PULSAblue
Model 3222 & 3223

WATER TREATMENT SYSTEM CONDUCTIVITY and pH/ORP CONTROLLER

INSTALLATION & OPERATION MANUAL

SERIAL #: _____

Table of Contents

Pulsafeeder™ Model 3222 / 3223 Controller

1 Quick Installation Sheet

1. **ATTACH CONTROLLER TO WALL**: Attach the four (4) supplied mounting feet to the back of the controller enclosure either vertically or horizontally. Install the controller on a flat, non-vibrating surface. Do not mount the controller to a steel object that has a large temperature change (side of cooling tower, etc). This can cause water to condense inside the enclosure.

2. **PLUMB SENSORS, VALVES, AND CHEMICAL PUMPS**: Install water meters, chemical pumps, plumbing assemblies, the pH or ORP sensor, and the conductivity sensor (see drawing on back for cooling tower). Initiate flow, Check for leaks.

3. **CONNECT INPUT/OUTPUT WIRING**: Wire the flow switch **(use jumper wire for no flow switch)**, conductivity sensor, pH or ORP sensor, water meters, and 4-20 mA outputs/inputs, if applicable (see drawings in manual). **Ensure wiring connections are correct or damage may occur.** Configure the H1 jumpers for either pH or ORP and configure the H2 jumpers for your sensor.

4. **CONNECT POWER WIRING**: Plug in chemical pumps and bleed valve to controller. If doing a conduit installation, remove receptacles and power cord. Wire the incoming power, the pumps, and the bleed valve directly to the terminals. **Motorized valves must be hardwired**. Refer to the instruction manual for more details.

5. **INITIALIZE THE WHOLE CONTROLLER**: Apply power to the controller, press "**BACK"** twice, press "**7"** System setup, press "**2"** Initialization, press "**2"** Whole controller, press "**1"** Yes. After initialization, press any key to get to the process screen.

6. **TEST THE RELAY OUTPUTS**: From the Process screen, Press "**ENT"** to get to the manual relay control screen. Use the number keys (1-7) to manually operate the relays to test your chemical pumps and bleed valve. Press "**BACK"** to return to the Process screen.

7. **CONFIGURE FOR pH OR ORP**: Press "**BACK"** to get to the main menu. Press "**7"** System Setup, press "**1"** Process Parameters, press "**2"** pH/ORP, press **"4"** to configure the controller for either pH or ORP. Press **"1"** for **pH** or press **"2"** for **ORP**. The parameters screen will change to the selected process. Press **"BACK"** several times to get to the main menu then press **"1"** to return to the process screen.

8. **CALIBRATE THE CONTROLLER**: To calibrate the controller, take a sample with a handheld conductivity/pH/ORP meter, press the "**CAL"** button, select the process to calibrate, type in the value, press "**ENT"**

PROGRAM THE CONTROLLER: Set up the digital inputs, water meters, and program the controller relays for bleed and chemical feed schemes. See instruction manual for more details..

2 Cautions and Warnings

IMPORTANT NOTICE

WARNING: CHEMICAL FEED

All electromechanical devices are subject to failure from a variety of causes. These include mechanical stress, component degradation, electromagnetic fields, mishandling, improper setup, physical abuse, chemical abuse, improper installation, improper power feeds, and exposure.

While every precaution is taken to insure proper functioning, extra precautions should be taken to limit the ability of over-feeding by limiting chemical quantities available, secondary shut-downs, alarms, and redundancy or other available methods.

CAUTION: POWER SOURCE AND WIRING

Low voltage wiring and high voltage (110 plus) should not be run in the same conduit. Always run separately. Even shielded low voltage is not a guarantee of isolation.

Every precaution should be taken to insure proper grounding and elimination of shorting or Electromagnetic field (EMF) interference.

WARNING: ELECTRICAL SHOCK

To reduce the risk of electrical shock, this equipment has a grounding-type plug that has a third (grounding) pin. This plug will only fit into a grounding -type outlet. If the plug does not fit into the outlet, contact a qualified electrician to install the proper outlet. ***DO NOT*** change the plug in any way.

3 Contact Information

We thank you for your selection and purchase of a Pulsafeeder product.

With proper care and maintenance, this device should give you many years of trouble-free service. Please take the time to read and understand this Installation and Operation Manual, paying special attention to the sections on **OPERATION** and **MAINTENANCE**.

If, in the future, any parts or repairs are required, we strongly recommend that only original replacement parts be used. Our Customer Service Department is happy to assist you with your parts or service requests.

☎ **Pulsafeeder Customer Service and Technical Support Departments can be reached by calling (800) 333-6677 or faxing (941) 575-4085, Monday through Friday, 8:00 a.m. - 5:00 p.m. EST.**

4 Introduction

The controller is a microprocessor based, menu driven, water treatment controller designed for use in cooling towers. The Controller provides for conductivity and pH or ORP tracking and control, flow monitoring and chemical injection. The Controller is NTL/CSA approved.

The Controller uses the latest in microprocessor capability, giving the user a high level of application flexibility. A large illuminated graphics screen, multiple inputs, and an intuitive menu characterize this new technology. Security features allow full access to programming features or restrict access to viewing only. An operator password can help ensure that only authorized personnel will operate the system.

The Controller is user-friendly with a graphical screen, numeric keypad, LEDs for power, alarm, flow, and relay status. It accepts multiple inputs and is easily configured. It's a combination of reliability, accuracy, security and simplicity.

The controller includes seven relay outputs. Relay number 1 is dedicated to bleed-off and can be configured to operate based on setpoint control, or based on water meter inputs for time or volume.

Relays 2, 3, 4, 5, 6, and 7 can be configured to operate based on setpoint, water meter input, percent of time, percent of blowdown, Calendar Timer, and alarms.

5 Features, Benefits, Specifications

5.1 Features

- Controller can be used for Cooling Towers.
- Removable power cord and receptacles for conduit installations. Enclosure is rated NEMA 4X
- Seven user configurable relays for conductivity and/or pH/ORP control and chemical addition. These relays can be configured in multiple ways including scheduled feed for biocide addition
- Two (2) water meter inputs, two drum switch, conductivity input, pH or ORP input, flow switch input, two channels of 4-20 mA output, and optional remote conductivity and pH or ORP input via 4-20 mA are all standard features.
- Designed with a single circuit board for high reliability and lower cost.
- Large open shallow enclosure for easy wiring.
- Ball valve delay feature allows accurate control of motorized ball valves.
- Heavy-duty stainless steel domed numeric keypad and illuminated graphical display allow for quick and easy programming. Steel domed switches improve the tactile sensing and life expectancy of the keypad.
- The Controller controller stores all setpoints, calibration values, and relay configurations in an EEPROM. An EEPROM does not require a battery to retain information, so if power is lost these values will be retained for years. The controller includes a capacitive backup device to retain information such as water meter totals, and clock and calendar information. The capacitive backup device will never need to be replaced and will hold data approximately 1 day after each power failure.

5.2 Benefits

- Easy to program, the Controller uses an intuitive menu.
- No add-on options. 4-20mA output, 4-20mA input, and biocide features are standard.

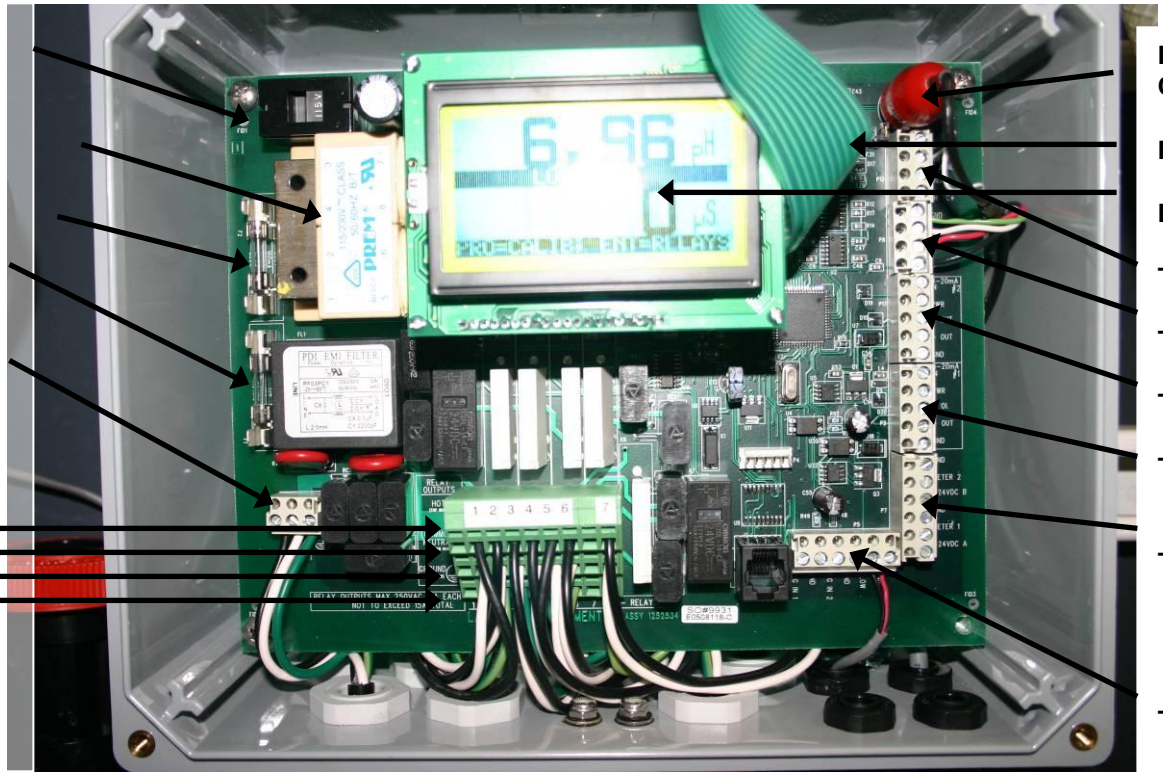


Figure 1: *Control Board*

5.3 Specifications

Conductivity range
50-10,000 μS for Cooling Towers

Conductivity sensor
2 electrode

Conductivity Resolution
± 10 μS (conductivity < 5000 μS)
± 100 μS (conductivity > 5000 μS)

Temperature comp.
Automatic

PH or ORP range
2-12 pH, -1500 to +1500 mV

PH or ORP sensor
Solution ground, Single ended,

or Signal differential

PH or ORP Resolution
.01 pH
1 mV for ORP

Accuracy & repeatability
± 1.0% of scale

Deadband/Setpoint
User programmable

Auto/Manual outputs
Menu selectable

Keypad
16 tactile steel-dome push buttons

Display
Illuminated 128 x 64 pixel LCD

Water meter inputs (2)
Contact head, paddle wheel or turbine

Relay ratings
3A each, 12A total

Output relays
6 selectable use, 1 blowdown

Power
120/240 VAC 50/60 Hz 6W

Digital Inputs
2 digital inputs for drum switches

Timer
Max. blowdown time exceeded.

Relay run time exceeded.

4-20 mA Input Signals
Two 4-20 mA, non-isolated, internally powered Input; one for conductivity and one for pH/ORP.

4-20 mA Output Signals
Two 4 – 20 mA, isolated or non-isolated optionally powered output for conductivity and pH/ORP.

Ambient temp
32° - 140°F (0 - 60°C)

Storage temp
-4° - 150°F (0 - 60°C)

Sensors/Plumbing	Cooling Tower
Max Pressure	140 psi (9.65 bar) @100°F
Max Temp	140°F (60°C)
Min flow	1 gpm (3.785 Lpm), 5 gpm max

6 Unpacking, Mounting and Installation

6.1 Unpacking

Inspect the shipping carton for obvious external damage. Note on the carrier's bill-of-lading the extent of the damage, if any, and ***notify the carrier***. Save the shipping carton until your controller is started up.

☎ **If shipping damage has occurred, call the Pulsafeeder Customer Service Department at (800) 333-6677 and return the controller to the factory in the original carton.**

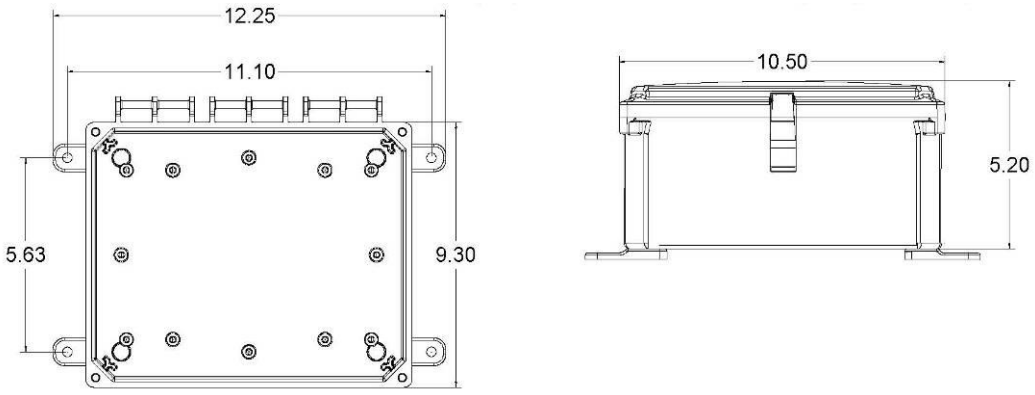
6.2 Mounting

The controller is supplied with four mounting feet, and can be mounted to a panel or to a flat non-vibrating wall.

- Attach the four mounting feet to the back of the controller enclosure. The feet can be installed either vertically or horizontally.
- Install on smooth surface to prevent stress on the mounting feet.
- Do not install on vibrating wall.
- If enclosure is installed in corrosive environments, consider purging.
- Dimensions indicated as inches (millimeters).
- The enclosure material is PVC.
- Use #10 mounting screws (4).

Avoid drilling or punching additional holes in the controller enclosure. Damage incurred as a result of any alteration to the enclosure is not covered under the Pulsafeeder product warranty.

The dimensions of the enclosure in inches are:



The controller has a shipping weight of approximately 10 lbs.

NOTE: EXCESSIVE HEAT AND/OR DIRECT SUNLIGHT EXPOSURE WILL DARKEN THE LCD DISPLAY SCREEN, MAKING IT DIFFICULT TO READ, AND MAY SHORTEN THE LIFE OF OTHER ELECTRONIC COMPONENTS.

7 Plumbing Installation

PLUMBING MATERIALS

- Inlet plumbing can be ¾ inch (1.9 cm) PVC, CPVC, or iron pipe.
- Provide at least 1 gpm (3.79 Lpm) to the sensor. A 4-psi (0.3 bar) differential pressure from take-off to injection is sufficient. If flow is marginal, consult your Pulsafeeder Factory Representative. The maximum recommended flow is 5 gpm (18.93Lpm).
- Outlet plumbing can be ¾ inch (1.9 cm) PVC, CPVC, or iron pipe. PVC, CPVC Schedule 80 is recommended for strength and sunlight protection.
- If iron pipe is used, install a PVC union to relieve the stress on the plumbing.
- The sample line inlet should be plumbed downstream of the recirculating pump and upstream of the heat exchanger. This line brings the sample water into the sensor plumbing for conductivity AND pH/ORP measurement. If the Pulsafeeder flow switch plumbing assembly is used, this flow of water also pushes the flow switch float up to activate the relay outputs of the controller.

NOTE: FOR YOUR CONVENIENCE, INCLUDE A PULSAFEEDER MODEL 9102 SAMPLE LINE SHUT-OFF VALVE AND A SAMPLE VALVE SPOUT (AS SHOWN) IN THE INLET FLOW PLUMBING.

Figure 2:

Model 9102 Valve & Spout

- The sample line outlet flow (solution/sample line) should be plumbed to the tower return line or the tower basin, where you can insert your chemical feed system. Refer to the suggested installation drawing in the back of this manual for an example of a typical installation.
- Remember to install isolation and bypass valves so that maintenance can be performed.

WARNING: NEVER INJECT CHEMICALS UPSTREAM OF THE CONTROLLER FLOW CELLS!

☎ **If you have questions or need assistance, call Pulsafeeder Technical Service Department at (800) 333-6677, Monday-Friday, 8:00 a.m. - 5:00 p.m. EST.**

WARNING: SOME CHEMICALS MAY HAVE TO BE INJECTED DIRECTLY INTO THE COOLING SYSTEM WATER LINE AND NOT INTO THE SAMPLE LINE. CONTACT YOUR WATER TREATMENT SPECIALIST FOR SPECIFIC RECOMMENDATIONS.

NOTE: IF THE SOLUTION/SAMPLE LINE IS RETURNED TO THE COOLING TOWER RETURN LINE, USE A CORPORATION STOP (PULSAFEEDER MODEL 9160), A SOLUTION LINE INJECTOR OR A DISPERSING PIPE. THIS AIDS CHEMICAL-WATER MIXING AND ENHANCES WATER TREATMENT CONTROL CAPABILITIES.

8 Electrical Installation

8.1 Incoming Power 115/230 VAC

This model can be powered from either 115 VAC or 230 VAC at 50/60 Hz. There is a power selector switch located in the upper left-hand corner of the control board. To select the appropriate voltage, slide the switch from one position to the other with a small screwdriver. **CAUTION: Do not power the controller with 230 VAC with the slide selector switch set to the 115VAC position. Damage will occur.**

The controller comes with a power cord and female molded receptacles for the blowdown valve and chemical pumps. The power cord and receptacles are rated for 115VAC. If the controller will be powered by 230 VAC, the power cord and receptacles will need to be removed and the incoming power and the relay outputs will need to be hard-wired.

The incoming power is connected to terminal block P1 at the bottom left corner of the control board. There is a hot or line input (L1), a neutral input (N) and an earth ground input (⏚). Refer to the drawing in the back of this manual for wiring instructions.

8.2 Relay Outputs

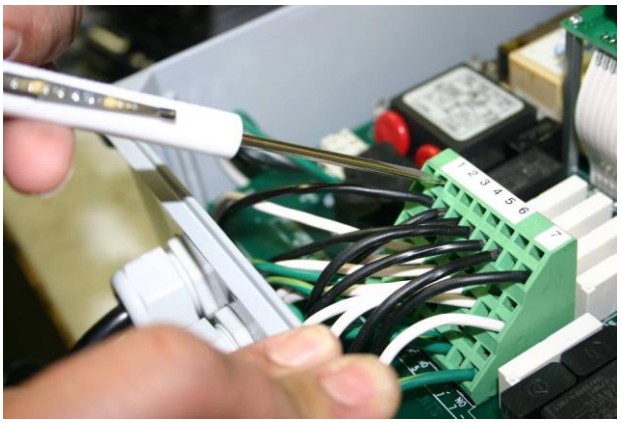
The relay outputs are of the same voltage as the power input. Ensure that the devices that are to be connected to the relay outputs are of the same voltage rating or damage will occur.

