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**W A L C H E M**

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IWAKI America Inc.

# **WCT/WBLW100 Series**

## **Cooling Tower and Boiler Controller**

**Instruction Manual**

Five Boynton Road Hopping Brook Park Holliston, MA 01746 USA

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## **Notice**

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## 1.0 INTRODUCTION

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The Walchem WCT/WBL100 Series controllers offer a high level of flexibility in controlling cooling tower and boiler water treatment applications.

One sensor input is available that are compatible with a variety of sensors:

- Cooling tower, boiler, and low cell constant condensate contacting conductivity
- Electrodeless conductivity

Two digital inputs may be used for a variety of purposes:

- State type: Flow switch or other Interlock to stop control, or drum level switch
- Water meter contactor: To control a relay to feed a chemical based on flow total
- Paddlewheel flowmeter: To control based on flow total or flow rate

Three relay outputs may be set to a variety of control modes:

- On/Off set point control
- Bleed or Feed based on a Water Contactor or Paddlewheel flow meter input
- Feed and Bleed
- Feed and Bleed with Lockout
- Feed as a percent of Bleed
- Feed as a percentage of elapsed time
- Daily, Weekly, 2-week or 4-week Biocide timers with pre-bleed and post-add lockout of bleed
- Intermittent sampling for boilers with proportional blowdown, controlling on a trapped sample
- Time Proportional control
- Always on unless interlocked
- Dual set point
- Probe Wash timer
- Diagnostic Alarm triggered by:
  - High or Low sensor reading
  - No Flow
  - Relay output timeout
  - Sensor error

An optional isolated analog output may be included to retransmit sensor input signals to a chart recorder, data logger, PLC or other device.

Our unique USB features provide the ability to upgrade the software in the controller to the latest version.

## 2.0 SPECIFICATIONS

### 2.1 Measurement Performance

<b>0.01 Cell Contacting Conductivity</b>		
Range	0-300 $\mu\text{S/cm}$	
Resolution	0.01 $\mu\text{S/cm}$ , 0.0001 mS/cm, 0.001 mS/m, 0.0001 S/m, 0.01 ppm	
Accuracy	$\pm 1\%$ of reading or 0.01 $\mu\text{S/cm}$ , whichever is greater	
<b>0.1 Cell Contacting Conductivity</b>		
Range	0-3,000 $\mu\text{S/cm}$	
Resolution	0.1 $\mu\text{S/cm}$ , 0.0001 mS/cm, 0.01 mS/m, 0.0001 S/m, 0.1 ppm	
Accuracy	$\pm 1\%$ of Reading or 0.1 $\mu\text{S/cm}$ , whichever is greater	
<b>1.0 Cell Contacting Conductivity</b>		
Range	0-30,000 $\mu\text{S/cm}$	
Resolution	1 $\mu\text{S/cm}$ , 0.001 mS/cm, 0.1 mS/m, 0.0001 S/m, 1 ppm	
Accuracy	$\pm 1\%$ of Reading or 1 $\mu\text{S/cm}$ , whichever is greater	
<b>10.0 Cell Contacting Conductivity</b>		
Range	1,000-300,000 $\mu\text{S/cm}$	
Resolution	10 $\mu\text{S/cm}$ , 0.01 mS/cm, 1 mS/m, 0.001 S/m, 10 ppm	
Accuracy	$\pm 1\%$ of Reading or 10 $\mu\text{S/cm}$ , whichever is greater	
<b>100<math>\Omega</math> RTD Temperature</b>		
Range	23 to 500°F (-5 to 260°C)	
Resolution	0.1°F (0.1°C)	
Accuracy	$\pm 1\%$ of Reading or $\pm 1^\circ\text{C}$ , whichever is greater	
<b>1000<math>\Omega</math> RTD Temperature</b>		
Range	23 to 500°F (-5 to 260°C)	
Resolution	0.1°F (0.1°C)	
Accuracy	$\pm 1\%$ of Reading or $\pm 0.3^\circ\text{C}$ , whichever is greater	
<b>10k or 100k Thermistor Temperature</b>		
Range	23 to 194°F (-5 to 90°C)	
Resolution	0.1°F (0.1°C)	
Accuracy	$\pm 1\%$ of Reading or $\pm 0.3^\circ\text{C}$ , whichever is greater	
<b>Electrodeless Conductivity</b>		
<b>Ranges</b>	<b>Resolution</b>	<b>Accuracy</b>
500-12,000 $\mu\text{S/cm}$	1 $\mu\text{S/cm}$ , 0.01 mS/cm, 0.1 mS/m, 0.001 S/m, 1 ppm	$\pm 1\%$ of reading
3,000-40,000 $\mu\text{S/cm}$	1 $\mu\text{S/cm}$ , 0.01 mS/cm, 0.1 mS/m, 0.001 S/m, 1 ppm	$\pm 1\%$ of reading
10,000-150,000 $\mu\text{S/cm}$	10 $\mu\text{S/cm}$ , 0.1 mS/cm, 1 mS/m, 0.01 S/m, 10 ppm	$\pm 1\%$ of reading
50,000-500,000 $\mu\text{S/cm}$	10 $\mu\text{S/cm}$ , 0.1 mS/cm, 1 mS/m, 0.01 S/m, 10 ppm	$\pm 1\%$ of reading
200,000-2,000,000 $\mu\text{S/cm}$	100 $\mu\text{S/cm}$ , 0.1 mS/cm, 1 mS/m, 0.1 S/m, 100 ppm	$\pm 1\%$ of reading

Temperature °C	Range Multiplier
0	181.3
10	139.9
15	124.2
20	111.1
25	100.0
30	90.6
35	82.5
40	75.5
50	64.3
60	55.6
70	48.9

Temperature °C	Range Multiplier
80	43.5
90	39.2
100	35.7
110	32.8
120	30.4
130	28.5
140	26.9
150	25.5
160	24.4
170	23.6
180	22.9

Note: Conductivity ranges above apply at 25°C. At higher temperatures, the range is reduced per the range multiplier chart.

## 2.2 Electrical: Input/Output

Input Power	100 to 240 VAC +/- 10%, 50 or 60 Hz, 7 A maximum Fuse: 6.3 A
<b>Input Signals</b>	
Contacting Conductivity	0.1, 1.0, or 10.0 cell constant OR
Electrodeless Conductivity	
Temperature	100 or 1000 ohm RTD, 10K or 100K Thermistor
<b>Digital Input Signals (2):</b>	
<b>State-Type Digital Inputs</b>	Electrical: Optically isolated and providing an electrically isolated 9V power with a nominal 2.3mA current when the digital input switch is closed Typical response time: < 2 seconds Devices supported: Any isolated dry contact (i.e. relay, reed switch) Types: Interlock
<b>Low Speed Counter-Type Digital Inputs</b>	Electrical: Optically isolated and providing an electrically isolated 9V power with a nominal 2.3mA current when the digital input switch is closed 0-10 Hz, 50 msec minimum width Devices supported: Any device with isolated open drain, open collector, transistor or reed switch Types: Contacting Flowmeter
<b>High Speed Counter-Type Digital Inputs</b>	Electrical: Optically isolated and providing an electrically isolated 9V power with a nominal 2.3mA current when the digital input switch is closed, 0-500 Hz, 1.00 msec minimum width Minimum pulse frequency for the rate to be displayed: 0.17 Hz Devices supported: Any device with isolated open drain, open collector, transistor or reed switch Types: Paddlewheel Flowmeter
<b>Powered Mechanical Relays (0 or 3 depending on model code):</b>	Pre-powered on circuit board switching line voltage 6 A (resistive), 1/8 HP (93 W) per relay All three relays are fused together as one group, total current for this group must not exceed 6A

