt** file will be transmitted to the modem. The response should be immediate. The window is displayed as follows without the boxes. These have been added to aid you in the identification of the important settings.



The following table defines the significance of each:

Text	Purpose
Template YO	Indicates the displayed template number (0). The ATZ1 command calls this template.
E0	The Local echo is set to OFF (set with the ATE0 command).
V0	The modem will return numeric result codes (set with the ATV0 command).
X4	The modem will return advanced results codes (set with the ATX4 command).
SPEED=19200	The modem's serial port speed. This is fixed with the AT&B1 command. This must read 'SPEED=19200'. Otherwise, the modem will not communicate properly.
&B1	The modem's serial port rate will be fixed (set with the AT&B1 command)*.
&D0	The modem's Data Terminal Ready pin will be overridden (set with the AT&D0 command).
S0=001	The modem will answer the phone after 1 ring (set with the ATS0=1 command).
* The &B1 command is specific to 3COM/USRobotics modems only. It is not part of the AT&T or Rockwell standard command sets. As such, issuance of this command may result in an ERROR (4) response code.	

11. Power the modem off.
12. Power the modem on.
13. Type 'ATI4' and [ENTER]. The modem will display its current operating settings. Compare these to those described in step 15. If there are any differences repeat section **13.1 MODEM PROGRAMMING**.

13.3 Hardware preparation

1. Disconnect power from the controller.
2. Open the controller's front panel by loosening the two screws at the top of the front panel.
3. Attach the modem to the controller with the supplied adapter. Plug the adapter into the port on the back of the modem (typically, a 25-pin DB style connector). Plug the white cable from the controller directly into the adapter.

NOTE **Your controller may have also shipped with a telephone line adapter. This looks like a little square box with a small piece of telephone line coming out of one side. Do not use this device to connect to the external modem. Plug the controller's cable directly into the modem adapter.**

4. Apply power to the modem. The following LED's on the modem's faceplate should illuminate: AA, TR, CS. These indicate that the modem is in Auto Answer mode (AA), the attached Terminal (PC in this case) is ready (TR), and the modem is Clear to Send data (CS). If these LED's are not illuminated, return to **13.1 MODEM PROGRAMMING**.

Refer to the following table for further LED information.

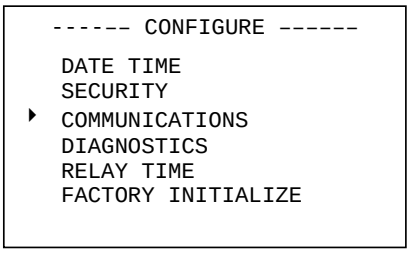
LED Label	Meaning
AA	Auto Answer. When on, it means that the modem will answer an incoming call. It flashes when the incoming line is ringing.
CD	Carrier Detect. Off when not connected to another modem. On when connected.
RD	Receive Data. Flashes when the modem is sending data to the controller.
SD	Send Data. Flashes when the controller is sending data to the modem.
TR	Data Terminal Ready. It means that the controller is ready to receive characters from the modem. This LED should illuminate whether the controller is connected or not since it is forced ON with the &D0 command.
CS	Clear to Send. On when it is ok for the controller to send data to the modem. The controller ignores this line.
ARQ/FAX	Error control / Fax. On when the modem is using error control to communicate to another modem.
OH	Off Hook. On when the modem has picked up the phone line to answer an incoming call.

5. Locate the Communications daughter card in your controller. It is the card that is perpendicular to the front panel located closest to panel hinge. Near card's the ejector latch, locate the TD and RD LED's. These LED's flash as the Controller sends data (TD – flashes red) and receives data (RD – flashes green).
6. Turn the controller's power on while observing the TD and RD LED's on the Communications daughter card. You should observe the TD and the RD LED's flash. Repeat the test while observing the RD and SD LED's on the modem. You should observe the SD then RD LED's flash. If you do not, check the cable between the modem and the controller.