The relay outputs are wired to the female molded receptacles. The molded receptacle on the far left is relay #1 and the molded receptacle on the far right is relay #7. If 115 VAC is used, simply plug your devices into the molded receptacles. If 230 VAC is used, remove the receptacles and hard-wire your devices to the relay outputs.

Relay #1 and #7 have both a normally open and normally closed contact. This is designed for used with a motorized blowdown valve. The normally open (NO) contact is hot when the relay is on, and the normally closed (NC) contact is hot when the relay is off. The normally open (NO) contact is used to open the valve, and the normally closed (NC) contact is used to close the valve. The other five relays only have a normally open contact.

All 7 relay outputs include a hot, a neutral (common), and an earth ground connection (⏚**)**.

To operate the terminal blocks to remove or add wiring, insert a small screwdriver into the slot above each wiring connection and pry upward while removing or inserting the wire.



The top row of connections is the hot connections, the middle row of connections is the neutral (common) connections, and the bottom row of connections is the earth ground connections. Refer to the drawing in the back of this manual for wiring instructions.

8.3 Flow Switch Wiring

The controller has a flow switch input. The purpose of the flow switch input is to disable the relay outputs on a loss of flow in the system. The flow switch input requires a digital contact. Any digital contact rated for 24 VDC and 500 mA may be used, such as a relay driven by the recirculating pump. Pulsafeeder manufactures a flow switch plumbing assembly for use with this model.

If a flow switch is not used then a jumper must be installed across the flow switch connections. Refer to the drawings in the back of this manual for wiring instructions.

8.4 Conductivity Sensor Wiring

The controller uses the Pulsafeeder two electrode conductivity sensor for the conductivity input. For wiring lengths of less than 20 feet between the controller and the sensor, the conductivity sensor is wired directly to the controller. For wiring lengths of greater than 20 feet between the sensor and the controller, a 4-20 mA transmitter should be used. The maximum recommended wiring distance for sensors without a 4-20 mA transmitter is 20 feet.

Conductivity sensors that are directly wired to the controller are wired to terminal block P8 on the upper right corner of the control board. Refer to the drawing in the back of this manual for wiring instructions for Pulsafeeder conductivity sensors.

4-20 mA transmitters that are used for the conductivity sensor input are wired to terminal block P2. The controller provides power to the 4-20 mA transmitter loop. Refer to the drawing in the back of this manual for wiring instructions for the 4-20 mA input.

8.5 pH/ORP Sensor Wiring

The controller uses the Pulsafeeder pH or ORP sensors. For wiring lengths of less than 15 feet between the controller and the sensor, these sensors are wired directly to the controller. For wiring lengths of greater than 15 feet between the sensor and the controller, a 4-20 mA transmitter should be used. The maximum recommended wiring distance for sensors without a 4-20 mA transmitter is 15 feet.

Sensors that are directly wired to the controller are wired to terminal block P13 and BNC connector BNC1 on the upper right corner of the control board. Refer to the drawing in the back of this manual for wiring instructions for each of the available Pulsafeeder pH and ORP sensors.

4-20 mA transmitters that are used for the pH or ORP sensor input are wired to terminal block P17. The controller provides power to the 4-20 mA transmitter loop. Refer to section 3.4.9 and the drawings in the back of this manual for wiring instructions for the 4-20 mA input.

8.6 pH/ORP Sensor Jumper Configuration

The controller uses jumper blocks to configure the sensor input for pH or ORP when the pH or ORP sensor is wired directly to the controller without the use of a 4-20 mA transmitter. Jumper blocks H1 and H2 must be configured for proper operation of the sensor input. Refer to drawing 1252534-22a for ORP configuration and drawing 1252534-21a for pH configuration.

Part # or Model #	Sensor Type
1240472	Differential / Reference on Shield
1240473	Single-Ended / Reference on Shield
520 Series	Differential / Reference on Wire
530 Series	Single-Ended / Reference on Wire

8.7 Water Meter

The controller will accept two water meter inputs. These inputs can be configured for make-up, make-up Second Source, Bleed, or Chill Loop make-up. Refer to the water meter manufacturer's manual for plumbing information.

The controllers will work directly with the following types of meters: dry contacting head meters, Seametrics open collector output meters, Signet 2535 and 2540 paddle wheel meters, and the Autotrol 1 inch and 2 inch meters. Contact Pulsafeeder for other types of water meters. The water meters are wired to terminal block P1 which is the top terminal block on the I/O board. Refer to the drawing in the back of this manual for wiring instructions.

8.8 Digital Inputs Wiring

The controller has two digital inputs that are intended to be used to give an alarm indication of a low drum level. The controller will display the words "DRUM LEVEL #1" for digital input #1 activation and "DRUM LEVEL #2" for digital input #2 activation.

The digital inputs require a dry contact input. The alarm is triggered when the contact is closed and the alarm is reset when the contact is opened. Any dry digital contact rated for 24 VDC and 500 mA may be used. The inputs are not polarity sensitive; either of the two wires can be connected to either of the two input terminals.

The digital inputs are wired to terminal block P5. Terminals 1 and 2 are used for digital input #1, and terminals 3 and 4 are used for digital input #2. Refer to the drawing in the back of this manual for wiring instructions.

8.9 4-20 mA Output Wiring

The controller has two channels of 4-20 mA output that can be used for conductivity and/or pH/ORP. These outputs can be isolated or non-isolated, externally powered or internally powered. If the 4-20 mA output is internally powered then it is non-isolated. If the 4-20 mA output is externally powered then it is isolated.

4-20 mA output #1 is wired to terminal block P2 on the right-hand side of the control board. 4-20 mA output #2 is wired to terminal block P17 on the right-hand side of the control board. Refer to the drawing in the back of this manual for wiring instructions.

8.10 4-20mA Input Wiring

The controller can accept 4-20 mA inputs for the conductivity and pH/ORP inputs. 4-20 mA input #1 is used for conductivity and 4-20 mA input #2 is used for either pH or ORP. The conductivity sensor is wired to a 4-20 transmitter and the transmitter is wired to terminal block P2 on the right-hand side of the control board. The pH/ORP sensor is wired to a 4-20 transmitter and the transmitter is wired to terminal block P17 on the right-hand side of the control board.

These inputs are non-isolated inputs and the controller provides the power to operate them. Refer to the manufacturer instructions for wiring of the 4-20 mA transmitters. Refer to the drawing in the back of this manual for specific instructions on wiring 4-20 mA transmitters to the controller.

9 Functional Overview

9.1 Front Panel

Figure 3: *Front Panel with Display*

LCD
A large, 128x64-pixel graphic display makes it easy to read the menu-driven program

ENCLOSURE
A sturdy NEMA 4X enclosure protects your controller. Make sure it is properly mounted on a flat, non-vibrating wall.

16-BUTTON KEYPAD
ENT = for Menu selection and/or acceptance of selected values.
BACK = to exit a Menu selection and/or skip input options.
CAL = to program a Menu selection.
LANG = Not used.

INDICATOR LIGHTS
LEDs for Power, Alarm, Relay status, and Flow

9.2 Display

The controller uses an illuminated 128x64-pixel LCD digital display for ease of viewing. It has multiple lines to display information such as the conductivity reading, the pH/ORP reading, alarms, relay status, relay configuration, clock, flow rates and total flow for both water meter inputs, and menu selections.

9.3 Keypad

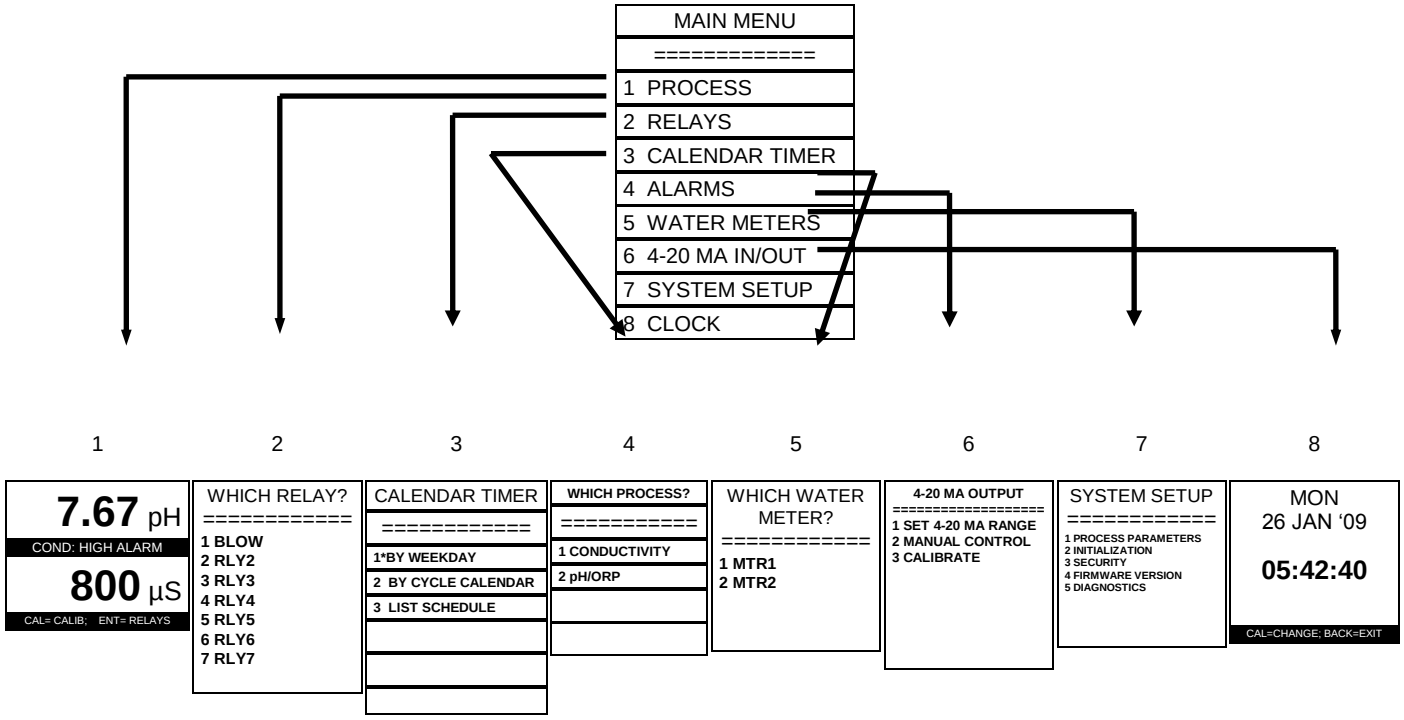
The controller uses a 16-key steel-domed numeric keypad for ease of programming. The keys have the following functions:

ENT	To accept a setting or to enter a screen.
BACK	To exit a screen or to access the main menu.
CAL	To calibrate the controller.
LANG	Not used.
UP arrow	To move about in the menu.

DOWN arrow To move about in a menu.
Number keys To input a value or to select a menu item.

9.4 Menu

The controller is programmed and calibrated by the use of a menu. The complete **Main Menu** has 8 available options that can be accessed in the **Technician Level**. However, a list of only six options can be viewed at one time. Use the ↑ and ↓ keys to scroll through the options. As an introduction, here is a graphic overview of the first level of each option in the **Main Menu** to see how it operates. Complete details of each option are provided later in this manual.



9.5 Security Levels

The controller has a security feature to lock out the menu to prevent tampering of the controller.

In normal operation the controller is in the TECHNICIAN security level. This level allows the user full access to the entire menu.

To prevent tampering of the controller, the controller can be placed into the View Only security level. When the controller is in the View Only security level, the menu is completely locked out; access is limited to manual operation of the relays, and viewing of the process screens.

A password is required to change from the VIEW ONLY security level to the TECHNICIAN security level. If the controller is in the View Only security level just press the password on the keypad to change to the TECHNICIAN security level.

The TECHNICIAN security level password is factory-preset to **2222**. This password can be changed to a different 4-digit password in the main menu. To change the password, refer to section 18.1.

10 Starting Up the Controller

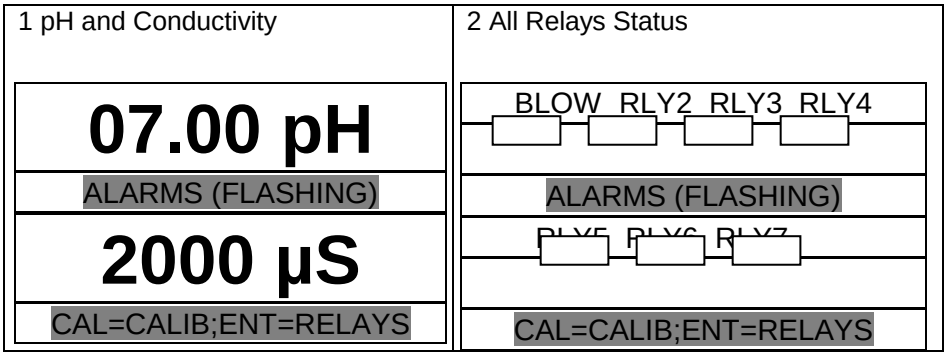
Once the hardware Installation is complete it is time to start up the controller.

1. Initiate sample flow to the sensor by opening the sample line isolation valves. Check for leakage.
2. Power up the controller by either turning on the circuit breaker or plugging the power cord into a 120 VAC receptacle.
3. For the initial start up it is best to initialize the whole controller to remove any settings that may be in the memory before programming the controller. Refer to section 18 of this manual to initialize the controller.
4. If the conductivity input will be coming from a 4-20 mA device, enable the 4-20 mA input and configure the 4-20 mA input settings. Refer to sections 18.
5. If the pH or ORP input will be coming from a 4-20 mA device, enable the 4-20 mA input and configure the 4-20 mA input settings. Refer to sections 18.
6. If pH or ORP is used and it is not coming from a 4-20 mA device set up the pH/ORP jumpers for the sensor. Refer to section 8.6.
7. If pH or ORP is used and it is not coming from a 4-20 mA device set up the Process Parameters (damping and temperature compensation) for the sensor. Refer to sections 18.
8. Set the date and time by following section 19.
9. Set the high and low conductivity and pH/ORP alarms by following section 19.
10. Set up the water meter inputs by following section 15.
11. Set up the 4-20 mA outputs by following section 16.
12. Configure the blowdown relay for operation by following sections 13.1.
13. Configure relays 2-7 for operation by following sections 13.1.
14. Configure the Calendar Timers by following section 13.3.
15. Calibrate the conductivity by following section 12.1.
16. Calibrate the pH/ORP by following section 12.2.
17. Perform a manual test of the relays. Refer to section 11.3.
18. Verify operation of the controller before leaving the area.

11 Operation of the Controller

11.1 Process Screen

The screens that are used the most in the controller are the Process Screens. There are eight different Process screen views. The calibrations screens and the manual relay control are accessed from any of the process screens. Below are all of the process screen views.



3 MTR1 Flow Total and Rate	4 MTR2 Flow Total and Rate
MTR1 TOTAL FLOW(GALS) **13,800** ALARMS (FLASHING) MTR1 FLOW RATE (GPM) **0** CAL=CALIB;ENT=RELAYS	MTR2 TOTAL FLOW(GALS) **2,600** ALARMS (FLASHING) MTR2 FLOW RATE (GPM) **0** CAL=CALIB;ENT=RELAYS
5 BLOW AND RLY 2 SETTINGS	6 RLY 3 AND RLY 4 SETTINGS
BLOW: SETPOINT= **99999 µS** ALARMS (FLASHING) RLY2: BY MTR1 METER AFTER GALS/LTRS= 100 RUN FOR 0 MIN 10 SEC CAL=CALIB;ENT=RELAYS	RLY3: 20% OF BLOWDOWN TIME ALARMS (FLASHING) RLY4: FEED 50% OF THE TIME CAL=CALIB;ENT=RELAYS
7 Relay 5 and Relay 6 Settings	8 Relay 7 Setting and DATE/TIME
RLY5: CALENDAR TIMER TODAY IS WED ALARMS (FLASHING) RLY6: ALARM RELAY CAL=CALIB;ENT=RELAYS	RLY7: DISABLED ALARMS (FLASHING) 1 JAN '08 **08:15:32** CAL=CALIB; ENT=RELAYS

Use the Up and Down Arrow Keys to Scroll through the Process Screens. Use the PRO key to calibrate. Use the ENT key to take manual control of the relays.

11.2 Process Screen Descriptions

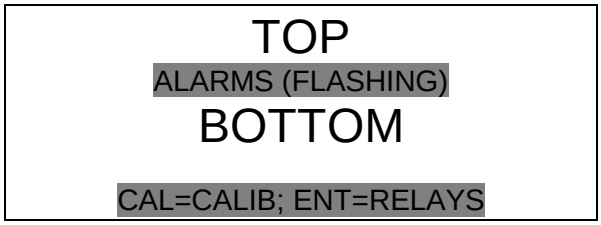
Each process screen has three sections. The top and bottom sections are used to display the different parameters that are monitored.

The alarm bar is displayed in the middle of the screen between the top and bottom sections. It is solid in appearance and flashes showing the all of the current active alarms in sequence.

The eight different process screens are accessed by using the up and down arrow keys on the keypad.

The calibration screens are accessed from any process screen by pressing the "**CAL**" key on the keypad.

The manual relay control screens are accessed from any process screen by pressing the "**ENT**" key on the keypad.



The eight Process Screens are:

1. pH/ORP and Conductivity Values

The top section of this screen is used to display the pH or ORP value. The bottom section is used to display the conductivity value.

2. All Relays Status

The top section of this screen is used to display the current status of relays 1-4. The bottom section is used to display the current status of relays 5-7. A clear rectangle is used for each relay to indicate that the relay is off. A darkened rectangle is used to indicate that the relay is on.