<b>Dry contact Mechanical Relays (0 or 3 depending on model code):</b>	6 A (resistive), 1/8 HP (93 W) per relay Dry contact relays are not fuse protected
<b>4 - 20 mA (0 or 1 depending on model code):</b>	Internally powered, 15VDC Fully isolated 600 Ohm max resistive load Resolution 0.0015% of span Accuracy $\pm 0.5\%$ of reading
<b>Agency Approvals</b>	
Safety	UL 61010-1:2012 3rd Ed + Rev:2016 CSA C22.2 No. 61010-1:2012 3rd Ed. + U1; U2 IEC 61010-1:2010 3rd Ed. EN 61010-1:2010 3rd Ed. BS EN 61010-1:2010 + A1:2019
EMC	IEC 61326-1:2012 EN 61326-1:2013 BS EN 61326-1:2013
Note: For EN61000-4-6, EN61000-4-3 the controller met performance criteria B. *Class A equipment: Equipment suitable for use in establishments other than domestic, and those directly connected to a low voltage (100-240 VAC) power supply network which supplies buildings used for domestic purposes.	

## 2.3 Intended Use

The Walchem W100 Series is a microprocessor-based measuring and control instrument used to measure water quality parameters and other process variables in a wide range of water and wastewater treatment applications. Operating the instrument in any way other than as described in these instructions may compromise the safety and function of the measuring system and is therefore impermissible. Electrical connection work and maintenance work may only be carried out by qualified personnel. The manufacturer is not liable for damage caused by improper or non-designated use.

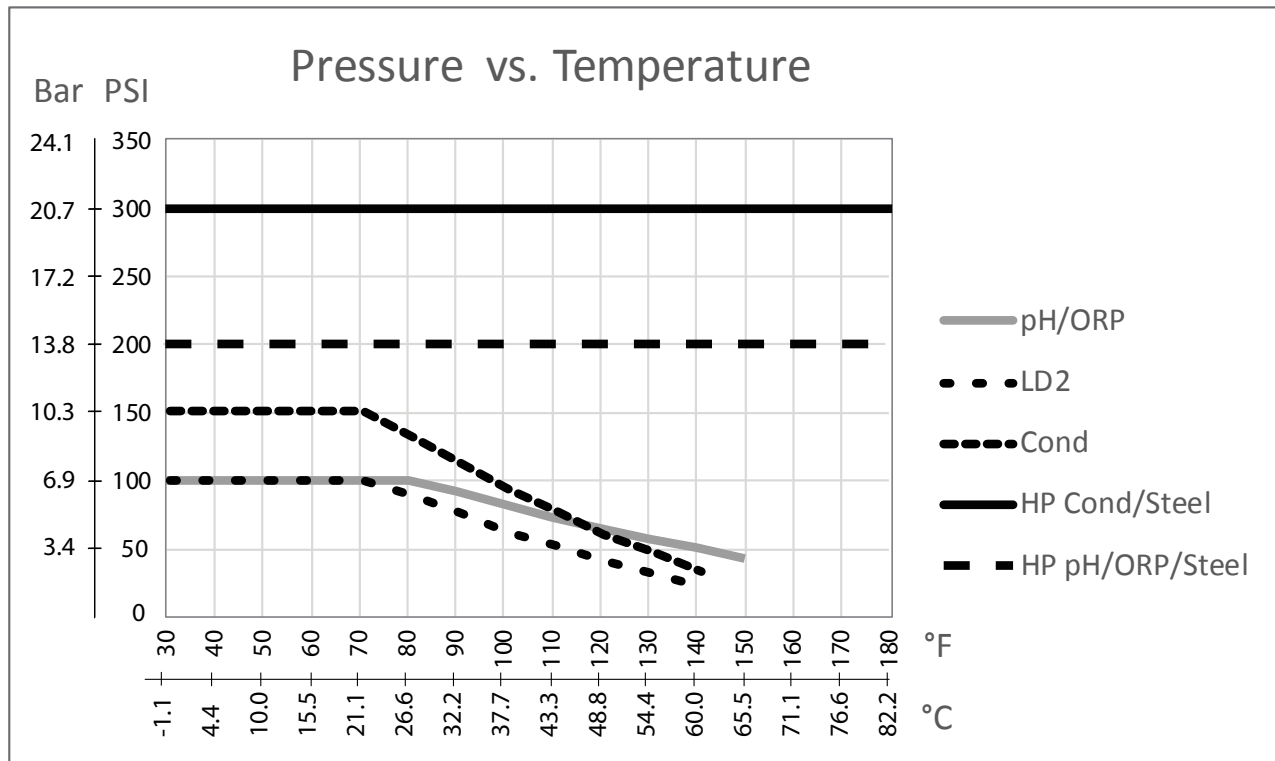
## 2.4 Mechanical

Enclosure Material	Polycarbonate
Enclosure Rating	Certified to UL 50 and UL 50E Type 4X. IEC 60529 meets IP65.
Environmental Conditions	Can be installed indoors and outdoors. Suitable for wet location.
Dimensions	8" x 8" x 3" (203 mm x 203 mm x 76 mm)
Display	128 x 64 graphic backlit display
Operating Ambient Temp	-4 to 131 °F (-20 to 55 °C)
Storage Temperature	-4 – 176°F (-20 – 80°C)
Humidity	10 to 90% non-condensing
Pollution Degree	2
Overvoltage Category	II
Altitude	2000 m (6560 ft) maximum

### Mechanical (Sensors) (\*See graph)

Sensor	Pressure	Temperature	Materials	Process Connections
Graphite contacting conductivity tower	0-150 psi up to 100°F (38°C)* 0- 50 psi at 140°F (60°C)	32-140°F * (0-60°C)	GFRPP, Graphite, FKM	3/4" NPTF

316 SS contacting conductivity tower	0-150 psi up to 100°F (38°C) * 0- 50 psi at 140°F (60°C)	32-140°F * (0-60°C)	GFRPP, 316SS, FKM	3/4" NPTF
High pressure tower	0-300 psi (0-20 bar)*	32-158°F * (0-70°C)	316SS, PEEK	3/4" NPTF
Electrodeless tower	0-150 psi up to 100°F (38°C)* 0- 50 psi at 140°F (60°C)	32-140°F * (0-60°C)	PP, PVC, FKM	3/4" NPTF
Low pressure manifold	0-150 psi up to 100°F (38°C)* 0- 50 psi at 140°F (60°C)	32-140°F * (0-60°C)	GFRPP, PVC, FKM, Isoplast	3/4" NPTF
High pressure manifold	0-300 psi (0-20 bar)*	32-158°F * (0-70°C)	Carbon steel, steel, brass	3/4" NPTF
Boiler/condensate contacting conductivity	0-250 psi (0-17 bar)	32-401°F (0-205°C)	316SS, PEEK	3/4" NPTM