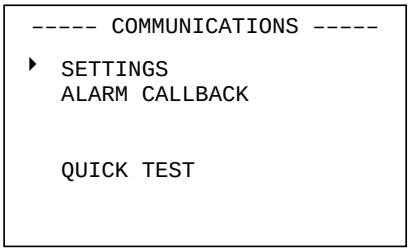
13.4 Controller Programming

If you determined in **13.1 MODEM PROGRAMMING** that your modem defaults to DTR active (i.e., you are using a US Robotics modem), then you will need to configure the controller's software to work with the modem. To do this, you will need to access the controller's COMMUNICATIONS SETTINGS menu. Use the following procedure:

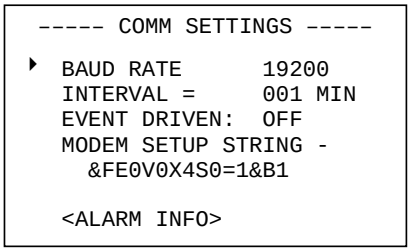
1. From the MAIN MENU use [SCROLL] to move the prompt to CONFIGURE and press [ENTER]. The CONFIGURE menu is displayed.



2. Use [SCROLL] to move the prompt to COMMUNICATIONS and press [ENTER]. The COMMUNICATIONS menu will appear.



3. Use [SCROLL] to move the prompt to SETTINGS and press [ENTER]. The COM SETTINGS menu will appear.
4. Use [SCROLL] to move the prompt to the BAUD RATE: line. Check your modem documentation. The modem's serial communications port must be capable of supporting the baud rate setting. Typically, this setting will match or exceed the maximum communications rate of the modem. It is a good idea to use the factory default of 19200 until you know that your modem is operating properly. To change the baud rate value press [ENTER]. Use the [UP]/[DOWN] keys to select the baud rate that matches your modem's capabilities. Press [ENTER] to accept your selection.



5. Use [SCROLL] to move the prompt to the MODEM SETUP STRING line. The controller will send this string to the modem at power-up and 15 minute intervals. The elements in this string are critical to the proper operation of the controller with the modem. Modify the string to read as follows: **Z1**. To do this press [ENTER] and the prompt will move to the first character – '&' in this case. Use [UP]/[DOWN] and [ENTER] to set the value for each position to 'Z1'.

NOTE **This string setting requires the modem to be pre-programmed (13.1 – MODEM PROGRAMMING). In addition, this setting will only function at a BAUD RATE setting of 19200 (see step 4).**

6. When you have finished making your changes, press [HOME]. A confirmation screen will appear. Press [ENTER] to save your changes. Press [HOME] to abort your changes.

13.5 Modem checkout

1. Attach the modem to the controller with the supplied adapter. Plug the adapter into the port on the back of the modem (typically, a 25-pin DB style connector). Plug the white cable from the controller directly into the adapter.

NOTE **Your controller may have also shipped with a telephone line adapter. This looks like a little square box with a small piece of telephone line coming out of one side. Do <u>not</u> use this device to connect to the external modem. Plug the controller's cable directly into the modem adapter.**

2. Apply power to the modem. The following LED's should illuminate: AA, TR, CS.
3. Locate the Communications daughter card in your controller. It is the card that is perpendicular to the front panel located closest to panel hinge. Near the card's ejector latch, locate the TD and RD LED's. These LED's flash as the Controller sends data (TD – flashes red) and receives data (RD – flashes green).
4. Turn the controller's power on while observing the TD and RD LED's. You should observe the TD and the RD LED's flash.
5. Attach a phone line to the modem (if necessary, see modem manufacturer's documentation).
6. Use a voice phone to dial the modem's phone number. The modem should pick-up the line and issue a carrier tone. If it does not. Turn both the modem and controller off. Then turn the modem on followed by the controller. Repeat the dial test. The ringing will be indicated by the flashing AA LED on the front of the modem. If the AA LED does not flash when the line should be ringing the phone line is not connected properly. Check all connections and repeat the dial test. If this fails, repeat **13.1 MODEM PROGRAMMING**.
7. Using a PC equipped with a modem dial into the controller. The modem should issue a carrier and connect to the controller. If the carrier sounds but the connection is not made, try setting the communications rate in the communications software to 19200.
8. Your modem is now ready for use.