3. MTR1 Total Flow and Flow Rate

The top section of this screen is used to display the total recorded flow for water meter input #1 (MTR1) in gallons or liters as selected in the water meter configuration screen. The bottom section is used to display the current flow rate for water meter input #1. If the water meter is configured as a contacting head type water meter the screen will show "# # #" in place of the flow rate value.

4. MTR2 Total Flow and Flow Rate

The top section of this screen is used to display the total recorded flow for water meter input #2 (MTR2) in gallons or liters as selected in the water meter configuration screen. The bottom section is used to display the current flow rate for water meter input #2. If the water meter is configured as a contacting head type water meter the screen will show "# # #" in place of the flow rate value.

5. BLOW and Relay 2 Settings

The top section of this screen is used to display the configuration of the blowdown relay. The bottom section is used to display the configuration of relay #2.

6. Relay 3 and Relay 4 Settings

The top section of this screen is used to display the configuration of relay #3. The bottom section is used to display the configuration of relay #4

7. Relay 5 and Relay 6 Settings

The top section of this screen is used to display the configuration of relay #5. The bottom section is used to display the configuration of relay #6

8. Relay 7 Setting and the DATE/TIME

The top section of this screen is used to display the current date and time. The bottom section is used to display the configuration of relay #7.

Relay Settings
The blowdown relay

Conductivity Setpoint
When the blowdown relay is configured to activate based on a **conductivity setpoint** the display will show the conductivity setpoint.
BASED ON VOLUME, TIME LIMITED
When the blowdown relay is configured to activate based on a **water meter volume for a specified amount of time**, the display will show the amount of flow to turn on the relay and the amount of time (in minutes and seconds) that the relay will be on.

BASED ON VOLUME, VOLUME LIMITED
When the blowdown relay is configured to activate based on a **water meter volume for a specified amount of volume**, the display will show the amount of flow to turn on the relay and the amount of volume to turn off the relay.

Relays 2-7

Disabled
When the relay is disabled, the display will show the word "**DISABLED**" and a rectangle indicating the current status of the relay. The rectangle will be clear when the relay is off and the rectangle will be darkened when the relay is on.

Conductivity Setpoint
When the relay is configured for a conductivity setpoint, the display will show the conductivity setpoint.

pH Setpoint
When the relay is configured for a pH setpoint, the display will show the pH setpoint.

ORP Setpoint
When the relay is configured for an ORP setpoint, the display will show the ORP setpoint.

Water Meter Actuated for Time
When the relay is configured as a water meter actuated relay for time, the display will show the water meter that will turn on the relay, the amount of flow to turn on the relay, and the amount of time (in minutes and seconds) that the relay will be on.

Percent of Blowdown Time
When the relay is configured for a percentage of blowdown time, the display will show the percentage of blowdown time and a rectangle indicating the current status of the relay. The rectangle will be clear when the relay is off and the rectangle will be darkened when the relay is on.

Percent of Time
When the relay is configured for a percentage of time, the display will show the percentage of time and a rectangle indicating the current status of the relay. The rectangle will be clear when the relay is off and the rectangle will be darkened when the relay is on.

Calendar Timer Relay
When the relay is configured as a Calendar Timer relay, the display will show the relay as a Calendar Timer relay, the current day, and a rectangle indicating the current status of the relay. The rectangle will be clear when the relay is off and the rectangle will be darkened when the relay is on.

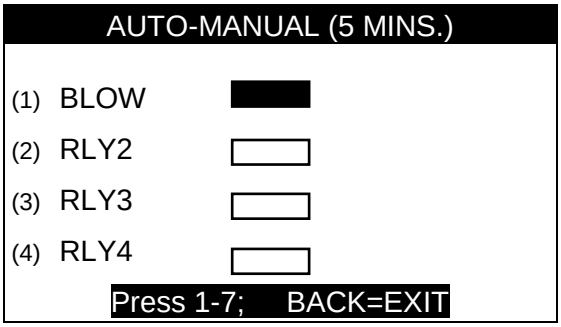
Alarm Relay

When the relay is configured as an alarm relay, the display will show the relay as an alarm relay and a rectangle indicating the current status of the relay. The rectangle will be clear when the relay is off and the rectangle will be darkened when the relay is on.

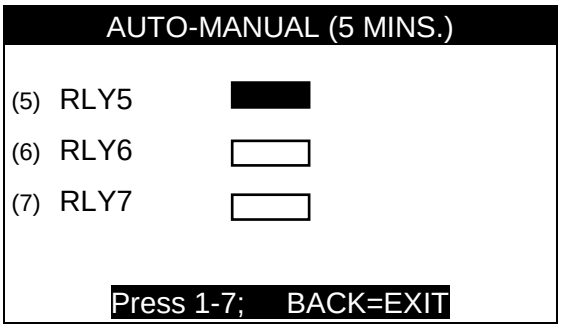
11.3 Manual Operation of the Relays

All seven of the relays can be operated manually. To manually operate the relays:

Go to a **Process** screen. Press "**ENT**". You will be taken to screens that look like:



Press the down arrow to access relays 5, 6, and 7.



Press the up arrow to access relays 1, 2, 3, and 4.

Press "**1-7** " to manually change the state of that particular relay.

Manual control of the relays changes the state of the relay. If the relay is off, taking manual control of the relay will turn it on. If the relay is on, taking manual control will turn it off.

When manual control of a relay is taken, a five-minute countdown timer will start counting down. After five minutes has expired the relay will return to automatic control. To return a relay to automatic control before the five-minute time expires simply press the number key for that relay again.

A relay that is in manual control will stay in manual control until the five minutes expire even if this screen is exited. The five-minute timer helps to prevent damage to the system if a relay is left in manual.

WARNING: Manual control overrides all automatic functions including the flow switch input. Use care when operating relays manually with no flow in the system.

12 Calibration of the Controller

The conductivity and pH/ORP inputs require periodic calibration for proper operation. Calibration is usually required after cleaning the sensors.

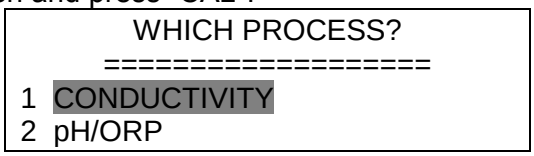
All single-point calibrations should be performed with the sensor in the piping assembly with good flow past the sensor. It is necessary to have an accurate reading of the water to properly calibrate the controller. A

hand-held meter that tests the sample works well for this purpose. The use of buffer solutions is not necessary for single point calibrations.

Two-point calibrations are generally not necessary unless there is an issue with the sensor.

To enter the calibration screens:

- Go to any Process screen and press “CAL".



Use the number keys to select the parameter to calibrate.

12.1 Calibration of Conductivity

If the conductivity sensor is connected to a 4-20 mA transmitter, that 4-20 mA transmitter should be calibrated before a calibration of the controller is performed for the first time. Follow the manufacturer's instructions for calibrating that transmitter.

If a meter that measures ppm is used, refer to the conductivity vs. ppm chart in section 12.1 and convert the ppm to an approximate conductivity value.

- Ensure that the controller is operating with good flow past the sensor.
- Take a sample of the water and measure with a hand-held conductivity tester.
- From the **PROCESS** screen, press “**CAL**” to enter the calibration screens. Select "**CONDUCTIVITY**" and use the keypad to input the conductivity reading from the hand-held. Press “**ENT**”.

Take a second hand-held sample to verify calibration.

12.1.1 Conductivity Calibration Error Messages

During the calibration of conductivity the controller monitors the conductivity calibration and detects errors that may affect the calibration.

Sensor Reads Zero

When a calibration of the conductivity is being performed and a non-zero conductivity value is entered for the calibration but the controller sees a zero value for conductivity, the controller will give the Sensor Reads Zero error message after the ENT key is pressed. Check the sensor wiring, or check that the sample piping is full and that there is good sample flow past the sensor.

Opened or Shorted T.C.

If the Opened TC or Shorted TC alarms are present the controller will display one of the two error messages when the ENT key is pressed during a conductivity calibration. The T.C. input is used to compensate the conductivity reading for temperature. If the T.C. is opened or shorted the temp comp reading defaults to 25°C and the conductivity reading will not be temperature compensated. Check the wiring of the conductivity sensor or check the temperature compensator.

12.1.2 Conductivity vs. ppm

The controller measures the conductivity of the water. The ppm of the water may be measured instead of conductivity. If ppm is measured, use the following chart for an approximation of the conductivity level and calibrate to the conductivity level that is closest to the ppm level that is measured. Remember this is just an

approximation because the ions that make up the conductivity may be different than the particles that make up the ppm reading.

Conductivity vs. PPM Table

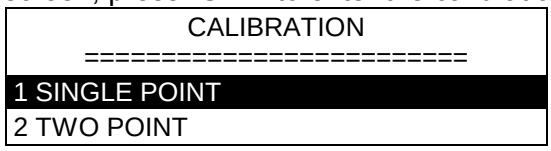
µS/cm	ppm	µS/cm	ppm	µS/cm	ppm
2	1	120	68	900	560
4	2.1	140	80	950	600
6	3.2	160	91	1000	630
8	4.2	180	100	1500	970
10	5.2	200	115	2000	1300
12	6.4	220	127	2500	1700
14	7.4	240	139	3000	2000
16	8.5	260	150	3400	2400
18	9.6	280	164	4000	2750
20	11.0	300	176	4500	3150
25	13.5	350	210	5000	3500
30	16.0	400	240	5500	3900
35	19.0	450	270	6000	4300
40	22.0	500	300	6500	4700
45	24.5	550	335	7000	5000
50	27.5	600	370	7500	5400
60	33.0	650	400	8000	5800
70	39.0	700	435	8500	6200
80	45.0	750	470	9000	6600
90	51.0	800	500	9500	7000
100	56.0	850	530	10,000	7400

12.2 Calibration of pH or ORP

If the pH or ORP sensor is connected to a 4-20 mA transmitter, the 4-20 mA transmitter should be calibrated before a calibration of the controller is performed for the first time. Follow the manufacturer instructions for calibrating the transmitter. When the pH or ORP is configured to the 4-20 mA input of the controller a single point calibration of the controller is all that is necessary.

Instructions for Calibration

- From the **PROCESS** screen, press "**CAL**" to enter the calibration screens. Select **pH** or **ORP**.

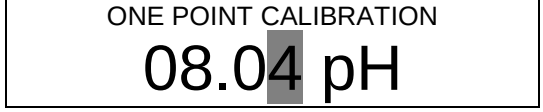


Use the number keys to select either a single-point calibration or a two-point calibration.

12.2.1 pH or ORP Single Point Calibration

A single point calibration is performed with the sensor in the plumbing assembly or piping with the water system in operation.

- Ensure that the controller is operating with good flow past the sensor.
- Press **"1" SINGLE POINT.** The controller will respond with the following screen:



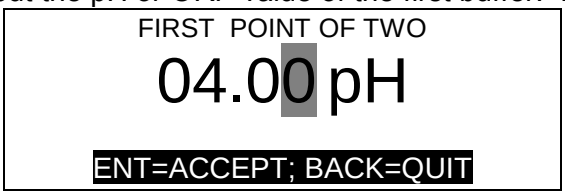
- Take a sample of the water and measure with a hand-held pH or ORP tester.
- Use the keypad to input the pH or ORP reading from the hand-held. Press "**ENT**".
- The controller will respond with **"CALIBRATION COMPLETE".**

Take a second hand-held sample to verify calibration.

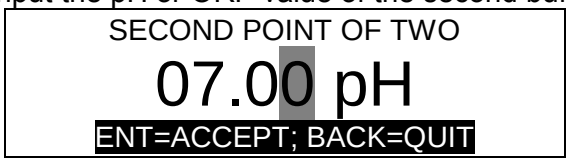
12.2.2 pH/ORP Two Point Calibration

A two point calibration is performed by placing the sensor in two different calibration solutions. For pH, the two calibration solutions must be at least 2.0 pH apart. For ORP, the two calibration solutions must be at least 200 mV apart.

- For a two point calibration, two separate buffer solutions at least two pH units apart are required for pH and at least 200 mV apart for ORP.
- Press **"2" TWO POINT.**
- Place the sensor in the first buffer solution, allow the reading to stabilize.
- Use the keypad to input the pH or ORP value of the first buffer. Press "**ENT**".



- Place the sensor in the second buffer solution, allow the reading to stabilize.
- Use the keypad to input the pH or ORP value of the second buffer. Press "**ENT**".



- Return the sensor to the system.

Check the calibration vs. actual and perform a single point calibration if required.

12.2.3 pH and ORP Calibration Error Messages

Opened or Shorted T.C.

If the Opened TC or Shorted TC alarms are present the controller will display one of the two error messages when the ENT key is pressed during a pH calibration. The T.C. input is used to compensate the pH reading for temperature. If the T.C. is opened or shorted the temp comp reading defaults to 25°C and the reading will not be temperature compensated. Check the wiring of the sensor or check the temperature compensator.

High Reference Impedance

The high reference impedance alarm indicates that there is a problem with the operation of the sensor. Check the wiring of the sensor, clean the sensor, or check that the sample piping is full and that there is good sample flow past the sensor.

Deviation > 1.5 pH from default / Deviation >300 mV from default This means that the user has input a calibration value that is greater than 1.5 pH units for pH or 300 mV for ORP, away from the default calibration value. Check the wiring of the sensor, clean the sensor, or check that the sample piping is full and that there is good sample flow past the sensor.

Calibration Points Less Than 2 pH Apart / Calibration Points less than 200 mV Apart. The two buffer solutions used during a two-point calibration are too close together for a good calibration. The two buffer solutions used during a two-point calibration must be at least two pH units apart for pH or 200 mV apart for ORP for a good calibration.

13 Main Menu

The **MAIN MENU** of the controller looks like this:

MAIN MENU
==========
1 PROCESS
2 RELAYS
3 CALENDAR TIMER
4 ALARMS
5 WATER METERS
6 4-20 MA IN/OUT
7 SYSTEM SETUP
8 CLOCK

The **MAIN MENU** can be accessed from any PROCESS screen by pressing "**BACK**"**.** If "BACK" is pressed and the MAIN MENU does not appear, the controller is probably in the VIEW ONLY security mode. If the controller is in the VIEW ONLY security mode, enter the TECHNICIAN security password to be able to access the MAIN MEN**U**.

There are eight different selections in the **MAIN MENU** but only six can be shown at a time. To see the other selections and to move about in the menu screen, use the ↑ and ↓ keys to highlight the desired option and press "**ENT**" or simply press the number key for the desired option.

Use the "**ENT**" key to accept a setting or to enter a screen. Use the "**BACK**" key to reject a setting or to exit a screen. From anywhere in the menu, pressing "**BACK**" will take you one step closer to the **MAIN MENU**.

Each of the MAIN MENU options is discussed in detail later in this manual.

13.1 Configuring the Relays

The **MAIN MENU** of the controller looks like this:

MAIN MENU
==========
1 PROCESS
2 RELAYS
3 CALENDAR TIMER
4 ALARMS
5 WATER METERS
6 4-20 MA IN/OUT
7 SYSTEM SETUP
8 CLOCK

The **MAIN MENU** can be accessed from any PROCESS screen by pressing "**BACK**"**.** If "BACK" is pressed and the MAIN MENU does not appear, the controller is probably in the VIEW ONLY security mode. If the controller is in the VIEW ONLY security mode, enter the TECHNICIAN security password to be able to access the MAIN MEN**U**.

There are eight different selections in the **MAIN MENU** but only six can be shown at a time. To see the other selections and to move about in the menu screen, use the ↑ and ↓ keys to highlight the desired option and press "**ENT**" or simply press the number key for the desired option.

Use the "**ENT**" key to accept a setting or to enter a screen. Use the "**BACK**" key to reject a setting or to exit a screen. From anywhere in the menu, pressing "**BACK**" will take you one step closer to the **MAIN MENU**.

Each of the MAIN MENU options is discussed in detail later in this manual.

13.1.1 Configuring the Blowdown Relays

The blowdown relay can be configured to operate based on a setpoint or based on a water meter input. When the blowdown relay is selected for programming the following screen will appear.

```
BLOWDOWN RELAY
=======================
1*BASED ON SETPOINT
2 BASED ON VOLUME
```

Blowdown can be configured based on a setpoint or based on volume.

An asterisk (*) is used to indicate the current method of configuration.

13.1.2 Based on Setpoint

To set up the blowdown relay to operate based on a setpoint, select **BASED ON SETPOINT**. The following screen will appear:

```
BASED ON SETPOINT
=======================
1 SETPOINT VALUES
2 WHEN TO BLOWDOWN
3 BALL VALVE DELAY
```

Relays 1, 2, 3, and 4 can be disabled. When a relay is disabled, it will not energize automatically.

- **From the** RELAY OPTIONS **screen press "**1**"** Disabled **to disable the relay.**

13.1.3 Setpoint Values

In the **SETPOINT VALUES** screen you will set the **SETPOINT**, the **DEADBAND** and the **BLOWDOWN TIMEOUT** alarm.

The **SETPOINT** is the conductivity value that you are trying to maintain. Check with your water treatment engineer to determine the conductivity setpoint for your system needs.

Follow these instructions to establish the controller's setpoint:

- Press "**1**" or highlight **SETPOINT VALUES** and press "**ENT**"**.**

```
SETPOINT=
99999 µS
DEADBAND=
20 µs
ENT=ACCEPT; CLR=QUIT
```

- Use the keypad numbers to enter the proper conductivity setpoint and press "**ENT**". When finished, you will automatically be moved down to the deadband.

13.1.4 Deadband

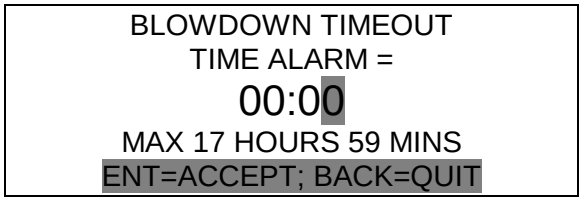
After the setpoint is established, the controller's deadband must also be set. "**Deadband**" refers to the amount of conductivity above and below the setpoint—a range within which the controller will not react. Due to continuous fluctuations in the conductivity level, it is necessary to have this deadband range or stable readings will be difficult to obtain. The Deadband should be a small percentage of the setpoint. Half the deadband amount will be automatically put above the setpoint, and the other half below it.