## 2.5 Variables and their Limits

Sensor input settings	Low Limit	High Limit
Conductivity alarm limits	0	50,000
Conductivity alarm dead band	0	50,000
Cell constant	0.01	10
Smoothing Factor	0%	90%
Comp Factor (conductivity linear ATC only)	0%	20%
Installation Factor (Electrodeless conductivity only)	0.5	1.5
Cable length	0.1	3,000
PPM conversion factor (only if units = PPM)	0.001	10,000
Default temperature	-20	500
Calibration Required Alarm	0 days	365 Days
Flow meter input settings	Low Limit	High Limit
Totalizer alarm	0	100,000,000

Volume/contact for units of Gallons or Liters	1	100,000
Volume/contact for units of m <sup>3</sup>	0.001	1,000
K Factor for units of Gallons or Liters	0.01	10,000
K Factor for units of m <sup>3</sup>	1	100,000
Paddlewheel rate alarm limits	0	High end of sensor range
Paddlewheel rate alarm deadband	0	High end of sensor range
Smoothing Factor	0%	90%
Set Flow Total	0	1,000,000,000
<b>Relay output settings</b>	<b>Low Limit</b>	<b>High Limit</b>
Output Limit Time	1 second	86,400 seconds (0 = unlimited)
Hand Time Limit	1 second	86,400 seconds (0 = unlimited)
Min Relay Cycle	0 seconds	300 seconds
Set Point	Low end of sensor range	High end of sensor range
Duty Cycle Period (On/Off, Dual Set-point modes)	0:00 minutes	59:59 minutes
Duty Cycle (On/Off, Dual Setpoint modes)	0%	100%
Dead Band	Low end of sensor range	High end of sensor range
Feed duration (Flow timer mode)	0 seconds	86,400 seconds
Accumulator volume (Flow timer mode)	0	1,000,000
Feed Percentage (Bleed then Feed mode)	0%	1000%
Feed Lockout Time Limit (Bleed & Feed, Bleed then Feed modes)	0 seconds	86,400 seconds
Prebleed to Conductivity (Biocide mode)	1 (0 = no prebleed)	High end of sensor range
Prebleed Time (Biocide mode)	0 seconds	86,400 seconds
Bleed Lockout(Biocide mode)	0 seconds	86,400 seconds
Event duration (Biocide, Timer modes)	0 seconds	86,400 seconds
Proportional band (Time/Pulse Proportional mode, Intermittent Sampling)	Low end of sensor range	High end of sensor range
Sample period (Time Proportional mode)	10 seconds	3600 seconds
Sample Time (Intermittent Sampling mode)	0 seconds	3600 seconds
Hold Time (Intermittent Sampling mode)	0 seconds	3600 seconds
Maximum Blowdown (Intermittent Sampling mode)	0 seconds	3600 seconds
Wait Time (Intermittent Sampling mode)	0 seconds	86,400 seconds
Max Rate (Pulse Proportional mode)	10 pulses/minute	2400 pulses/minute
Minimum Output (Pulse Proportional mode)	0%	100%
Maximum Output (Pulse Proportional mode)	0%	100%
On Delay Time (Alarm mode)	0 seconds	23:59:59 HH:MM:SS
Off Delay Time (Alarm mode)	0 seconds	23:59:59 HH:MM:SS
<b>Analog (4-20 mA) Output settings</b>	<b>Low Limit</b>	<b>High Limit</b>
4 mA Value	0	30,000
20 mA Value	0	30,000
Hand Output	0%	100%
Set Point	0	30,000
Proportional Band	0	30,000
Minimum Output	0%	100%
Maximum Output	0%	100%
Off Mode Output (Proportional, PID, Flow Prop modes)	0 mA	21 mA
Pump Capacity (Flow Prop mode)	0 gal/hour or l/hour	10,000 gal/hour or l/hour
Pump Setting (Flow Prop mode)	0%	100%

Specific Gravity (Flow Prop mode)	0 g/ml	9.999 g/ml
Target (Flow Prop mode)	0 ppm	1,000,000 pm
Error Output	0 mA	21 mA
<b>Configuration settings</b>	<b>Low Limit</b>	<b>High Limit</b>
Local Password	0000	9999
Alarm Delay	0:00 minutes	59:59 minutes

## 3.0 UNPACKING & INSTALLATION

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### 3.1 Unpacking the unit

Inspect the contents of the carton. Please notify the carrier immediately if there are any signs of damage to the controller or its parts. Contact your distributor if any of the parts are missing. The carton should contain a W100 series controller and an instruction manual. Any options or accessories will be incorporated as ordered.

### 3.2 Mounting the electronic enclosure

The controller is supplied with mounting holes on the enclosure. It should be wall mounted with the display at eye level, on a vibration-free surface, utilizing all four mounting holes for maximum stability. Do not install the enclosure in a location where it will be exposed to direct sunlight. Use M6 (1/4" diameter) fasteners that are appropriate for the substrate material of the wall. The enclosure is NEMA 4X (IP65) rated. The maximum operating ambient temperature is 131°F (55°C); this should be considered if installation is in a high temperature location. The enclosure requires the following clearances:

Top:	2" (50 mm)
Left:	8" (203 mm) (not applicable for prewired models)
Right:	4" (102 mm)
Bottom:	7" (178 mm)

### 3.3 Installation

Once the controller is mounted, the metering pumps may be located at any distance from the controller.

#### *Plumbing*

The W100 series controllers can be supplied with a flow switch manifold designed to provide a continuously flowing sample of cooling water to the sensors. Please refer to Figures 2 through 6 below for some typical installation drawings.

#### **Cooling Towers:**

Tap off the discharge side of the recirculation pump to provide a minimum flow of 1 gallon per minute past the sensor. The sample must flow into the bottom of the manifold in order to close the flow switch, and return to a point of lower pressure in order to ensure flow. Install an isolation valve on both sides of the manifold to stop flow for sensor maintenance.

The **contacting conductivity sensor** should be placed as close to the controller as possible, to a maximum distance of 250 ft. (76 m). Less than 25 ft. (8 m) is recommended. The cable must be shielded from background electrical noise. Always route low voltage (sensor) signals with at least a 6" (15 cm) separation from AC voltage wiring.

The **electrodeless conductivity sensor** should be placed as close to the controller as possible, to a maximum distance of 120 ft. (37 m). Less than 20 ft. (6 m) is recommended.. The cable must be shielded from background electrical noise. Always route low voltage (sensor) signals with at least a 6" (15 cm) separation from AC voltage wiring. These sensors are affected by the geometry and conductivity of their surroundings, so either maintain 6 inches (15 cm) of sample around the sensor or ensure that any nearby conductive or nonconductive items are consistently positioned. Do not install the sensor in the path of any electrical current that may be flowing in the solution, as this will shift the conductivity reading.

**IMPORTANT:** To avoid damaging the female pipe threads on the supplied plumbing parts, use no more than 3 wraps of PTFE tape and thread into the pipe FINGER tight only! DO NOT use any pipe dope, plumber's putty or other sealing products that contain acetone alcohol, as these attack the flow switch plastic! Use PTFE tape ONLY!