14. Internal Modem FCC Compliance Information

The following is provided to comply with the FCC Part 68 Rules that apply to the internal modem. This device is optional and as such, may not have been ordered with your controller.

Type of Service: The Internal Modem (08-600-45/49) is designed to be used on standard device telephone lines. It connects to the telephone line by means of a standard jack called the USOC RJ-11C (or USOC FJ45S). Connection to telephone company provided coin service (central office implemented systems) is prohibited. Connection to party lines service is subject to state tariffs.

Telephone Company Procedures: The goal of the telephone company is to provide you with the best service it can. In order to do this, it may occasionally be necessary for them to make changes in their equipment, operations or procedures. If these changes might affect your service or the operation of your equipment, the telephone company will give you notice, in writing, to allow you to make any changes necessary to maintain uninterrupted service.

In certain circumstances, it may be necessary for the telephone company to request information from you concerning the equipment which you have connected to your telephone line. Upon request of the telephone company, provide the FCC registration number and the ringer equivalence number (REN); both of these items are listed on the equipment label. The sum of all of the REN's on your telephone lines should be less than five in order to assure proper service from the telephone company. In some cases, a sum of five may not be usable on a given line.

If Problems Arise: If any of your telephone equipment is not operating properly, you should immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When practical, they will notify you in advance of this disconnection. If advance notice is not feasible, you will be notified as soon as possible. When you are notified, you will be given the opportunity to correct the problem and informed of your right to file a complaint with the FCC. Contact your telephone company if you have any questions about your phone line.

15. Glossary

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

Analog – a continuous signal that can be used to represent a physical variable, e.g., conductivity, pH, or 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 – 1) to release water from the system, used to control conductivity

2) The amount of time the Blowdown valve will be held open after a hold period.

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.

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

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

Cal-Tune – button that activates the calibration-tune menu

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 (i.e., PULSAtron)

Chemical Metering Pump – see Chemical Feed Pump

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

Conduit – tubing through which wire is run

Configure – procedure to set up basic functions of the controller, i.e., date, time, setpoint 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

Cursor – See prompt

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 setpoint value (see chattering)

Dip Switch – very small switches located on a circuit board usually used in combination to configure the circuit

Double Junction – type of construction on a pH sensor where a permeable membrane separates two buffer solutions

Dry Contact – relay contacts without power

EEPROM – Electrically Erasable Programmable Only Memory

Electrodes – or sensors, the metal protrusions that measure conductivity in the conductivity sensor assembly

Float Switch – a mechanical switch that provides an electrical contact when the 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 that consists of a screw assembly that adjusts a gate that crosses the fluid flow path

GFPPL – Glass Filled Polypropylene

Ground Loops – a condition that occurs when two pieces of equipment are electrically connected but do not share the same ground point. This can result in current flow between the equipment that can result in inaccurate readings or damage to the control.

Heat Exchanger – a mechanical device that facilitates the transfer of heat between two mediums

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 power is disrupted for more than 14 days)

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

Hold – the amount of time a sample is captured before reading its conductivity

Independent Setpoint – this feature 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 disbursement 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 reset the controller to original factory conditions

Inorganic Scale Deposits – undesirable precipitate formations within the cooling tower system

Inputs – receptacles or hookups for signals delivered to the controller

Interval – the amount of time between blowdown events

Isolated Input – an input (analog or digital) that is electrically isolated from main power supply and its ground

(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 μS/CM

Mother Board – main circuit board located in controller behind the front panel

Motorized Ball Valve – a ball valve with a positioning device activated by an electric motor

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 conditions of the system under control

Prompt – a triangular pointer used to indicate the active menu line

Pulse – the action of a water meter that when equipped with a contact head, can generate a dry contact closure that can be read by 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 located at the back of the controller for relay outputs, water meter hookups, flow switch, etc.