For example, a conductivity setpoint of 1,000 μS with a deadband of 100 μS would result in the BLOWDOWN valve opening at 1,050 μS and closing at 950 μS.

- Use the keypad numbers to enter the proper deadband setpoint and press "**ENT**". When finished, you will automatically be switched to the **BLOWDOWN TIMEOUT** alarm screen.

13.1.5 Blowdown Timeout

The **BLOWDOWN TIMEOUT** alarm is designed to notify the operator of a problem in the blowdown system such as, a clogged strainer or the blowdown valve did not open. The blowdown timeout function, as part of setpoint control of conductivity, is strictly a visual alarm feature displayed on the controller–**it will not turn off the blowdown relay**. If a relay is configured as an alarm relay, the **BLOWDOWN TIMEOUT** alarm will energize the alarm relay. To disable this function, simply program 0 hours, 0 minutes.

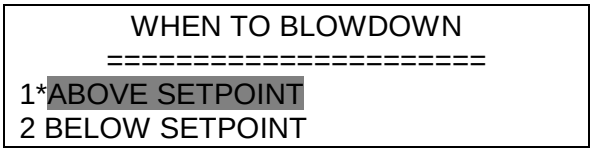


Use the keypad numbers to enter the time in hours and minutes before this alarm will appear and press "**ENT**".

13.1.6 When to Blowdown

Most applications for cooling towers and boilers will turn on the blowdown relay when conductivity is *above* the setpoint. There are some chill loop systems, however, where a reverse setpoint method is preferred. That is, the blowdown relay turns on when the conductivity is *below* the setpoint. In these applications the user will apply a chemical pump to the bleed outlet and feed a chemical to raise the conductivity of a chiller loop. If using this method be sure that the high conductivity alarm is set as high as possible.

- In the **BASED ON SETPOINT** screen, select "**2**" **WHEN TO BLOWDOWN**.



- **In the** WHEN TO BLOWDOWN **screen, select either "**1**"** ABOVE SETPOINT **or "**2**"** BELOW SETPOINT**. The asterisk (*) indicates the current method of configuration.**

13.1.7 Ball Valve Delay

Motorized ball valves require a few seconds to open and close. If the valve is commanded to close before it completes the process of opening, it may enter a state where it is half-open. The ball valve delay feature prevents this from occurring. To use this feature, determine how many seconds it takes to open and close the valve. Use the longest time and round up 1 second. Use this value as your Ball valve delay time. This delay time will also be observed when manually operating the BLOWDOWN relay.

Recommended Delay Times

Valve	Delay Time
Solenoid	0 Seconds
Motorized Valves	8 Seconds

13.1.8 Based on Volume

To program the blowdown to be based on volume, select "**2**" **BASED ON VOLUME** in the **BLOWDOWN**

RELAY screen. The following screen will appear.

```
BASED ON VOLUME
=======================
1 BLOWDOWN VOLUME
2 BALL VALVE DELAY
```

When "**1**" **BLOWDOWN VOLUME** is selected the following **HOW TO BLOWDOWN** screen will appear:

```
HOW TO BLOWDOWN?
====================
1*TIME LIMITED
2 VOLUME LIMITED
```

An asterisk (*) is used to indicate the current method of configuration.

There are two methods available to blowdown based on volume, **TIME LIMITED** and **VOLUME LIMITED**.

With **TIME LIMITED,** the blowdown relay will be on for a specified amount of time after a specified amount of make-up has been received.

With **VOLUME LIMITED,** the blowdown relay will be on until a specified amount of blowdown volume is met.

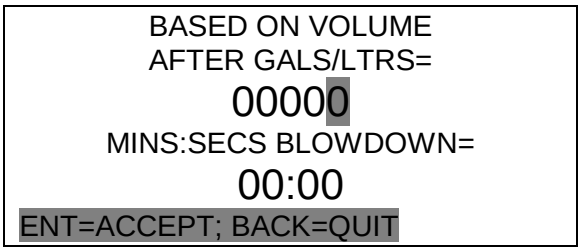
13.1.9 Time Limited

If **TIME LIMITED** is selected the controller will ask which water meter to use as the makeup water meter:

```
MAKEUP WATER METER?
====================
1*MTR1
```

- Select the water meter you want to base blowdown on by pressing "**1**" for **MTR1**, pressing "**2**" for **MTR2**, or pressing "**3**" for the sum of **BOTH** water meters.

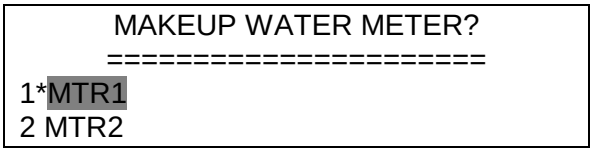
The controller will enter the **TIME LIMITED** configuration screen:



Use the keypad numbers to enter the proper water volume and press "**ENT**". You will automatically be moved down to the amount of time to blow down in minutes and seconds. Enter the amount of time to blowdown and press "**ENT**".

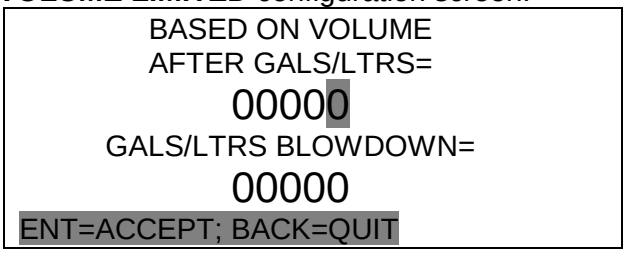
13.1.10 Volume Limited

If **VOLUME LIMITED** is selected the controller will ask which water meter to use as the makeup water meter:



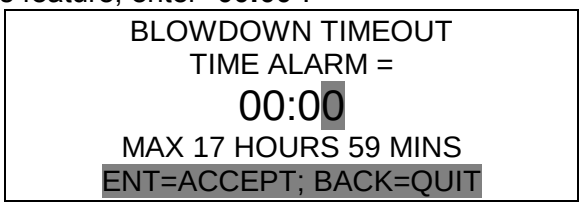
- Select the water meter you want to base blowdown on by pressing "**1**" for **MTR1**, or pressing "**2**" for **MTR2**. The water meter not selected will be configured as the blowdown water meter.

The controller will enter the **VOLUME LIMITED** configuration screen:



- Use the keypad numbers to enter the proper water volume and press "**ENT**". You will automatically be moved down to the amount of volume to blow down in gallons or liters. Enter the amount of volume to blowdown and press "**ENT**".

- The next screen is the **BLOWDOWN TIMEOUT ALARM** screen. Enter the amount of blowdown time before the **BLOWDOWN TIMEOUT ALARM** will occur then press "**ENT**". **This alarm will close the blowdown valve** and it will give an alarm indication on the display. The alarm time is set in hours and minutes. To disable this feature, enter "**00:00**".



13.1.11 Ball Valve Delay

Motorized ball valves require a few seconds to open and close. If the valve is commanded to close before it completes the process of opening, it may enter a state where it is half-open. The ball valve delay feature prevents this from occurring. To use this feature, determine how many seconds it takes to open and close the valve. Use the longest time and round up 1 second. Use this value as your Ball valve delay time. This delay time will also be observed when manually operating the BLOWDOWN relay.

Recommended Delay Times

Valve	Delay Time
Solenoid	0 Seconds
Motorized Valve	8 Seconds

13.1.12 Blowdown Relay Overrides

The normal operation of the blowdown relay is overridden by any of the following:
A High conductivity Alarm will force a blowdown to occur.
A Low pH alarm will force a blowdown to occur.

An active Calendar Timer sequence will control the Blowdown relay.

13.2 Configuring Relays 2,3,4,5,6,7

Below is the **RELAY OPTIONS** screen for relays 2 through 7. The asterisk (*) next to one of the options indicates how that relay is configured. Relays 2, through 7 can be programmed in each of the methods shown on the RELAY OPTIONS screen.

```
RLY2
========================
1*DISABLED
2 SETPOINT
3 WATER METER
4 PERCENT BLOWDOWN
5 PERCENT OF TIME
6 CALENDAR TIMER
7 ALARM RELAY
```

13.2.1 Disabled

Relays 2 through 7 can be disabled. When a relay is disabled, it will not energize automatically.
To disable a relay:

From the **RELAY OPTIONS** screen press "**1**" **Disabled** to disable the relay.

13.2.2 By Setpoint

Relays 2 through 7 can be configured to operate based on a conductivity or pH/ORP setpoint. Refer to section 6.5.1.1 and 6.5.1.2 for a description of the setpoint and deadband.

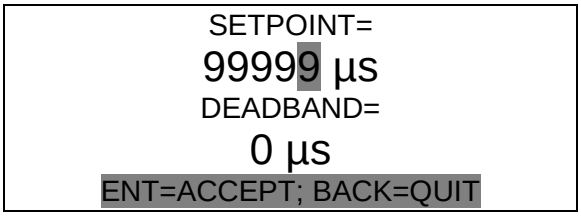
When relays 2 through 7 are configured for setpoint control, **the timeout alarm will shut off the relay when the timeout time expires.**

Setpoint Values

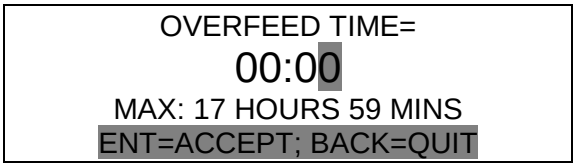
- From the **RELAY OPTIONS** screen press "**2**" **SETPOINT** to configure the relay as a setpoint relay. This will take you to the **WHICH PROCESS** screen.

```
WHICH PROCESS?
====================
1*CONDUCTIVITY
2 pH/ORP
```

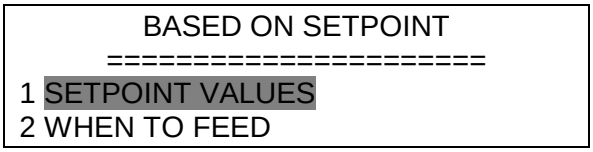
- Use the number keys to select the type of setpoint to configure. This will take you to the **SETPOINT** screen for the parameter you have selected.



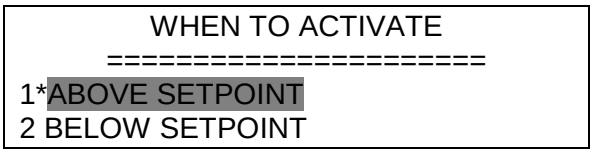
- Use the keypad to enter the **SETPOINT**, press "**ENT**".
- Use the keypad to enter the **DEADBAND** value, press "**ENT**"**.** This will take you to the **TIMEOUT** screen.



- The **TIMEOUT** alarm will turn off the relay. Enter "**00:00**" to disable this feature. Use the keypad to enter a time for the **TIMEOUT** alarm then press "**ENT**". You will be taken to the **BASED ON SETPOINT** screen.



- The **BASED ON SETPOINT** screen allows you to make changes to the setpoint you just set and to configure the relay to activate either above or below the setpoint. To make changes to the setpoint select "**1 SETPOINT VALUES**" and you will be taken back to the setpoint screen.
- Select "**2 WHEN TO FEED**" to configure the relay to activate either above the setpoint or below the setpoint.



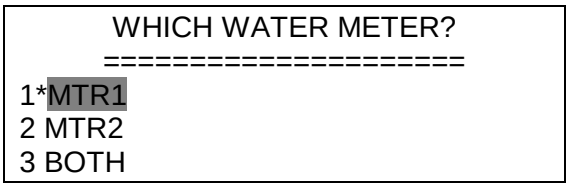
Select "**1**" **ABOVE SETPOINT** or "**2**" **BELOW SETPOINT**. An asterisk (*) is used to indicate the current configuration. When ABOVE SETPOINT is selected the relay when turn on when the parameter is higher than the setpoint and when BELOW SETPOINT is selected the relay will turn on when the parameter is below the setpoint.

13.2.3 By Water Meter

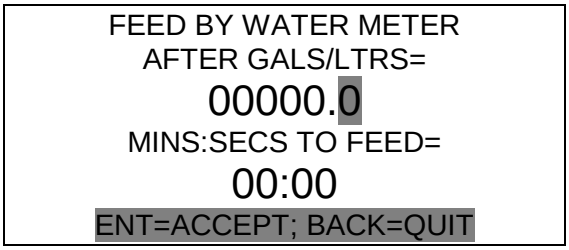
Relays 2 through 7 can be configured to operate for a specified amount of time based on a specified amount of flow through the water meter inputs. The flow total of MTR1, or MTR2, or the sum of BOTH water meter inputs can be used to activate the relay.

To set up the relay to operate for a specified amount of time based on a specified amount of flow through the water meter inputs:

- From the **RELAY OPTIONS** screen press "**3**" **WATER METER**.



- Select either **MTR1** or **MTR2** or **BOTH** as the trigger for the relay. You will be taken to the WATER METER FOR TIME screen.

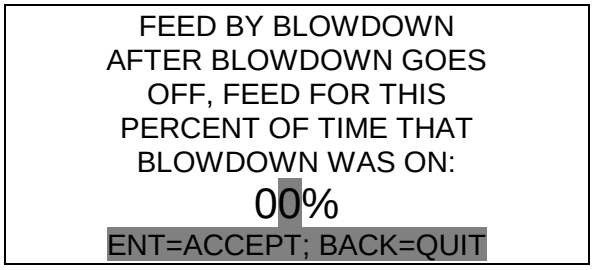


- Use the keypad to enter the amount of flow before the relay is activated. Press "**ENT**".
- Enter the amount of time that the relay will be activated. Press "**ENT**".

13.2.4 By Percent of Blowdown Time

Relays 2 through 7 can be activated by a percent of the time that the blowdown relay was on. The relay will activate after the blowdown relay shuts off. For example, if 50% is entered and the blowdown relay is on for 10 minutes, the relay will be energized for 5 minutes.

- From the **RELAY OPTIONS** screen, press "**4**" **PERCENT BLOWDOWN.** The following screen will appear:



Use the keypad to enter a percent of blowdown time to activate this relay. Press "**ENT**".

13.2.5 By Percent of Time

The Percent of Time feature allows you to feed chemical strictly based by a percent of time. This relay control scheme works in patterns of 20-second time blocks. A relay is on for some multiple of 20 seconds and off for some multiple of 20 seconds. Below is a chart showing how Percent of Time works over a 400 second **example**.

x = 20 seconds on
- = 20 seconds off

	←==========400 seconds==========→
0%	- - - - - - - - - - - - - - - - - - - -
5%	x - - - - - - - - - - - - - - - - - - -
10%	x - - - - - - - - - x - - - - - - - - -
20%	x - - - - x - - - - x - - - - x - - - -
30%	x - - x - - x - - - x - - x - - x - - -
40%	x - x - - x - x - - x - x - - x - x - -
50%	x - x - x - x - x - x - x - x - x - x -
60%	x - x x - x - x x - x - x x - x - x x -
70%	x x - x x - x x x - x x - x x - x x x -
80%	x x x x - x x x x - x x x x - x x x x -
90%	x x x x x x x x x - x x x x x x x x x -
95%	x x x x x x x x x x x x x x x x x x x -
100%	x x x x x x x x x x x x x x x x x x x x

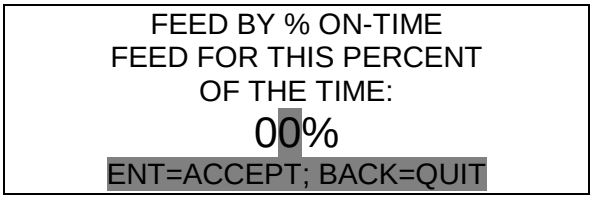
A 400-second example is shown because it will cover the patterns of the major percentages. The patterns for odd values such as 37% or 52% cannot be shown in a 400-second time interval but they would look very much like those patterns shown for 40% and 50% respectively. In an extreme case such as 99%, the relay would be on for 99 20-second blocks (1980 seconds) and then off for 1 20-second block (20 seconds) and then on for 1980 seconds and off for 20 seconds etc.

To determine the total amount of chemical fed over a 24 hour period, multiply the percent of time by the number of hours a day that your controller is operating, then multiply by your chemical pump flow rate per hour.

For example:
We select 10% of the time, our controller operates 24 hours a day and our chemical pump flow rate is 1 gallon per hour.

$$10\% \times \frac{24 \text{ hours}}{\text{Day}} \times \frac{1 \text{gallon}}{\text{Hour}} = \frac{2.4 \text{ Gallons}}{\text{Day}}$$

- From the **RELAY OPTIONS** screen press "**5**" **PERCENT OF TIME**. The following screen will appear:



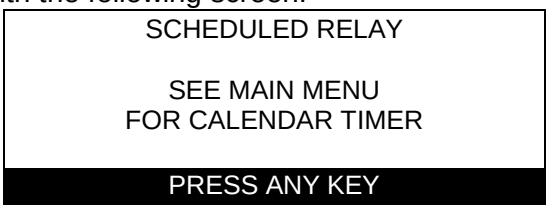
Use the keypad to enter the percentage of time desired. Press "**ENT**".

13.2.6 By Calendar Time

The Calendar Timer is used to feed chemicals such as biocides on a time of day basis. Setting up the Calendar Timer is a two-step process. The first step is to configure the relay so that it will operate by Calendar Timer. The second step of the process is to configure the Calendar Timer. The Calendar Timer is covered in section 13.3.

- From the **RELAY OPTIONS** screen press "**6**" **CALENDAR TIMER**.

The controller will respond with the following screen.



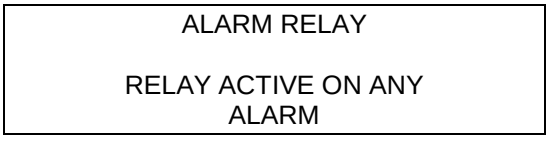
The relay has been configured to operate based on a Calendar Timer but, the relay will not activate because the Calendar Timer has not been programmed yet.

Press any key on the keypad to return to the relay configuration screen.

13.2.7 As an Alarm Relay

Relays 2 through 7 can be configured as alarm relays. Any alarm will cause all alarm relays to activate.

- From the **RELAY OPTIONS** screen press "**7**" **ALARM RELAY.** The controller will respond with the following screen.