**Boilers:**

The **conductivity sensor** should be placed as close to the controller as possible, to a maximum distance of 250 ft. (76m). The cable **MUST** be shielded from background electrical noise. Use 24 AWG cable.

***Important Boiler Installation Notes: (see figures 3 and 4)***

1. The boiler sensor is designed for water! Steam will give low & erratic readings and may severely shorten the life of the sensor.
2. Make sure the minimum water level in the boiler is at least 4-6 inches (10-15 cm) above the skimmer blowdown line. If the skimmer line is closer to the surface, it is likely that steam will be drawn into the line instead of boiler water. The skimmer line must also be installed above the highest tube.
3. Always install in a 3/4 inch tee and maintain a 3/4 inch minimum pipe ID with no flow restrictions from the tap for the boiler skimmer blowdown line to the electrode. If the ID is reduced below 3/4 inch, then flashing will occur beyond that point and the conductivity reading will be low and erratic. Minimize the usage of tees, valves, elbows or unions between the boiler and the electrode.
4. A manual shut off valve should be installed so that the electrode can be removed and cleaned. This valve must be a full port valve in order to avoid a flow restriction.
5. Keep the distance between the tap for the boiler skimmer line to the electrode as short as possible, to a maximum of 10 feet (3m).
6. Mount the electrode in the side branch of a 3/4 inch tee in a horizontal run of pipe. This will minimize entrapment of steam around the electrode and will allow any solids to pass through. Do NOT install in a larger tee with reducing bushing – this can cause flashing at the electrode and will not allow the electrode to be properly placed in the flow path.
7. For best results, align the hole in the conductivity electrode (note ID arrow on the Nut) such that the direction of water flow is through the hole.
8. There **MUST** be a flow restriction after the electrode and/or control valve in order to provide back pressure. This flow restriction will be either a flow control valve or an orifice union. The amount of the flow restriction will affect the blowdown rate as well, and should be sized accordingly.
9. Install the motorized ball valve or solenoid valve per the manufacturer's instructions.

For best results, align the hole in the conductivity electrode such that the direction of water flow is through the hole.

***Guide to Sizing Blowdown Valves and Orifice Plates***

**1. Determine the Rate of Steam Production in Pounds per Hour:**

Either read off the boiler name plate (water-tube boilers) or Calculate from horsepower rating (fire-tube boilers):  
 $HP \times 34.5 = \text{lbs./hr.}$  Example: 100 HP = 3450 lbs./hr

**2. Determine the Concentration Ratio (BASED ON FEEDWATER)**

A water treatment chemical specialist should determine the desired number of cycles of concentration. This is the ratio of TDS in the boiler water to TDS in the feedwater. Note that feedwater means the water that is fed to the boiler from the deaerator and includes makeup water plus condensate return.

Example: 10 cycles of concentration has been recommended

### 3. Determine the Required Blowdown Rate in Pounds Per Hour

Blowdown Rate = Steam Production / (Concentration Ratio - 1)

Example:  $3450 / (10 - 1) = 383.33$  lbs./hr.

### 4. Determine if Continuous or Intermittent Sampling is Required

Use intermittent sampling when the boiler operation or loading is intermittent, or on boilers where the required blowdown rate is less than 25% of the smallest available flow control valve or less than the flow through the smallest orifice. See the graphs on the next page.

Use continuous sampling when the boiler is operating 24 hours per day and the required blowdown rate is more than 25% of the smallest applicable flow control valve or orifice. See the graphs on the next page.

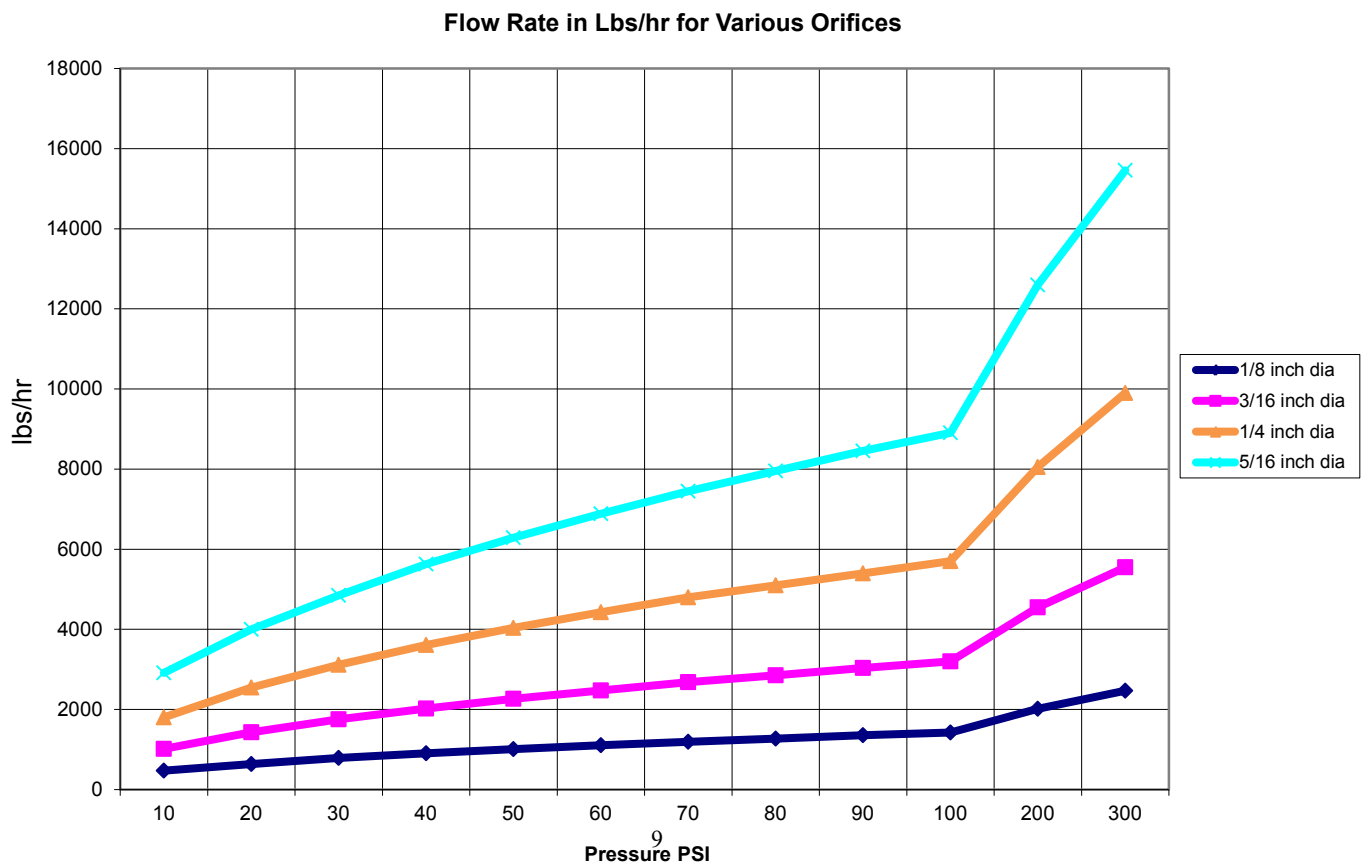
Use of a flow control valve will give you the best control of the process, since the flow rate can be easily adjusted. The dial on the valve also gives you a visual indication if the flow rate has been changed. If the valve clogs, it can be opened to clear the obstruction, and closed to the previous position.