Relay Indicators – lights (LED's) located beneath the relay keys on the face of the control panel that indicate the status of individual relays

Sample – 1) to obtain a quantity of water for test purposes,
2) the amount of time the blowdown valve will be held open

Sample Cock – see Sample Valve

Sample Cooler – a small heat exchanger designed to cool a small flow of boiler water to a temperature where it can exist in it's liquid state at standard atmospheric pressure (i.e., it is not boiling)

Sample Line – a line through which a portion of the system water flows, 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 characteristic value in the water, like the conductivity

Setpoint – the user determined value within a monitored range at which the controller initiates action (e.g., activates a relay)

Setpoint Differential – also referred to as dead band or hysteresis; the offset applied to a setpoint to prevent chattering of an output relay around a setpoint

Solenoid – an electromagnetically controlled switch

Storage Boot – small protective rubber boot or bottle 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 in the Run (ON) condition

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

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

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

µS/CM – conductivity unit of measure. Often referred to as 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

16. Index

18. 28-day timer (Biocide) Programming Work Sheet

(Please make copies of this sheet for future use)

Chemical Name _____ **Biocide** _____

Program #1 Month _____

Week _____ Day _____

Start Time: _____:_____H:M

Program #2 Month _____

Week _____ Day _____

Start Time: _____:_____H:M

Program #3 Month _____

Week _____ Day _____

Start Time: _____:_____H:M

Program #4 Month _____

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 28-Day Timer

19. Relay Assignments

Model	Relay "C"	Relay "D"	Relay "E"	Relay "F"	Relay "G"	Relay "H"	Relay "I"
Panel >	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5	Relay 6	Alarm
931X	Tower #1 Bleed	Timer #1	Timer #2	Timer #3	Timer #4		Alarm
932X	Tower #1 Bleed	ORP Feed	Timer #1	Timer #2	Timer #3	Timer #4	Alarm
933XA	Tower #1 Bleed	Acid	Timer #1	Timer #2	Timer #3	Timer #4	Alarm
933XB	Tower #1 Bleed	Acid	Caustic	Timer #1	Timer #2	Timer #3	Alarm
951X	Tower #1 Bleed	Timer #1	Timer #2	Timer #3	Timer #4		Alarm
952X	Tower #1 Bleed	ORP Feed	Timer #1	Timer #2	Timer #3	Timer #4	Alarm
953XA	Tower #1 Bleed	Acid	Timer #1	Timer #2	Timer #3	Timer #4	Alarm
953XB	Tower #1 Bleed	Acid	Caustic	Timer #1	Timer #2	Timer #3	Alarm
954XA	Tower #1 Bleed	pH	Timer #1	Timer #2	Timer #3	Timer #4	Alarm
954XB	Tower #1 Bleed	Acid	Caustic	Timer #1	Timer #2	Timer #3	Alarm
955XA	Tower #1 Bleed	pH	ORP Feed	Timer #1	Timer #2	Timer #3	Alarm
955XB	Tower #1 Bleed	Acid	Caustic	ORP Feed	Timer #1	Timer #2	Alarm
956X	Open Loop Bleed (e.g., Tower)	Closed Loop Bleed (e.g., Chiller).	Timer #1 (Open Loop System)	Timer #2 (Closed Loop System)	Timer #3 (Open Loop System)	Timer #4 (Closed Loop System)	Alarm
957X	Tower#1 Bleed	Tower#2 Bleed	Timer #1 (Tower#1)	Timer #2 (Tower#2)	Timer #3 (Tower #1)	Timer #4 (Tower #2)	Alarm

Example: A Series 9510 has the following relay assignments: Bleed, Timer #1, Timer #2, Timer #3, Timer #4 and Alarm (one unused relay position).

20. Analog Input/Output option definition

The model number string reflects the number of installed Analog Inputs and Outputs. The following chart should help define the available Inputs and Outputs on any given model.

Model	Number Analog Inputs (9500)	Number Analog Outputs (9300/9500)
XX0	0	0
XX1	0	2
XX2	0	4
XX3	2	0
XX4	2	2
XX5	2	4
XX6	4	0
XX7	4	2
XX8	4	4

Example: A model Series 554 has 2 Analog Outputs and 2 Analog Inputs.