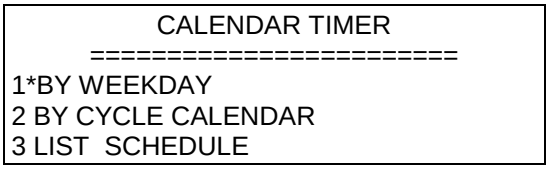


13.3 Setting Up the Calendar Timer

Refer to section 13.2.6 to configure a relay to feed based on the Calendar Timer before continuing with this section.

The CALENDAR TIMERS are used to feed chemical on a time of day basis. To get to the Calendar Timer menu:

- From the **MAIN MENU** press "**3**" **CALENDAR TIMER**. You will see the following screen:



13.3.1 Weekday or Cycle Timer

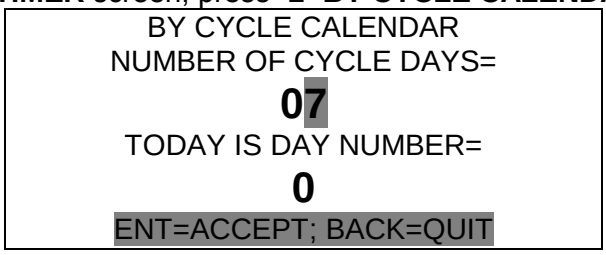
The Calendar Timer can be programmed to feed chemicals by either **WEEKDAY** or by a **CYCLE CALENDAR** basis.

BY WEEKDAY is used to feed chemicals by the weekday name, i.e. Monday, Tuesday, Wednesday etc. This is a seven-day schedule. At the end of the week, the schedule starts over again. To configure the Calendar Timer to feed by weekday:

- From the **CALENDAR TIMER** screen, press "**1**" **BY WEEKDAY.**

BY CYCLE CALENDAR is used to feed chemicals by a schedule other than one that is seven days long. **BY CYCLE CALENDAR** can be used to feed the same chemical every day or up to 28 days between feedings. The operator specifies the number of days in the cycle calendar. After the cycle calendar is completed, the schedule starts over again. This method of feeding is particularly useful when feeding two biocides on alternating weekly basis. To configure the Calendar Timer to feed by cycle calendar:

- From the **CALENDAR TIMER** screen, press "**2**" **BY CYCLE CALENDAR.**



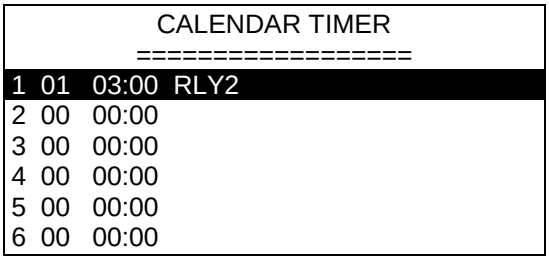
- Use the keypad to enter the number of days in your cycle then press "**ENT**". Remember the maximum number of days allowed is 28.

  Use the keypad to enter which day today is in your cycle; e.g. today is day number 5 in my 14 day cycle. Then press "**ENT**".

13.3.2 Editing the Calandar Timer

After selecting whether the Calendar Timer will be fed by **WEEKDAY** or by **CYCLE CALENDAR** it is time to actually program the schedule. To enter and edit the Calendar Timer from the Calendar Timer screen above:

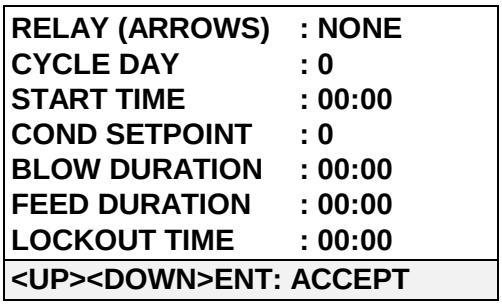
- Press "**3**" **LIST SCHEDULE**. This will take you to a list of all scheduled feeds as shown in the screen below.



NOTE: The maximum number of scheduled feeds is 12 (twelve) total.

- If there are no scheduled feeds, select the first schedule and press "**ENT**". If you are editing the schedule, select the schedule that you want to edit and press "**ENT**".

Below is an example screen for programming a chemical feed. Before programming a chemical feed, you need to configure Relay 2, 3, 4, 5, 6, or 7 to be a Calendar Timer relay.



NOTE: ALL TIMES ARE IN HOURS AND MINUTES

- To program the schedule use the keypad to enter the values in the above screen. Press "**ENT**" to move to the next item.

RELAY is which relay you want to program (you must configure a relay to be a Calendar Timer relay first). Use the arrow keys to select the available relays.

CYCLE DAY or **DAY** is the day you wish to actuate the Calendar Timer relay.

START TIME is the time you want to start the Calendar Timer sequence.

COND SETPOINT is a pre-bleed setpoint. This would typically be lower than the normal conductivity setpoint. Because the bleed valve will be disabled during a scheduled feed, a pre-bleed will help prevent a build up of tower conductivity. A setting of 0 μS will disable this feature.

BLOW DURATION if the COND SETPOINT is not met within this time, the blowdown will stop and the Calendar Timer relay will be actuated. Inputting 0:00 will disable this feature. Pulsafeeder recommends that some time be entered if pre-bleed is used.

FEED DURATION is the amount of time the Calendar Timer relay will be on.

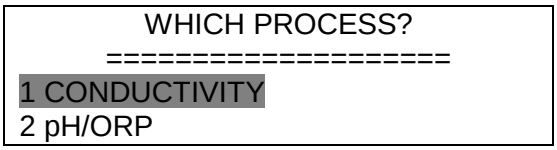
LOCKOUT TIME after the Calendar Timer relay has run; an additional lockout time for all relays can be programmed. The lockout time prevents the other relays from operating until this time expires. Set this time to 0:00 to disable this feature.

14 Alarms

The Controller is equipped with high and low conductivity alarms, high and low pH or ORP alarms. This menu option allows you to program the specific values for these alarms. When a high or low alarm is received, it will appear as a flashing message in the middle of the display and any configured alarm relays will be activated. Consult your water treatment specialist when determining the proper High and Low Alarm values for your system.

To get to the alarm settings:

- From the **MAIN MENU** press "**4**" **ALARMS**.



- Use the keypad to select the alarm process. You will be taken to the alarm settings screen for the process you select.

- Use the keypad to enter a value for the high alarm. Press "**ENT**".
- Use the keypad to enter a value for the low alarm and press "**ENT**".

NOTE: The high conductivity and the low pH alarms will override the normal blowdown relay configuration and force a blowdown to occur.

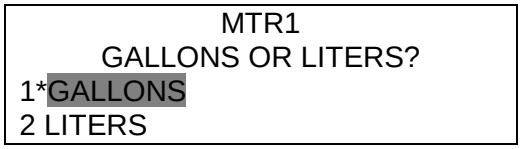
15 Water Meter

The controllers will work directly with the following types of meters: dry contacting head meters, Seametrics open collector output meters, Signet 2535 and 2540 paddle wheel meters, and the Autotrol 1 inch and 2 inch meters. Contact Pulsafeeder for other types of water meters.

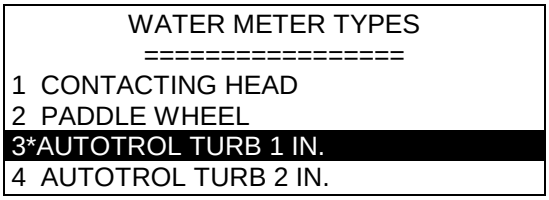
Both water meter inputs are programmed in the same manner.

To configure the water meter inputs:

- From the **main menu**, press "**5**" **WATER METERS**. This will take you to the **WHICH WATER METER SCREEN.**
- Press "**1**" for **MTR1** or press "**2**" for **MTR2**.



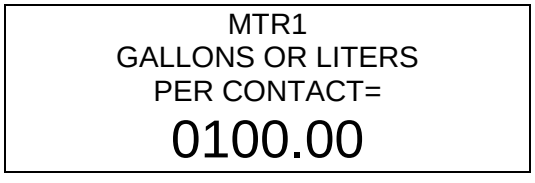
- The water meters can be configured for gallons or liters. Press "**1**" for **GALLONS** or press "**2**" for **LITERS**. The asterisk (*) indicates current configuration.
- This will take you to the **WATER METER TYPES** screen as shown below.

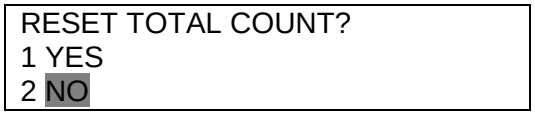


- Use the keypad to select the type of water meter that you are using. The asterisk (*) indicates current configuration.

If **CONTACTING HEAD** is selected:

- You will be taken to the **GALLONS OR LITERS PER CONTACT** screen.

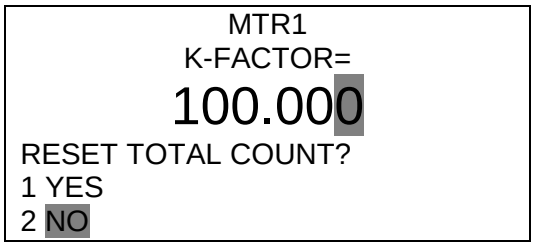




- Use the keypad to enter the number of gallons or liters per contact for your specific meter then press "**ENT**". You will then be asked if you want to reset the total count for that meter to zero. Press "**1**" for **YES** or press "**2**" for **NO**.

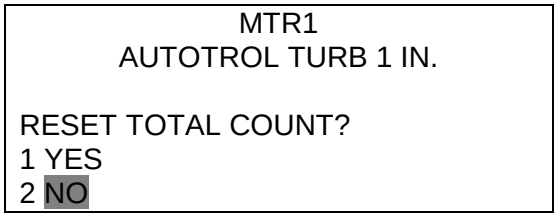
If **PADDLE WHEEL** is selected:

- You will be taken to the **K-FACTOR** screen.



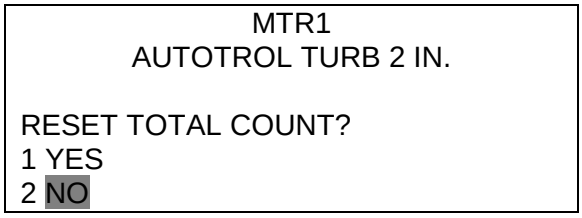
- Use the keypad to enter the K-factor for your particular water meter then press "**ENT**". You will then be asked if you want to reset the total count for that meter to zero. Press "**1**" for **YES** or press "**2**" for **NO**.

If **AUTOTROL TURB 1 IN.** is selected**:**



- The controller will confirm that the **AUTOTROL TURB 1 IN.** has been selected and you will be asked if you want to reset the total count for that meter to zero. Press "**1**" for **YES** or press "**2**" for **NO**.

If the **AUTOTROL TURB 2 IN.** is selected:



The controller will confirm that the **AUTOTROL TURB 2 IN.** has been selected and you will be asked if you want to reset the total count for that meter to zero. Press "**1**" for **YES** or press "**2**" for **NO**.

16 4-20mA Input & Output

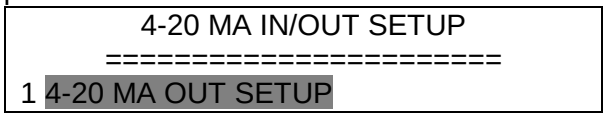
The controller has two 4-20 mA **outputs** that can be configured for conductivity and/or pH/ORP. The process type and the range of the 4-20 mA outputs are user configurable.

The controller has two 4-20 mA **inputs**, one for conductivity and one for pH/ORP. The 4-20 mA inputs are used for remote sensor inputs to the controller when the wiring length between the controller and sensors is longer than the recommended maximum. The maximum recommended wiring length for conductivity is 20 feet; the maximum recommended wiring length for pH or ORP is 15 feet.

16.1 Set Up of the 4-20 mA Output

To set up the 4-20 mA outputs:

- From the **Main Menu**, press "**6**" **4-20 mA IN/OUT**.



```
2 4-20 MA IN SETUP
```

- Press ”**1**” **4-20 mA OUT SETUP**.

To configure a 4-20 mA output channel; Select the channel, select the process parameter, set the range, and calibrate the output. Below is the **Which 4-20 mA Output** screen.

16.1.1 Select the 4-20 mA Output Channel

```
WHICH 4-20 MA OUTPUT?
=====================
1 4-20 MA OUT #1
2 4-20 MA OUT #2
```

- Use the keypad to select a channel for configuration. Each output is configured by the same method. Below is the 4-20 mA output setup screen.

```
4-20 MA OUT #1
======================
1 WHICH PROCESS?
2 SET 4-20 MA RANGE
3 MANUAL CONTROL
4 CALIBRATE 4-20 MA
```

16.1.2 Select the 4-20 mA Output Process

The 4-20 mA output channel must be configured to either conductivity or to pH/ORP. This is done in the Which Process screen.

- From the **4-20 mA Output Setup** screen, press ”**1**” **WHICH PROCESS.**

```
WHICH PROCESS?
======================
1*pH/ORP
2 CONDUCTIVITY
```

Use the keypad to select the process to which the 4-20 mA output will be configured. The asterisk (*) indicates current configuration.

16.1.3 Set the 4-20 mA Output Range

The 4-20 mA output range must be set for the output to be useful.

- From the **4-20 mA Setup** screen, press ”**2**” **Set the 4-20 mA RANGE.**

```
4 MA VALUE=
0 µS
20 MA VALUE=
05000 µs
CAL: +/-   ENT:ACCEPT
```

- Use the keypad to enter a process value for the 4-mA point. Press ”**ENT**”.

Use the keypad to enter a process value for the 20-mA point. Press ”**ENT**”

16.1.4 Manual Control of the 4-20 mA Output

Manual control is used to temporarily change the 4-20 mA output.

- From the **4-20 mA Setup** screen, press ”**3**” **MANUAL CONTROL**.

```
MANUAL 4-20 CONTROL
  4   8   12  16  20
  +   +   +   +   +
```

<-DOWN UP->
BACK=EXIT

Use the up and down arrow keys to raise or lower the 4-20 mA output. To exit this screen press "**BACK**".
Note: The 4-20 mA output reverts to automatic control when this screen is exited.

16.1.5 Calibrate the 4-20 mA Output

The 4-20 mA needs to be calibrated to the actual output to be accurate. The 4-20 mA output calibration is a two-point calibration. A milliamp meter is necessary to calibrate the 4-20 mA output. Connect the milliamp meter in-line with one leg of the 4-20 mA output. Refer to the drawing in the back of this manual for wiring instructions.

- From the **4-20 mA Setup** screen, press "**4**" **CALIBRATE.**

4 MA READING=
04.0
20 MA READING=
20.0
ENT=ACCEPT; BACK=QUIT

- The controller will output a value that is close to 4 mA. Use the keypad to enter the milliamp reading from the milliamp meter for the **4** mA point. Press "**ENT**".
- The controller will output a value that is close to 20 mA. Use the keypad to enter the milliamp reading from the milliamp meter for the **20** mA point. Press "**ENT**".

Remove the milliamp meter and reconnect all wires.

16.1.6 Setup of the 4-20 mA Inputs

The 4-20 mA inputs are used for a remote conductivity or a remote pH/ORP application where the conductivity sensor will be mounted greater than 20 feet from the controller or the pH/ORP sensor will be mounted greater than 15 feet from the controller. An external 4-20 mA device is required. Contact the factory for recommended analog signal conditioners.

The 4-20 mA inputs are dedicated. Input #1 is dedicated to conductivity and input #2 is dedicated to pH/ORP. The setup of the 4-20 mA input consists of: enabling the input channel, set the 4-20 mA range, and calibrate the input.

When 4-20 MA IN SETUP is selected the controller goes into the 4-20 ma input setup screens:

- From the Main Menu press "**6**" **4-20 mA IN/OUT.**

4-20 MA IN/OUT SETUP
==========
1 4-20 MA OUT SETUP
2 4-20 MA IN SETUP

Press "**2**" **4-20 mA IN SETUP.** The controller will go to the WHICH 4-20 mA INPUT screen.

16.1.7 Select the 4-20 mA Input Channel

WHICH 4-20 MA INPUT?
==========
1 CONDUCTIVITY
2 pH/ORP

- Use the keypad to select the desired input channel.

To configure a 4-20 mA input channel; Enable the 4-20 mA input, set the range, and calibrate the input.

```
4-20 MA INPUT
======================
1 SET 4-20 MA RANGE
2 ENABLE/DISABLE
3 CALIBRATE
```

16.1.8 Enable/Disable the 4-20 mA Input

To use the 4-20 mA input channel, it must be enabled.

- From the **4-20 mA INPUT** setup screen, press "**2**" **ENABLE/DISABLE.**

```
ENABLE 4-20 MA INPUT?
======================
1 YES
2*NO
```

Press "**1**" to enable the 4-20 mA input or press "**2**" to disable the 4-20 mA input.

16.1.9 Set the 4-20 mA Input Range

The 4-20 mA input range must be set to the 4-20 mA output range of the 4-20 mA device to be useful.

- From the **4-20 mA IN** setup screen, press "**1**" **Set 4-20 mA RANGE.**

```
4 MA VALUE=
0 µS
20 MA VALUE=
##### µs
ENT=ACCEPT; BACK=QUIT
```

- Use the keypad to enter a conductivity value for the 4-mA point. Press "**ENT**".

  Use the keypad to enter a conductivity value for the 20-mA point. Press "**ENT**".

16.1.10 Calibrate the 4-20 mA Input

The 4-20 mA input needs to be calibrated to the actual input to be accurate. A milliamp meter is necessary to calibrate the 4-20 mA input. Connect the milliamp meter in-line with one leg of the 4-20 mA input. Refer to the drawing in the back of this manual for wiring instructions.

- From the **4-20 mA Setup** screen, press "**3**" **CALIBRATE.**

```
INPUT MA READING=
00.0
ENT=ACCEPT; BACK=QUIT
```

- The 4-20 mA input calibration is a single-point calibration. Use the keypad to enter the milliamp reading from the milliamp meter. Press "**ENT**".
- Remove the milliamp meter and reconnect all wires.

  The calibration of the 4-20 mA channel is only necessary during the initial configuration of the 4-20 mA inputs. All future calibrations of conductivity or pH/ORP will be performed by using the normal calibration procedures.