If an orifice plate is used, you must install a valve downstream from the orifice in order to fine tune the flow rate and provide additional back pressure in many applications.

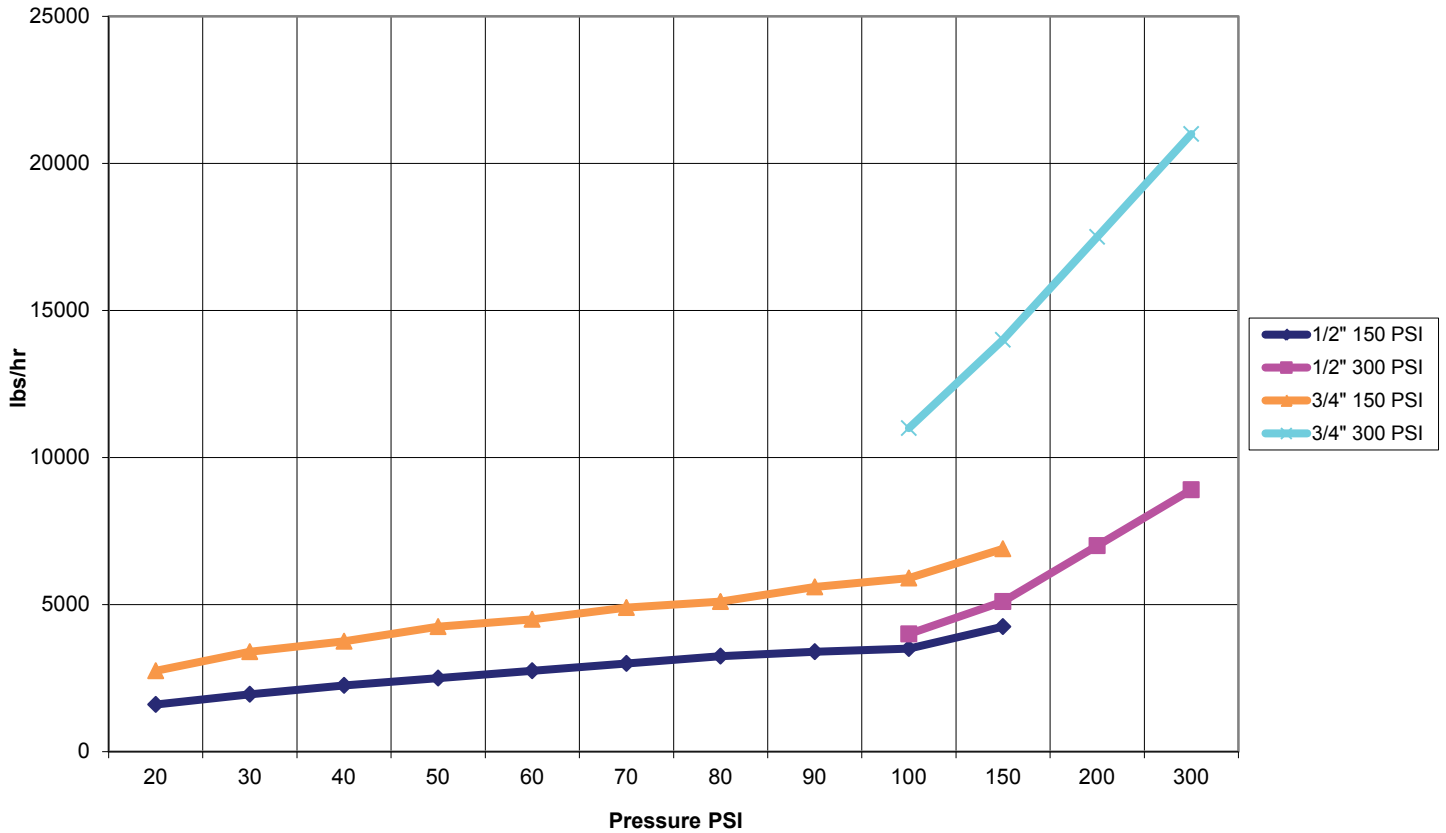
Example: An 80 psi boiler has a Required Blowdown Rate of 383.33 lbs./hr. The maximum flow rate of the smallest flow control valve is 3250 lbs./hr.  $3250 \times 0.25 = 812.5$  which is too high for continuous sampling. Using an orifice, the flow rate through the smallest diameter plate is 1275 lbs./hr. This is too high for continuous sampling.

### 5. Determine the Orifice or Flow Control Valve Size for this Blowdown Rate

Use the following graphs to select a flow control device:



**Flow Control Valve  
Maximum Flow Rates in Lbs/hr**



### 3.4 Icon Definitions

Symbol	Publication	Description
	IEC 417, No.5019	Protective Conductor Terminal
	IEC 417, No. 5007	On (Supply)
	IEC 417, No. 5008	Off (Supply)
	ISO 3864, No. B.3.6	Caution, risk of electric shock
	ISO 3864, No. B.3.1	Caution

### 3.5 Electrical installation

The various standard wiring options are shown in figure 1 below. Your controller will arrive from the factory prewired or ready for hardwiring. Depending on your configuration of controller options, you may be required to hardwire some or all of the input/output devices. Refer to figures 7 through 13 for circuit board layout and wiring.

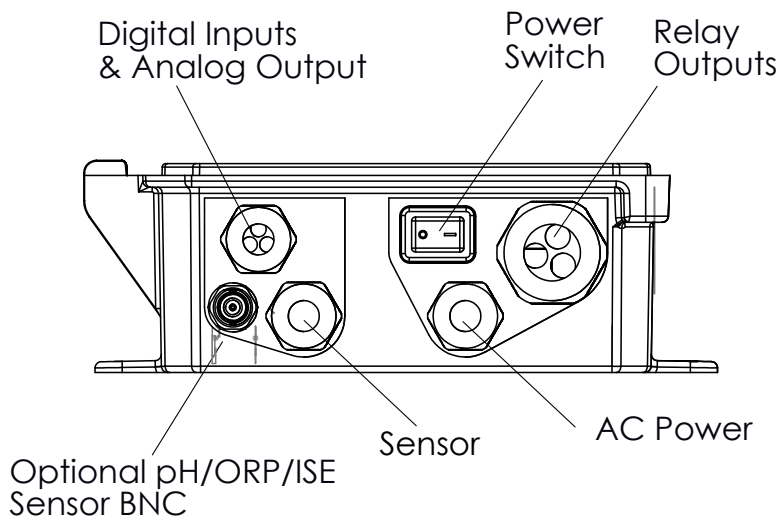
Note: when wiring the optional flow meter contactor input, the 4-20 mA outputs or a remote flow switch, it is advisable to use stranded, twisted, shielded pair wire between 22-26 AWG. Shield should be terminated at the controller (see figure 10).



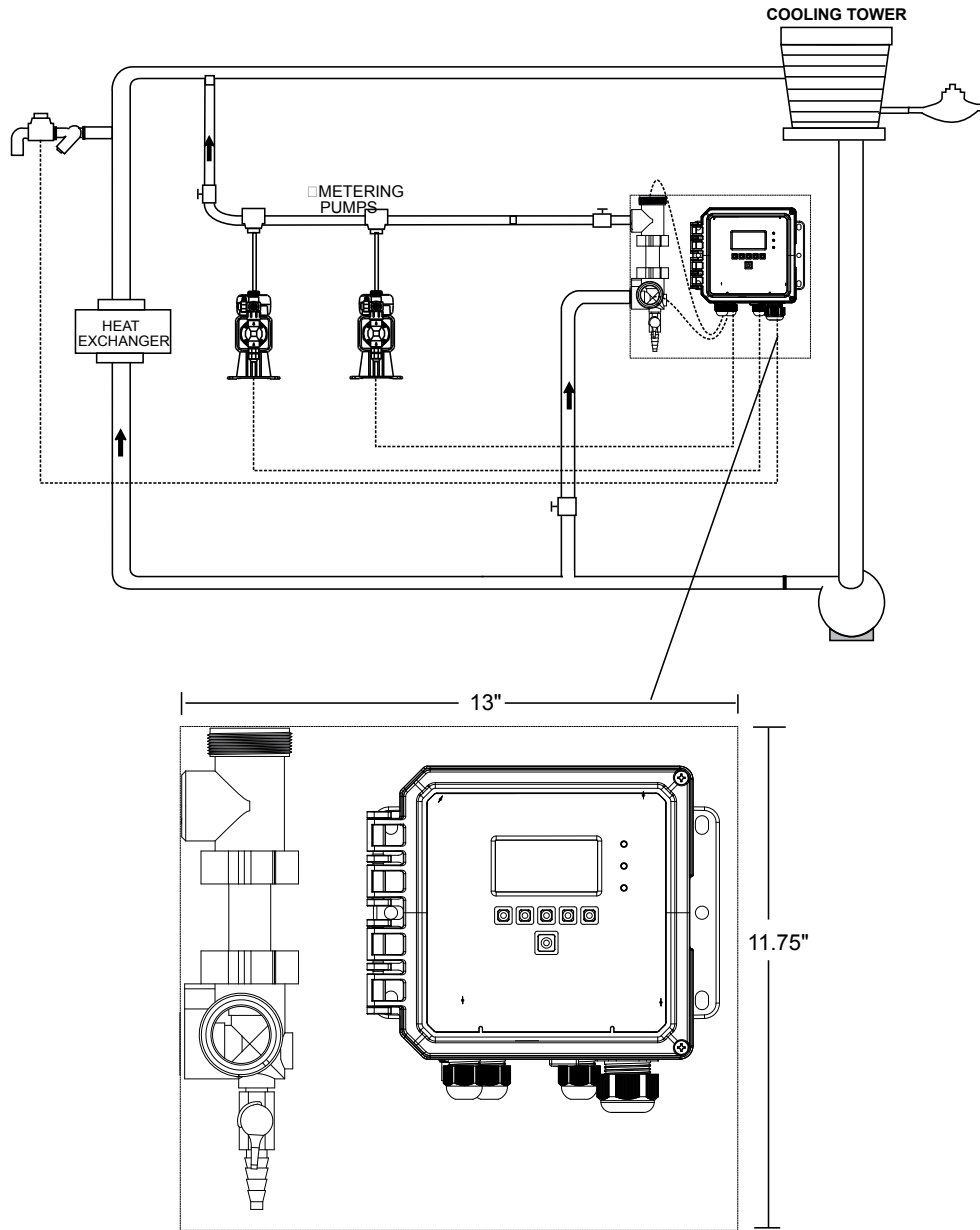
**CAUTION**



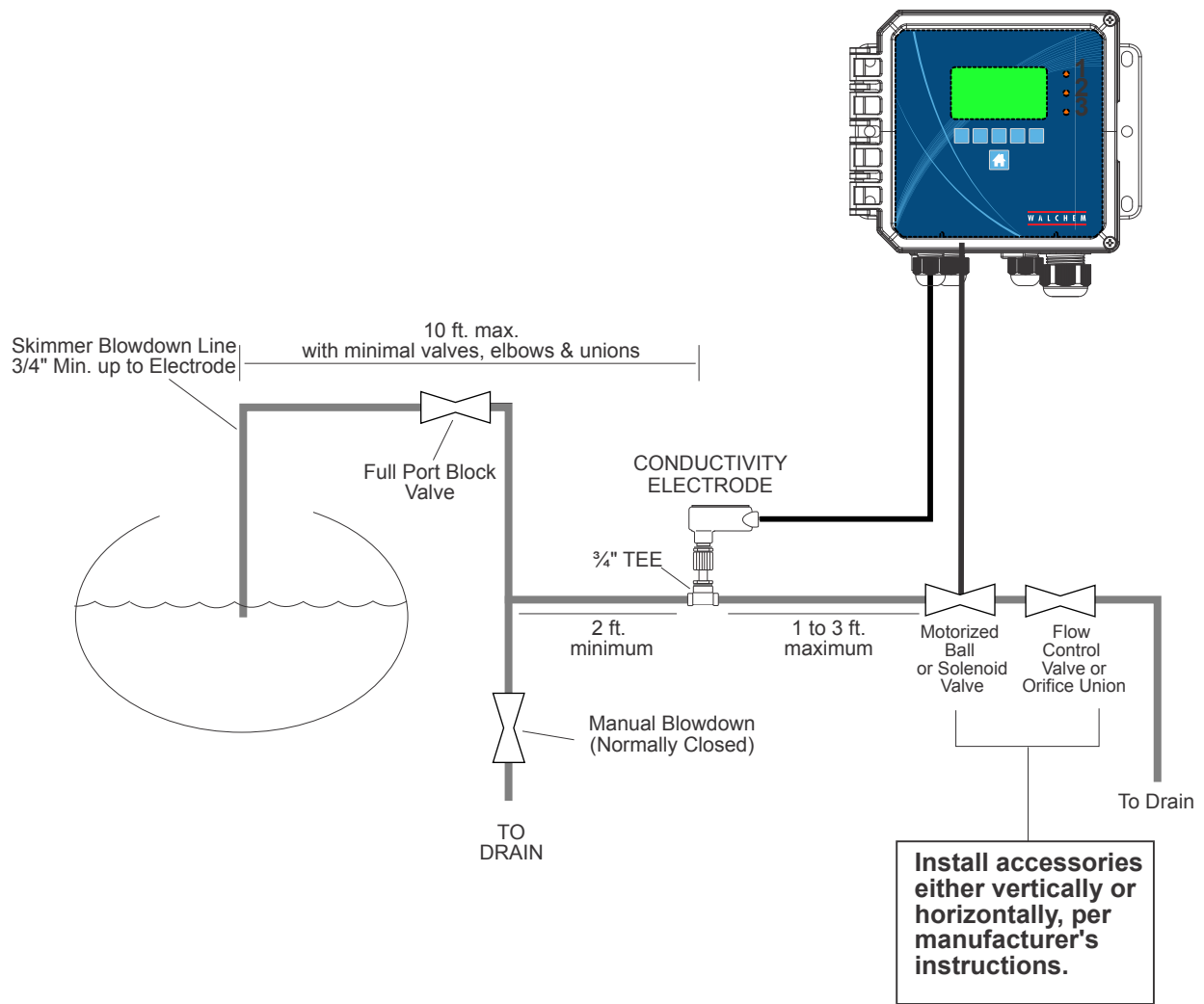
1.	There are live circuits inside the controller even when the power switch on the front panel is in the OFF position! The front panel must never be opened before power to the controller is REMOVED! If your controller is prewired, it is supplied with a 8 foot, 18 AWG power cord with USA style plug. A tool (#1 Phillips driver) is required to open the front panel.
2.	When mounting the controller, make sure there is clear access to the disconnecting device!
3.	The electrical installation of the controller must be done by trained personnel only and conform to all applicable National, State and Local codes!
4.	Proper grounding of this product is required. Any attempt to bypass the grounding will compromise the safety of persons and property.
5.	Operating this product in a manner not specified by Walchem may impair the protection provided by the equipment.