17 System Set-up Menu

The system setup menu is used to: configure the conductivity input, configure the pH/ORP input, initialize the controller, change the security password, check the firmware version, and view the controller diagnostics.

```
SYSTEM SETUP
======================
1 PROCESS PARAMETERS
2 INITIALIZATION
3 SECURITY
4 FIRMWARE VERSION
5 DIAGNOSTICS
```

17.1 Process Parameters

The process parameters screens are used to configure the conductivity input and the pH/ORP input.

```
WHICH PROCESS?
======================
1 CONDUCTIVITY
2 pH/ORP
```

- Use the keypad to select the process input to configure.
- The following message will be displayed if the 4-20 mA input is enabled for the process selected:

```
PROCESS PARAMETERS
CAN NOT BE SET WHEN
4-20 MA IS ENABLED.
     ENT=ACCEPT; BACK=QUIT
```

17.1.1 Conductivity Temperature Compensation

In the Conductivity process parameters screen, the temperature compensation for the conductivity input can be disabled. The process parameters screen for conductivity looks like:

```
COND PARAMETERS
======================
1 TEMP COMPENSATION
```

- Use the keypad to select **1 TEMP COMPENSATION**.

```
TEMP COMPENSATION
======================
1  NONE
2 *500 NTC
```

Use the keypad to select the temperature compensation option. The asterisk (*) indicates current configuration.

17.1.2 pH/ORP Process Parameters

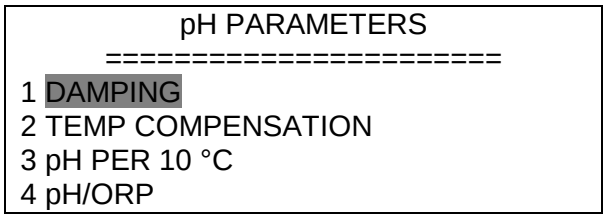
The pH/ORP input can be configured for either pH or ORP. The process parameters screen that is displayed is based on the parameter that is currently active.

If ORP is active, the Process Parameters screen allows you to configure the damping and change the input to pH. The Process Parameters screen for ORP looks like:

```
ORP PARAMETERS
======================
1 DAMPING
2 pH/ORP
```

Note: Both of the selections in the ORP Process Parameters screen are the same as in the pH Process Parameters screen and will be described in the pH Process Parameters section.

If pH is active, the Process Parameters screen allows you to configure the damping, configure the temperature compensation input for pH, change the amount of temperature compensation for pH, and change the input to ORP. The Process Parameters screen for pH looks like:

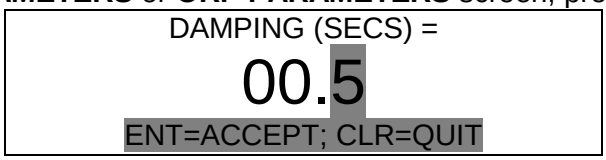


17.1.3 Damping

Damping is used to slow down the rate of change of the pH or ORP reading in cases where the reading is changing rapidly. The default setting is 0.5 seconds. The larger the time, the slower the readings will change.

To change the damping value:

- From the **pH PARAMETERS** or **ORP PARAMETERS** screen, press **"1" DAMPING**.

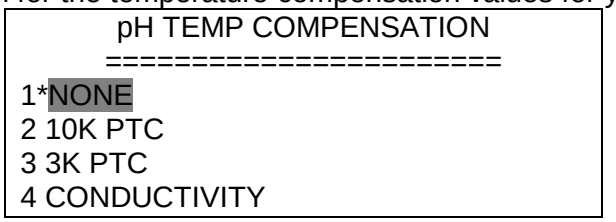


Use the keypad to change the damping time and press **"ENT"**.

17.1.4 Temperature Compensation for pH

The controller can accept a 10K PTC or a 3K PTC temperature compensator for pH, or the pH can use the conductivity sensor temperature compensator for the pH temperature compensation. The temperature compensator for pH can also be disabled.

The temperature compensation for your sensor must be set for your pH sensor. Refer to the manufacturer's information for the temperature compensation values for your pH sensor.



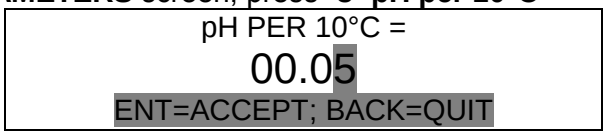
Press "**1**" for **NONE**. Press "**2**" for **10k PTC**. Press **"3"** for **3K PTC**. Press "**4**" for **CONDUCTIVITY**.

17.1.5 pH per 10°C

The controller has the ability to change the amount of temperature compensation for each 10°C temperature change.

To change the amount of temperature compensation:

- From the **pH PARAMETERS** screen, press "**3**" **pH per 10°C**



- Use the keypad to enter a value for the amount of temperature compensation. Press **"ENT".**

17.1.6 pH/ORP

The controller pH/ORP input can be configured for either pH or ORP.

To configure the pH/ORP input:

- From the **pH PARAMETERS** screen, press "**4**" **pH/ORP** or from the **ORP PARAMETERS** screen, press "**2**" **pH/ORP**.

```
pH/ORP INPUT
======================
1*pH
2 ORP
```

- Use the keypad to configure the pH/ORP input. The asterisk (*) is used to indicate current configuration.

18 Initialization

Initialization restores the factory default settings to the controller. The whole controller can be initialized or just the calibrations. It is suggested that you initialize the whole controller before you program the controller for the first time. This will clear any random settings that may be in the controller.

Initialization of Whole Controller:

- From the **Main Menu**, press "**7**" **SYSTEM SETUP**.
- Press "**2**" **INITIALIZATION**.

```
INITIALIZATION
======================
1 CALIBRATIONS
2 WHOLE CONTROLLER
```

- Press "**2**" **WHOLE CONTROLLER** and press "**ENT**". A warning will appear on the screen:

```
WARNING:
THIS OPTION MAY
REQUIRE YOU TO
RE-PROGRAM THE
CONTROLLER.
ARE YOU SURE?
1 YES
2 NO
```

- Press "**1**" to proceed with the initialization, or press "**2**" to cancel.

NOTE: Initialization of the whole controller will restore all factory settings and will require re-programming of the entire controller.

Initialization of Calibrations:

- Press "**1**" **CALIBRATIONS** in the procedure above.

```
WHICH PROCESS?
======================
1 CONDUCTIVITY
2 pH/ORP
```

- Use the keypad to select the process calibrations to initialize. The same warning as above will appear on the screen. Press "**1**" to proceed, "**2**" to cancel.

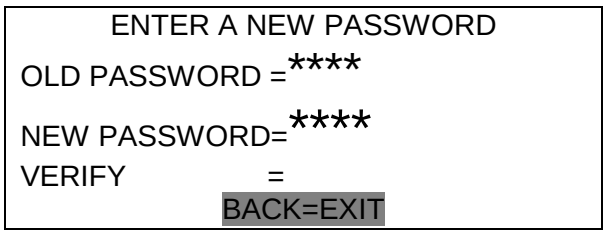
18.1 Change the Security Password

The security password can be changed from the factory default setting of **2222** to any four-digit value that you desire.

To change the security password:

- From the **Main Menu**, press "**7**" **SYSTEM SETUP**.
- Press "**3**" **SECURITY**.

```
PASSWORDS ARE 4 KEYS
```



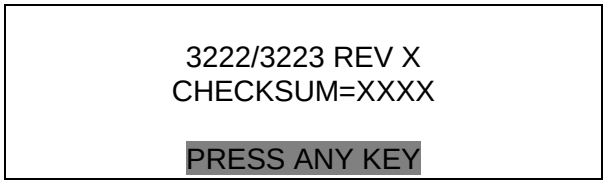
- Use the keypad to enter the old password. If the password has not been changed before, the old password is **2222**.
- Use the keypad to enter the new password.
- Use the keypad to enter the new password a second time for verification

If you lose your password, contact Pulsafeeder for assistance.

18.2 Firmware Version

Sometimes it is necessary to verify the firmware version of the controller for troubleshooting purposes. To get to the firmware version:

- From the **Main Menu**, press "**7**" **SYSTEM SETUP**.
- Press "**4**" **FIRMWARE VERSION**.



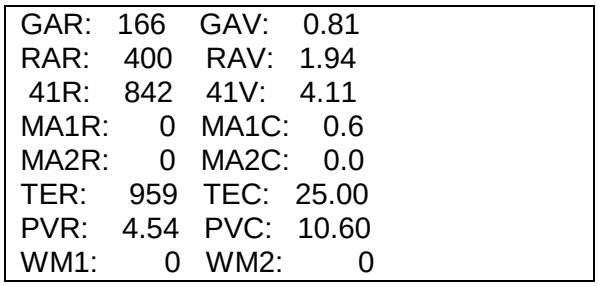
The firmware version will be displayed along with a checksum value. The checksum value is used to verify that the program has not been corrupted. To exit this screen, press any key.

18.3 Diagnostics

The DIAGNOSTICS screen is used for troubleshooting purposes.

To get to the DIAGNOSTICS screen:

- From the **Main Menu**, press "**7**" **SYSTEM SETUP**.
- Press "**5**" **DIAGNOSTICS**.

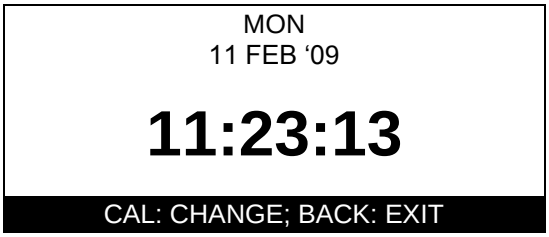


- The above information can be very useful to the technician to help troubleshoot a problem with the controller. Contact Pulsafeeder for assistance in using the DIAGNOSTICS screen.
- Press "**BACK**" to exit this screen.

19 Setting the Clock

The clock uses the 24 hour or military time. 06:00:00 is 6 a.m. 18:00:00 is 6 p.m. To set the clock:

- From the **Main Menu** press "**8**" **CLOCK**. The following screen will appear:



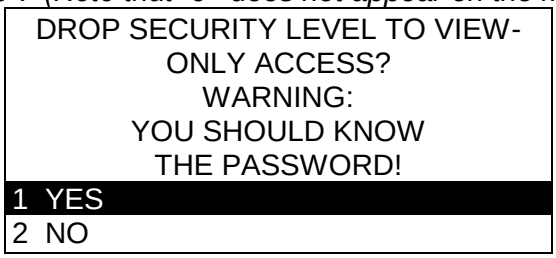
- Press "**CAL**" to change the clock settings. The day will start to flash.
- Use the up and down arrow keys to change the day of the week. Press "**ENT**".
- Use the number keys to change the date. Press "**ENT**".
- Use the arrow keys to change the month. Press "**ENT**".
- Use the number keys to change the year. Press "**ENT**".
- Use the number keys to change the hour. Press "**ENT**".
- Use the number keys to change the minutes. Press "**ENT**".
- Use the number keys to change the seconds. Press "**ENT**".
- Press "**BACK**" to exit this screen.

You must press "**ENT**" all the way through this menu for the settings to take affect.

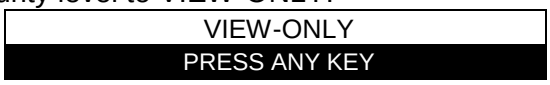
20 Changing the Security Levels

The security level can be changed to prevent any unwanted tampering of the controller. To change the security level from **Technician** to **View-Only**:

- From the **Main Menu**, press "**0**". *(Note that "**0"** does not appear on the menu screen.)*



- Select **YES** to change the security level to VIEW-ONLY.



The controller menu now functions at the VIEW-ONLY security level.

To return to the **Technician** security level:

- In the VIEW-ONLY mode, the controller will be in the **Process** screen. Use the keypad to type in the 4-digit password to enter the TECHNICIAN mode:

NOTE: The default Technician password is **2222**. You may change the password in the SYSTEM SETUP menu under SECURITY.

21 Maintenance

Periodic maintenance is required to ensure trouble free operation of the controller. The following sections cover the required maintenance.

21.1 Sensor Maintenance

Routine maintenance is necessary in order to maximize the efficiency and accuracy of your sensor. Clean the electrode end of the conductivity and pH/ORP sensors at least once per month. Cleaning of the sensors may need to be performed more frequently if it is in a high fouling environment.

Conductivity

- Remove power from the controller and shut off the sample flow.
- Remove the sensor from its plumbing.
- Use a wire brush to lightly brush the sensor tips. Do not use cloth to clean the sensor tips. Cloth has oils that will foul the sensor.
- If there is oil on the sensor tips, use isopropyl alcohol to clean the tips. If necessary determine the source of oil contamination and correct.
- If necessary, use a 10% Muriatic or HCL acid to remove scale from the sensor.
- Wash the sensor off with tap water.
- Clean and lubricate the "O" ring with a silicone-based lubricant (petroleum-based lubricants will cause the O-ring to swell).
- Install the sensor in its plumbing.
- Restore sample flow and check for leaks.
- Restore power to the controller and allow the reading to stabilize.
- Perform a calibration of the conductivity.
- Verify operation before leaving the area.

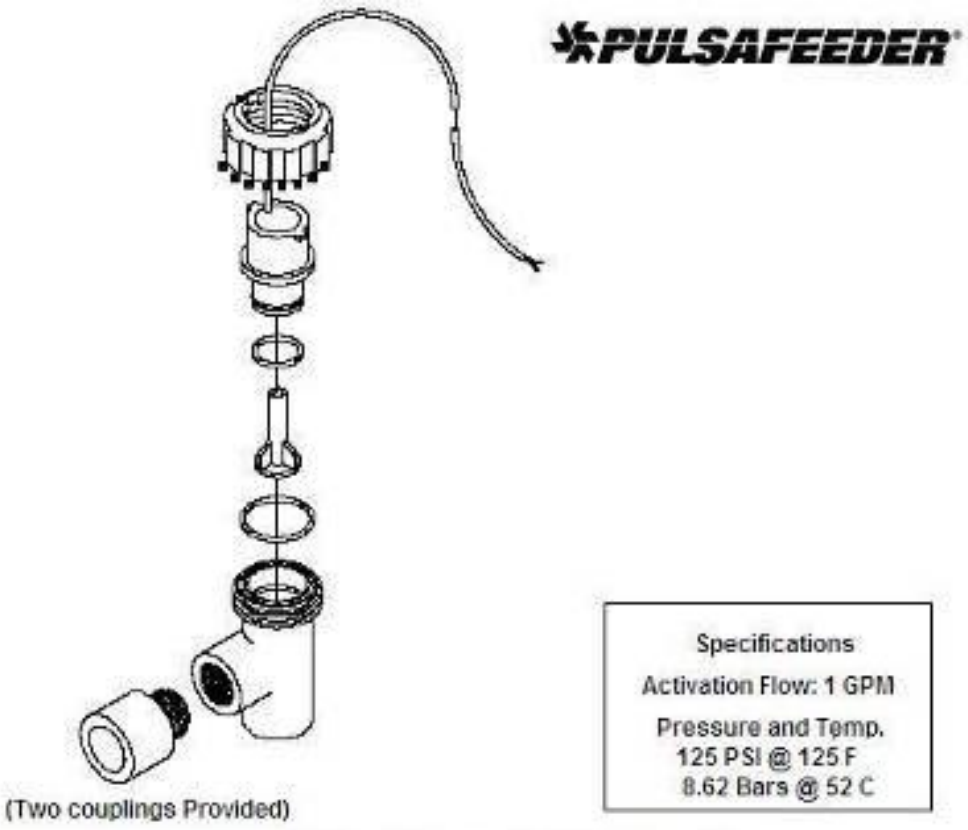
pH/ORP

- Remove power from the controller and shut off the sample flow.
- Remove the sensor from its plumbing.
- Flush the sensor tip with tap water. Do not use cloth to clean the sensor tip. Cloth has oils that will foul the sensor.
- If there is oil on the sensor tip, use isopropyl alcohol to clean the tip. If necessary determine the source of oil contamination and correct.
- If necessary, use a 10% Muriatic or HCL acid to remove scale from the sensor.
- If necessary, a cotton swab can be used to clean the reference junction of the sensor. Avoid contact with the glass as much as possible.
- Wash the sensor off with tap water.
- Clean and lubricate the "O" ring with a silicone-based lubricant (petroleum-based lubricants will cause the O-ring to swell).
- Install the sensor in its plumbing.
- Restore sample flow and check for leaks.
- Restore power to the controller and allow the reading to stabilize.
- Perform a calibration of the pH or ORP.
- Verify operation before leaving the area.

21.2 Flow Switch Maintenance

If you have the flow switch plumbing assembly, you may need to periodically clean the wetted parts in this assembly.

* Shut off the inlet flow and the power to the controller.
* Turn the coupling nut for the flow switch counterclockwise.
* Pull out the red shuttle with your fingers.
* Use a bottlebrush on the shuttle, flow sight and the flow switch assembly to remove any residue.
* Clean and lubricate the "O" ring with a silicone-based lubricant (petroleum-based lubricants will cause the O-ring to swell).
* Tighten down the coupling nut after you replace the components.
* Turn the inlet flow back on and check for leaks.



P/N 04-350-90-1 Flow Switch Assembly

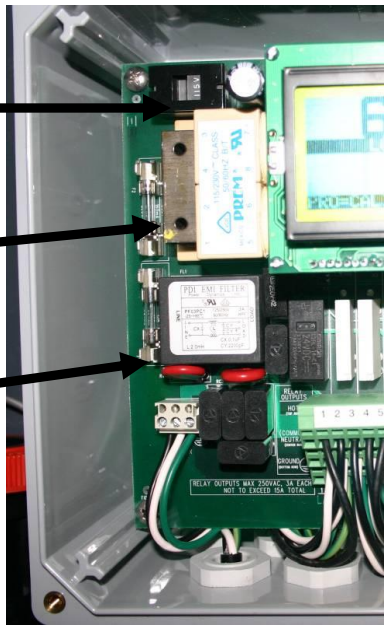
22 Replacing the Fuses

The Controller contains a two 5 x 20 mm, European-style fuses. Replacement fuses must be a Littlefuse 217 015 or equivalent 15A, 250V, fast acting type for Fuse F1, and a Littlefuse 218.160 or equivalent 160mA, slow blow for Fuse F2. If a fuse is blown, the display will be blank when the unit is connected to power. Refer to the troubleshooting section of this manual for more information about blank displays.