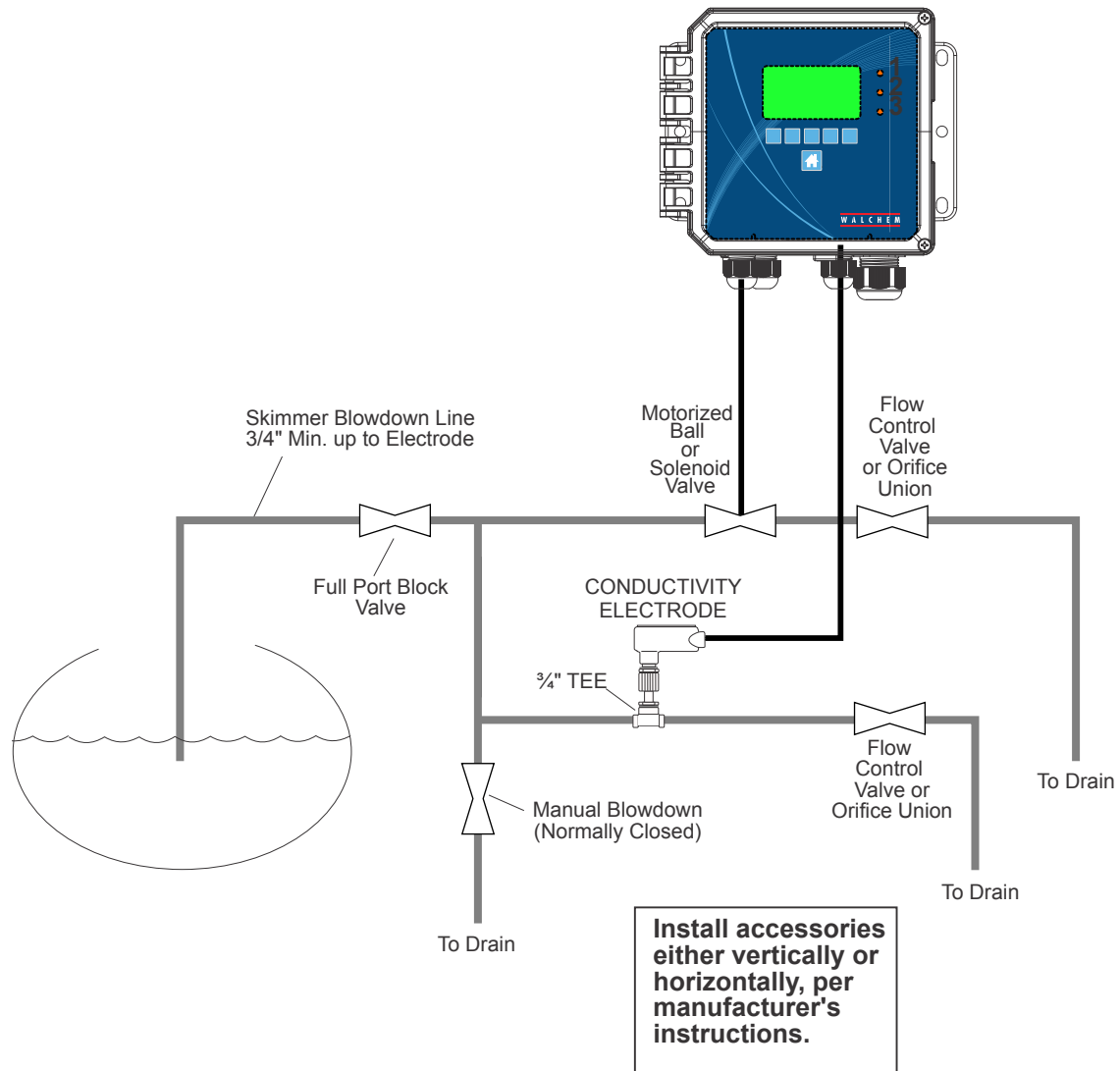
**Figure 1 Conduit Wiring**



**Figure 2 Typical Cooling Tower Installation**



**Figure 3 Typical Boiler Installation Intermittent Sampling**



**Figure 4 Typical