115/230VAC power selector switch

160mA, 250V, slow blow fuse

15A, 250V, fast acting fuse



23 Troubleshooting

23.1 Error Messages

This section discusses some of the more common questions with the Controller. These notes are not intended to be all-inclusive—only to cover the most common situations. If you have other questions or are in need of support, contact the Pulsafeeder Technical Service Department toll free at (800) 333-6677.

PROBLEM	WHAT THIS MEANS	CORRECTIVE ACTION
{Alarm Flashing} "CONDUCTIVITY HIGH".	Conductivity is too high with respect to the high alarm setpoint. Also opens up Bleed Valve (useful during CALENDAR TIMER lockout).	1. See {BLOWDOWN TIMEOUT}. 2. Verify operation of the flow switch. 3. Change the High Alarm Value.
{Alarm Flashing} "CONDUCTIVITY LOW".	Conductivity is too low with respect to the low alarm setpoint.	1. Check blowdown setpoint and deadband. 2. Verify blowdown valve is not stuck open. 3. Insure the system is not overflowing. 4. Change the Low Alarm Value.
{Alarm Flashing} "PH OR ORP HIGH" OR "PH OR ORP LOW"	PH or ORP is too high or low with respect to the high or low alarm setpoint.	1. See problem "RELAY TIMEOUT". 2. Check the chemical pump operation. 3. The chemical drum is empty. 4. Check the High or Low Alarm Value. 5. Check relay setpoints and deadbands. 6. Insure the system is not overflowing.
Water meters not accumulating.	There may be a problem with the wiring or the reed switch in the meter may be bad. For water meters other than the contacting head type, check the manufacturer's user manual for that particular water meter.	1. Approximately 5 volts DC should be present at the input terminal when the water meter contact is closed. That should change to zero VDC when the contact opens. Check these voltages and for correct wiring. 2. Is the controller configured for your type of water meter?

{Alarm Flashing} "FEED SEQUENCE ACTIVE".	This simply indicates that a Calendar Timer relay is active.	No action necessary.
Display is blank.	There may be a problem with the incoming power, the fuses or the circuit board. Open the front panel to troubleshoot.	1. Check the fuse F1. Replace with 5 x 20 mm, 15A, 250V, fast blow fuse. 2. Check the fuse F2. Replace with 5 x 20 mm, 160mA, 250V, slow blow fuse. 3. Does the unit have power? 4. If there is power across terminals L1 and N on P1, call Pulsafeeder Technical Service for more information.
{Alarm Flashing} "NO FLOW" alarm.	Flow input switch is not closed.	1. The flow switch float may be stuck or no flow is present. 2. Flow switch may be bad. Replace reed switch in plumbing assembly. If no flow switch is used, a jumper wire should be installed across the flow switch input. Removing the jumper disables all relay outputs.
{Alarm Flashing} "BLOWDOWN TIMEOUT".	This indicates that the controller has been trying to reduce the conductivity for longer than the user-programmed time and is unable to reach the setpoint.	1. Verify operation of Blowdown valve system. Use the manual relay control to help. 2. Check that the blowdown valve is not stuck closed or restricted. 3. Verify operation of Makeup water system. 4. Verify blowdown timeout time is properly set for your application (see item #2 or RELAYS in MAIN menu).
{Alarm Flashing} "RELAY X TIMEOUT"	This indicates that the controller has been trying to reach a setpoint for longer than the user-programmed time and is unable to reach the setpoint.	1. Verify operation of Blowdown valve system. Use the manual relay control to help. 2. Verify operation of Makeup water system. 3. Verify operation of chemical pump. 4. Adjust overfeed time for affected relay.
{Alarm Flashing} "OPEN COND TC".	Temperature compensator of the conductivity sensor is not being properly read.	1. Check conductivity sensor wiring. 2. Verify the resistance of the conductivity sensor TC using an ohm meter. 3. 4. Replace conductivity sensor.
{Alarm Flashing} "SHORTED COND TC".	Temperature compensator of the conductivity sensor is not being properly read.	1. Check conductivity sensor wiring. 2. Verify the resistance of the conductivity sensor TC using an ohm meter. 3. Replace conductivity sensor.

{Alarm Flashing} "OPEN PH TC".	Temperature compensator of the pH sensor is not being properly read.	1. Check pH sensor wiring. 2. Verify the resistance of the pH sensor TC using an ohm meter. 3. Replace pH sensor.
{Alarm Flashing} "SHORTED PH TC".	Temperature compensator of the pH sensor is not being properly read.	1. Check pH sensor wiring. 2. Verify the resistance of the pH sensor TC using an ohm meter. 3. Replace pH sensor.
Motorized ball valve turns, but will not remaining either the "open" or "closed" position.	The motorized ball valve is continually turning. This is usually caused by a loose of bad switch on the valve.	1. Adjust the limit switch for the motorized ball valve. 2. Verify that power is not applied to both the normally open and normally closed contact of the blow relay at the same time.
Calibration points < 2 pH apart or Calibration points <200 mV apart	You are trying to perform a two point calibration with two solutions that are too close to the same reading to allow a good calibration to occur.	1. For a pH two point calibration, the two solutions must be at least two pH apart. 2. For an ORP two point calibration, the two solutions must be at least 200 mV apart. 3. Initialize the calibration.
Deviation >1.5 pH from default or Deviation >200mV from default	You are trying to calibrate the controller to a value that is too far from the value the controller expects based on the input from the sensor.	1. Initialize the calibrations and try again. 2. Check sensor operation in a cup of the system water or buffer. 3. Clean sensor.

23.2 Factory Service

Your PULSAblue is a state of the art microprocessor based controller. If you are experiencing a problem with your process control instrument, first consult the troubleshooting guide in this manual. If the problem is not covered or cannot be solved, contact Technical Services for assistance:

PULSAFEEDER INC. (SPO)

27101 AIRPORT ROAD

PUNTA GORDA, FL 33982

941-575-3800

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

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

MAINTENANCE

Warranty

Pulsafeeder, Inc. warrants control systems of its manufacture to be free of defects in material or workmanship. Liability under this policy extends for 24 months from date of shipment. Electrodes/probes are considered maintenance items and as such are warranted for six (6) months from the date of shipment of the controller. Electrodes/probes purchased as spare parts are warranted for 90 days from date of shipment. The manufacturer's liability is limited to repair or replacement of any failed equipment or part, which is proven defective in material or workmanship upon completion of the manufacturer's examination. This warranty does not include removal or installation costs and in no event shall the manufacturer's liability exceed the selling price of such equipment or part.

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

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

Service Guide

When calling Pulsafeeder, please have your controller's complete model number and serial number available, together with the firmware version so that the Technician can better assist you.

Refer to the Ordering Information section of this manual for part numbered replacement parts.

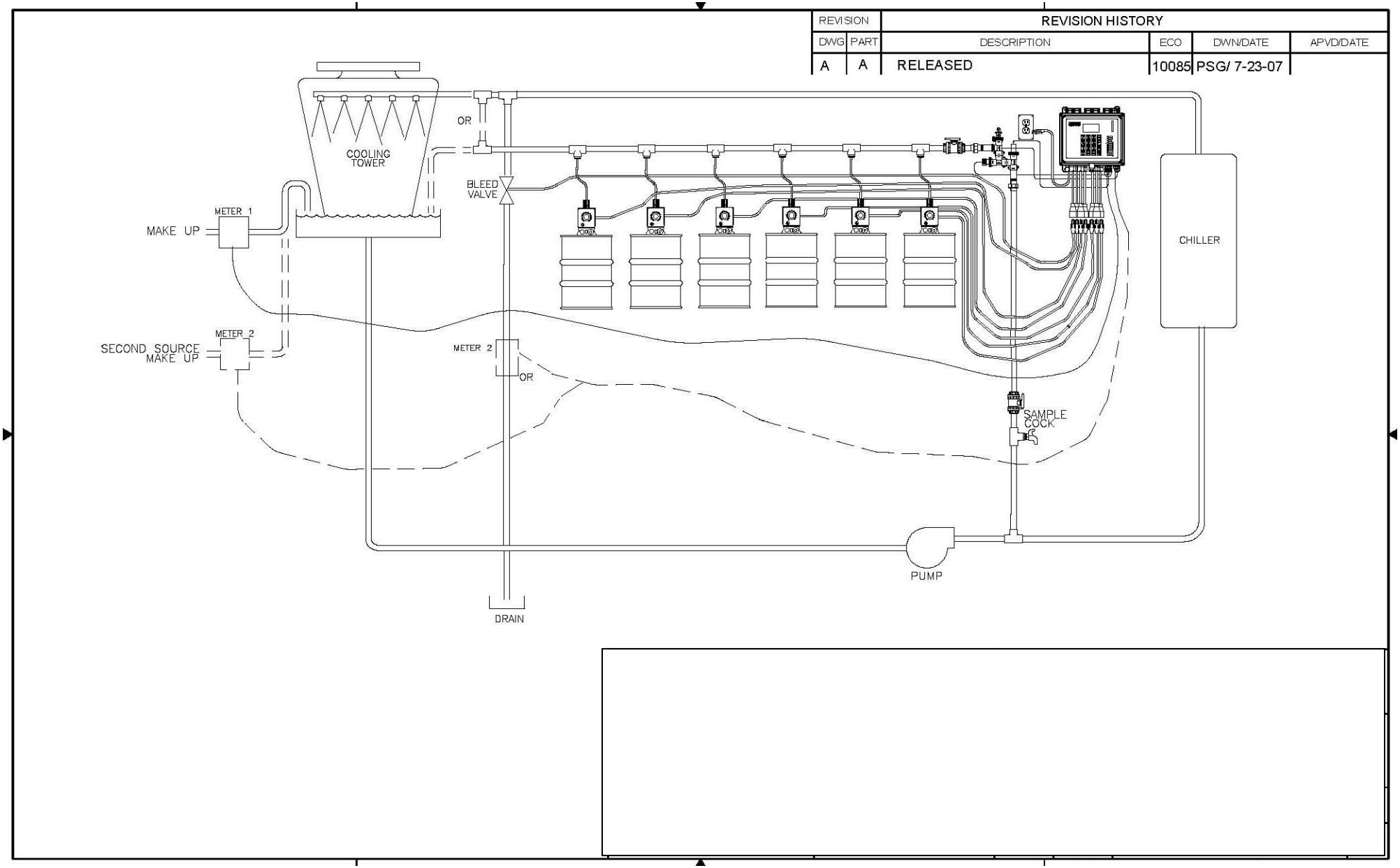
Write your controller's complete model number, serial number, and firmware version here so that you will have them available if you wish to contact a Pulsafeeder technician.

Model Number:

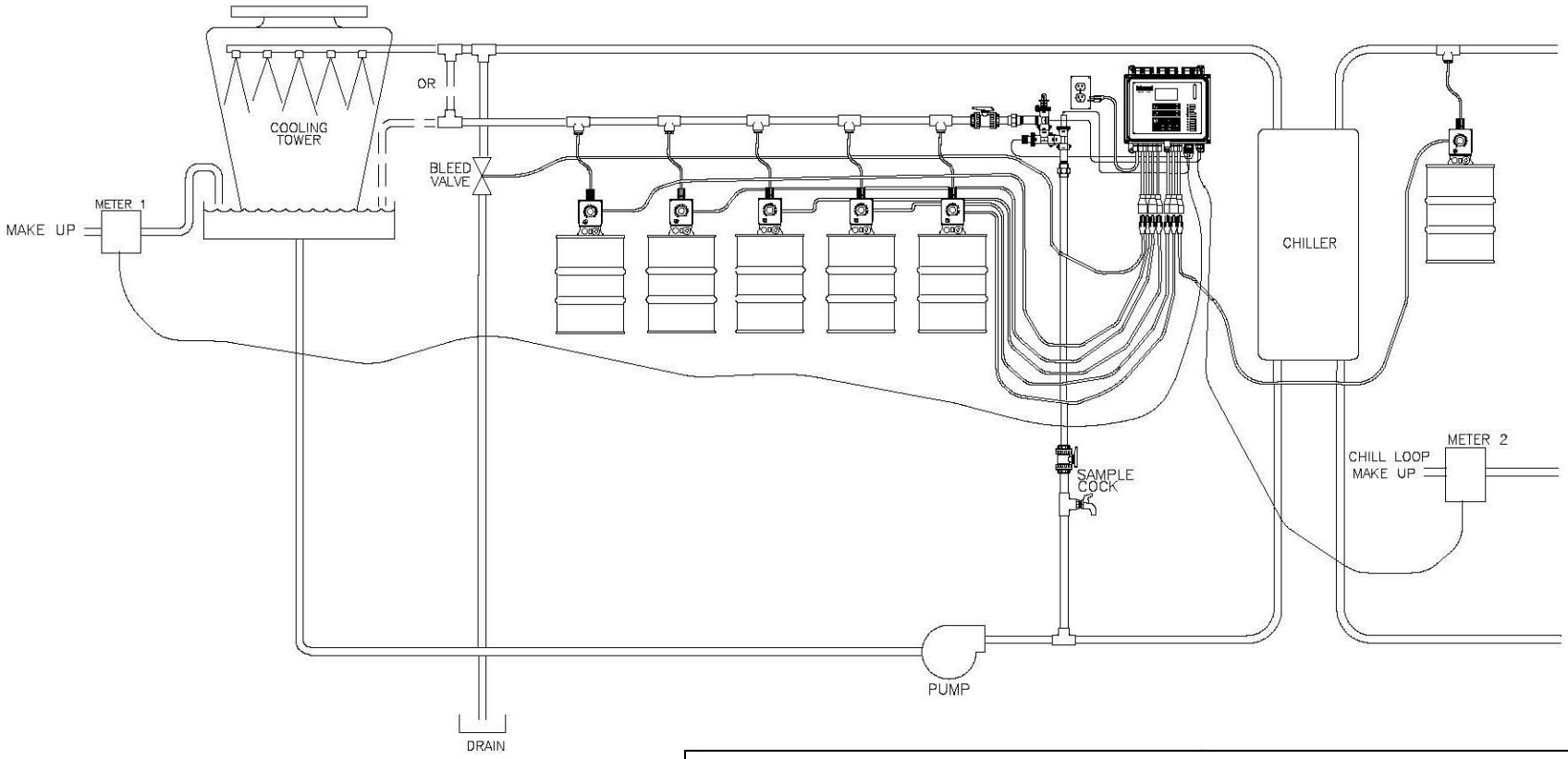
Serial Number:

Firmware Version:

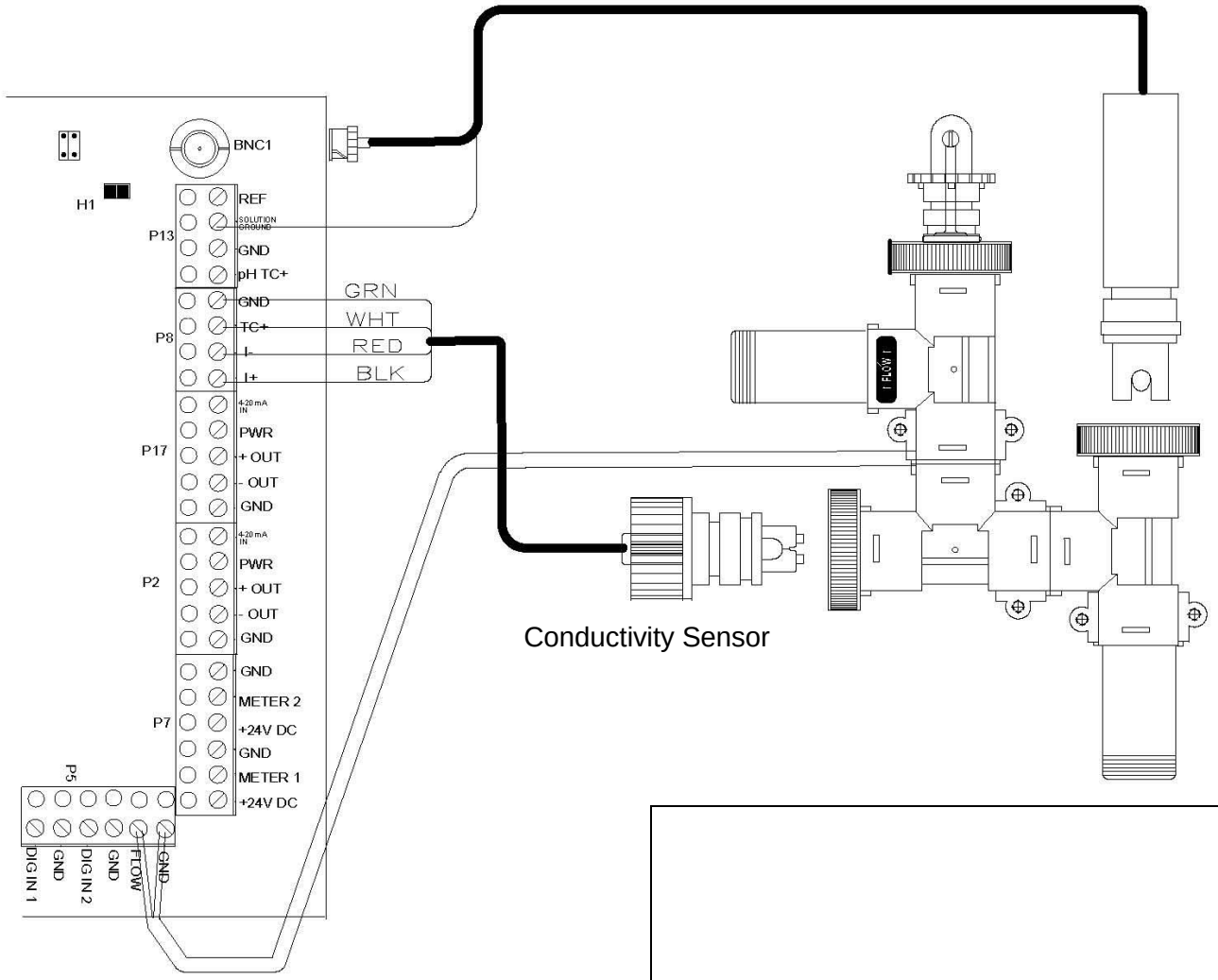
24 Drawings


REVISION
REVISION HISTORY
DWG
PART
DESCRIPTION
ECO
DWN/DATE
APVD/DATE
A
A
RELEASED
10085
PSG/ 7-23-07
COOLING TOWER
OR
BLEED VALVE
METER 1
MAKE UP
METER 2
SECOND SOURCE MAKE UP
METER 2
OR
CHILLER
SAMPLE COCK
PUMP
DRAIN

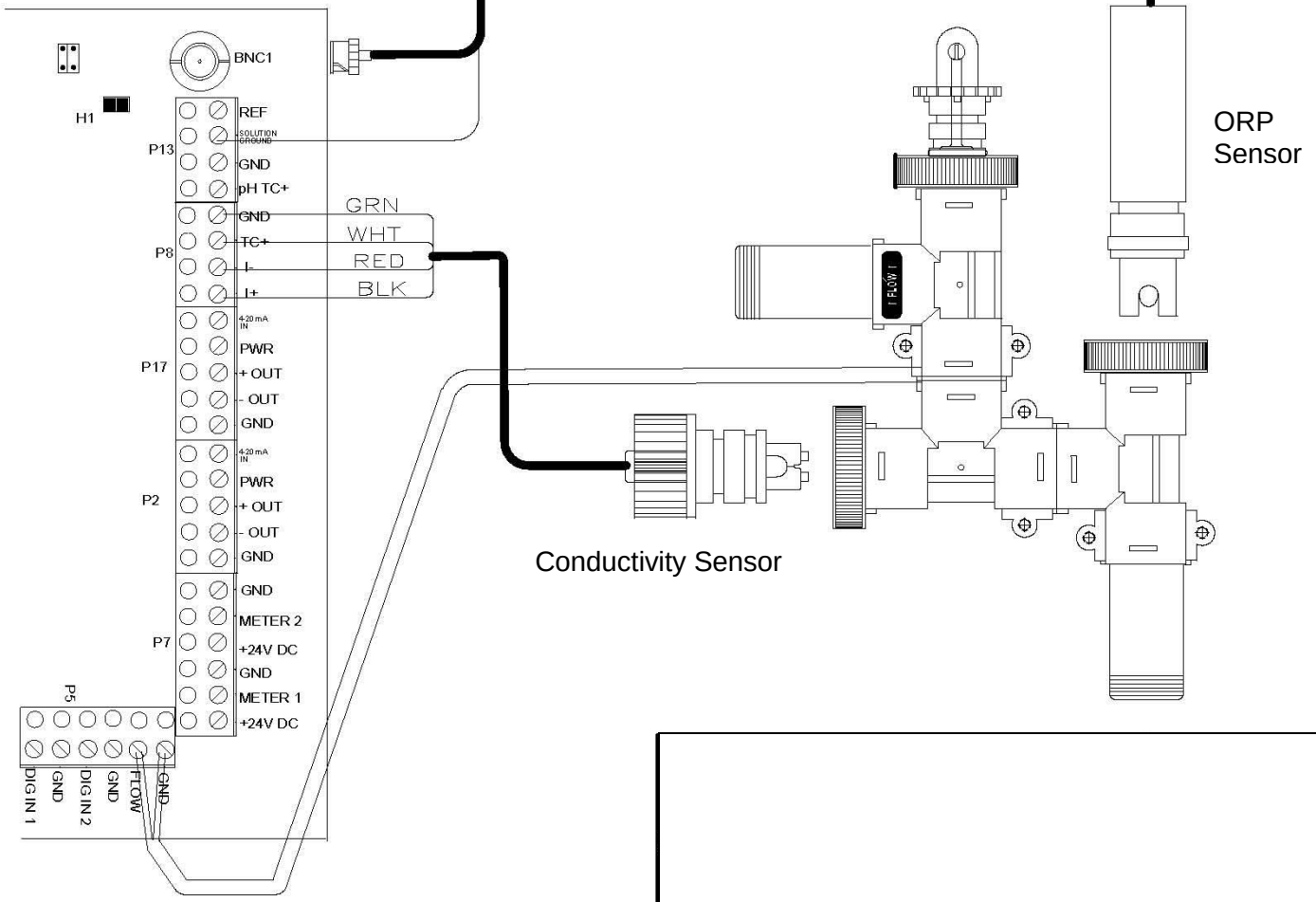
REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A	A	RELEASED	10085	PSG/ 7-24-07	



REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A	A	RELEASE	10085	PSG 7-19-07	



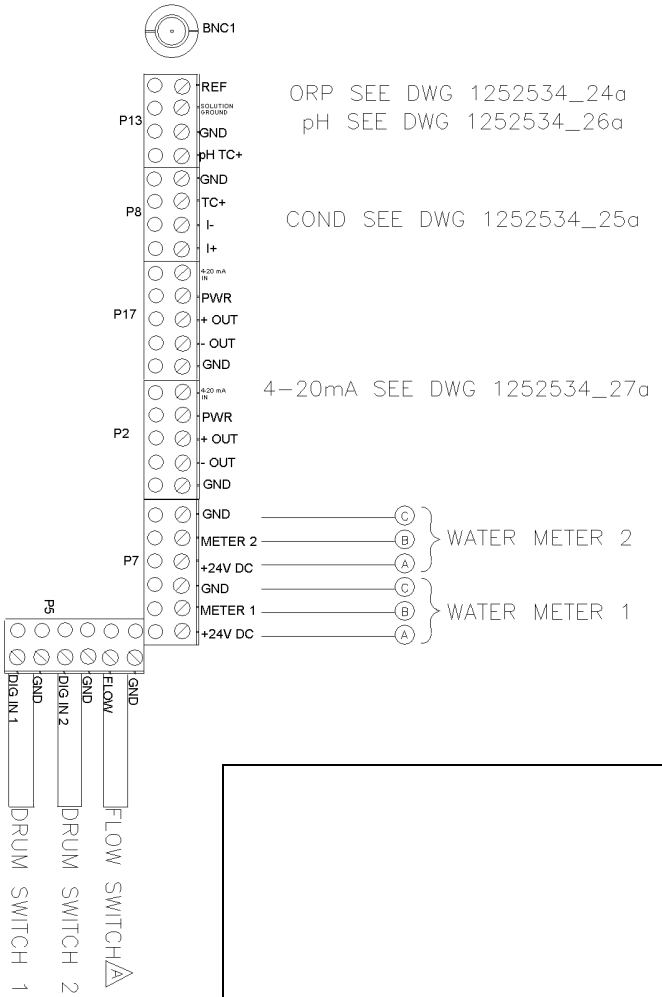
REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A	A	RELEASE	10065	PSG 7-19-07	

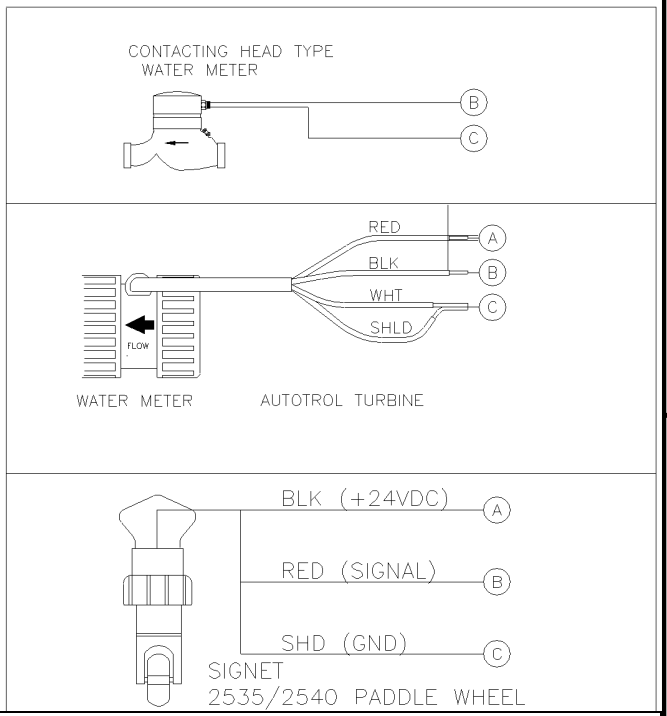


NOTES: UNLESS OTHERWISE SPECIFIED

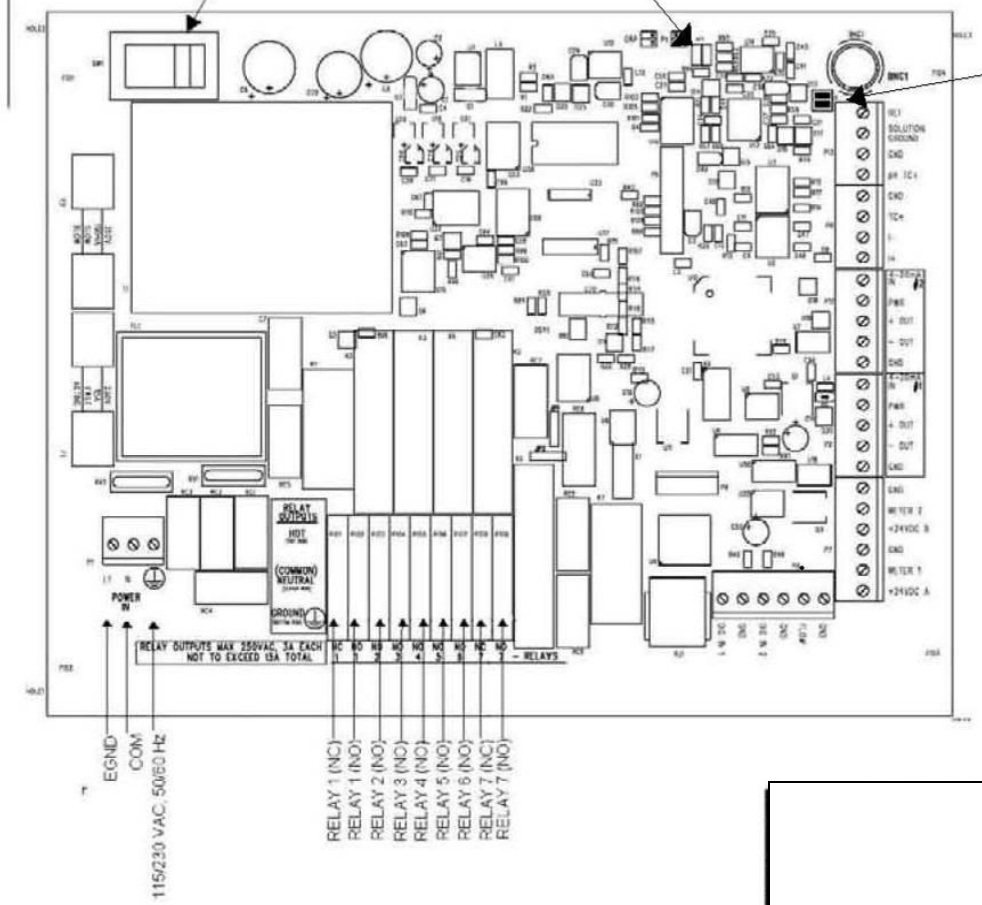
△A IF NO FLOW SWITCH IS USED, SHORT OUT PINS 1 & 2 WITH WIRE

REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A	A	RELEASE	10085	PSG 7/19/07	



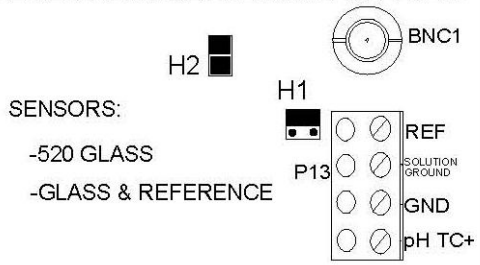


REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A	A	RELEASED	10085	PSG/8-1-07	

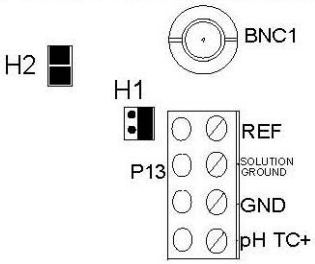


REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A	A	RELEASE		PSG 7-19-07	

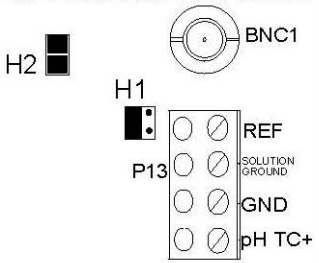
DIFFERENTIAL / REFERENCE ON WIRE



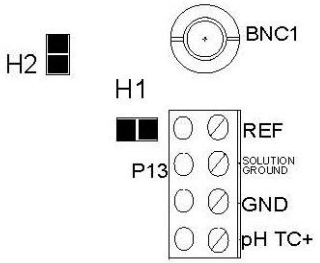
DIFFERENTIAL / REFERENCE ON SHIELD



SINGLE ENDED / REFERENCE ON WIRE



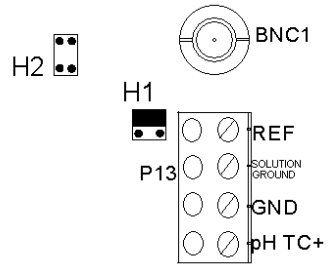
SINGLE ENDED / REFERENCE ON SHIELD



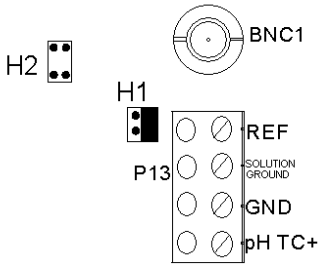
pH JUMPER CONFIGURATIONS

REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A	A	RELEASE	10085	PSG/ 7-19-07	

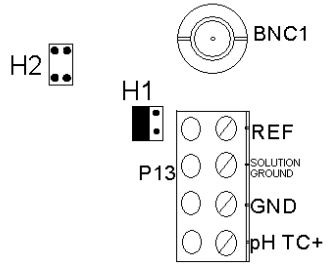
DIFFERENTIAL / REFERENCE ON WIRE



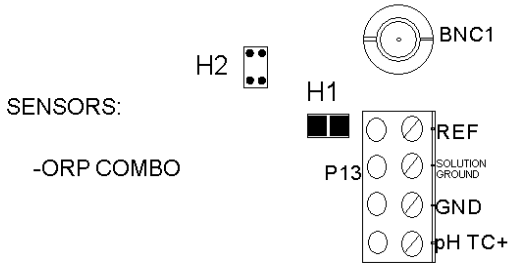
DIFFERENTIAL / REFERENCE ON SHIELD



SINGLE ENDED / REFERENCE ON WIRE



SINGLE ENDED / REFERENCE ON SHIELD

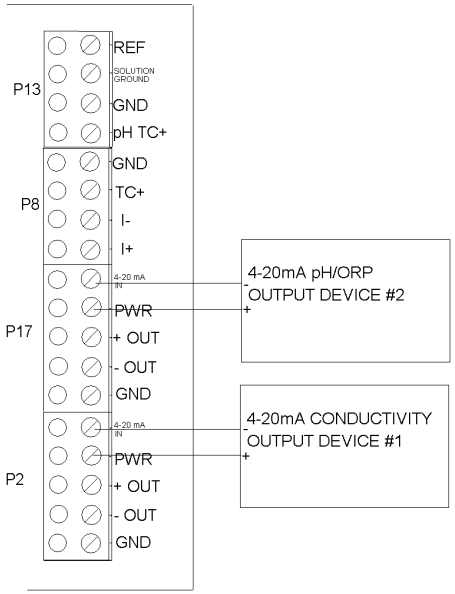


ORP JUMPER CONFIGURATIONS

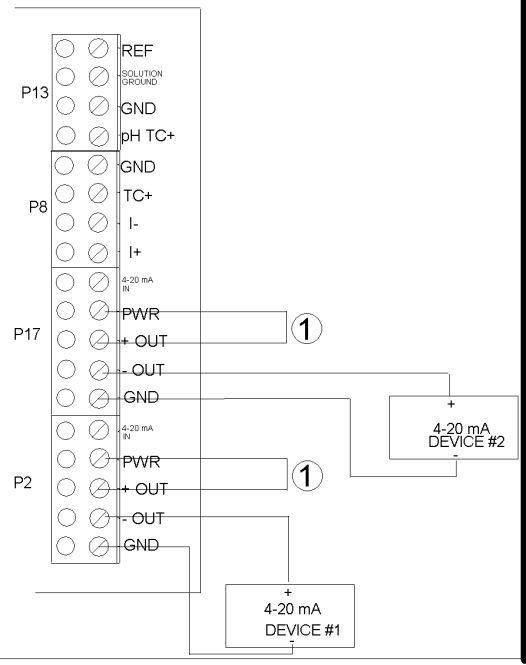
① FOR INTERNAL 24VDC JUMPER WIRE IS REQUIRED

REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A B	A B	RELEASED UPDATED LABELED	10085	PSG / 7-19-07 PSG/1-27-09	

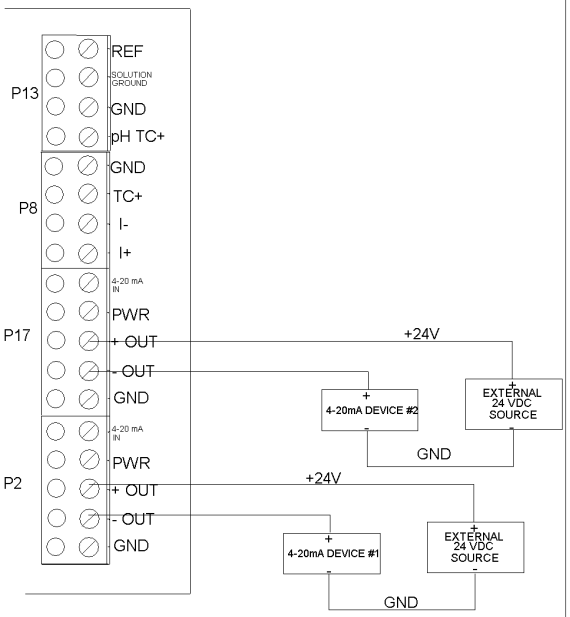
4-20 mA INPUT FROM AN EXTERNAL 4-20mA DEVICE



NONISOLATED 4-20mA OUTPUT WITH INTERNAL 24VDC POWER SUPPLY



ISOLATED 4-20 mA OUTPUT WITH EXTERNAL 24VDC POWER SUPPLY



REVISION		REVISION HISTORY			
DWG	PART	DESCRIPTION	ECO	DWN/DATE	APVD/DATE
A	A	RELEASED	10085	PSG/7-20-07