Boiler Installation Continuous Sampling**

## TYPICAL INSTALLATION SUBMERSION ELECTRODE

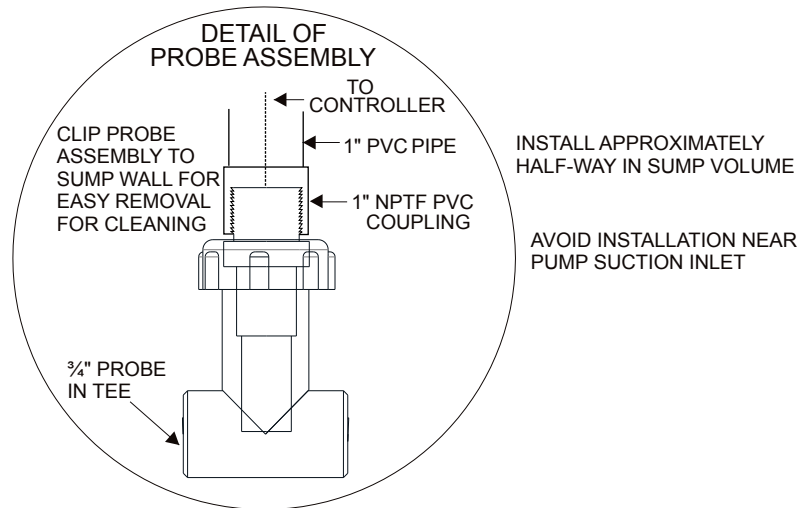
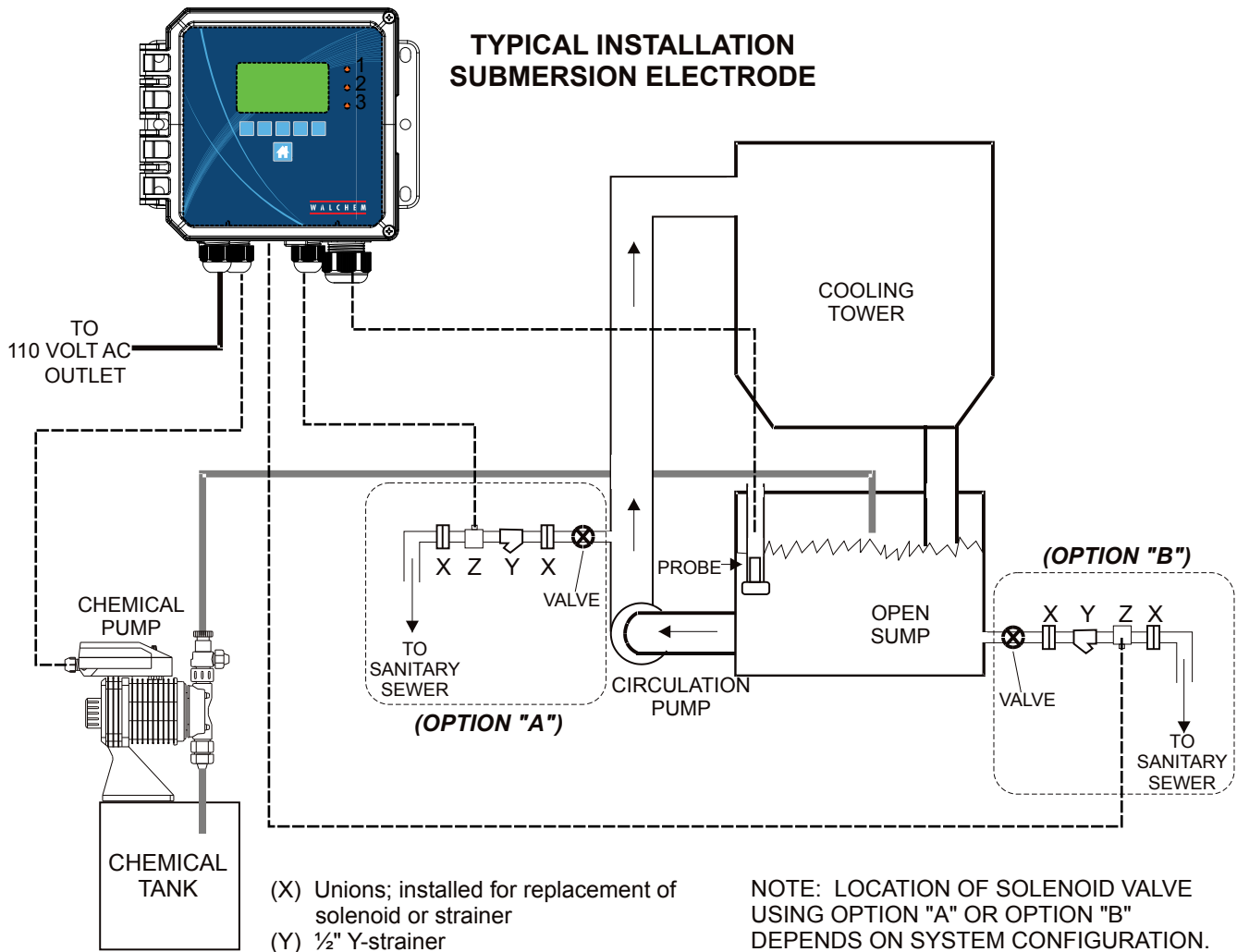
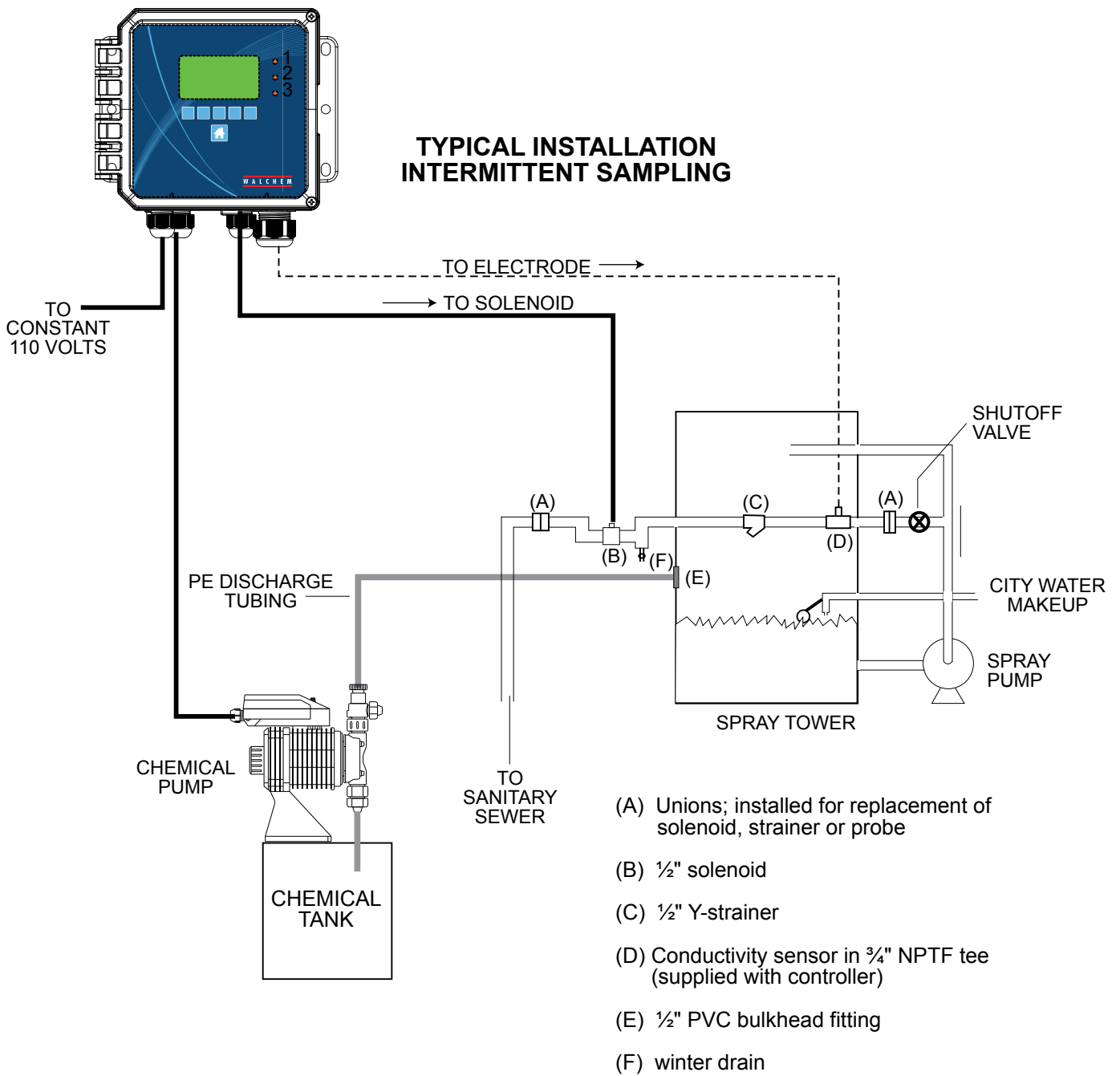
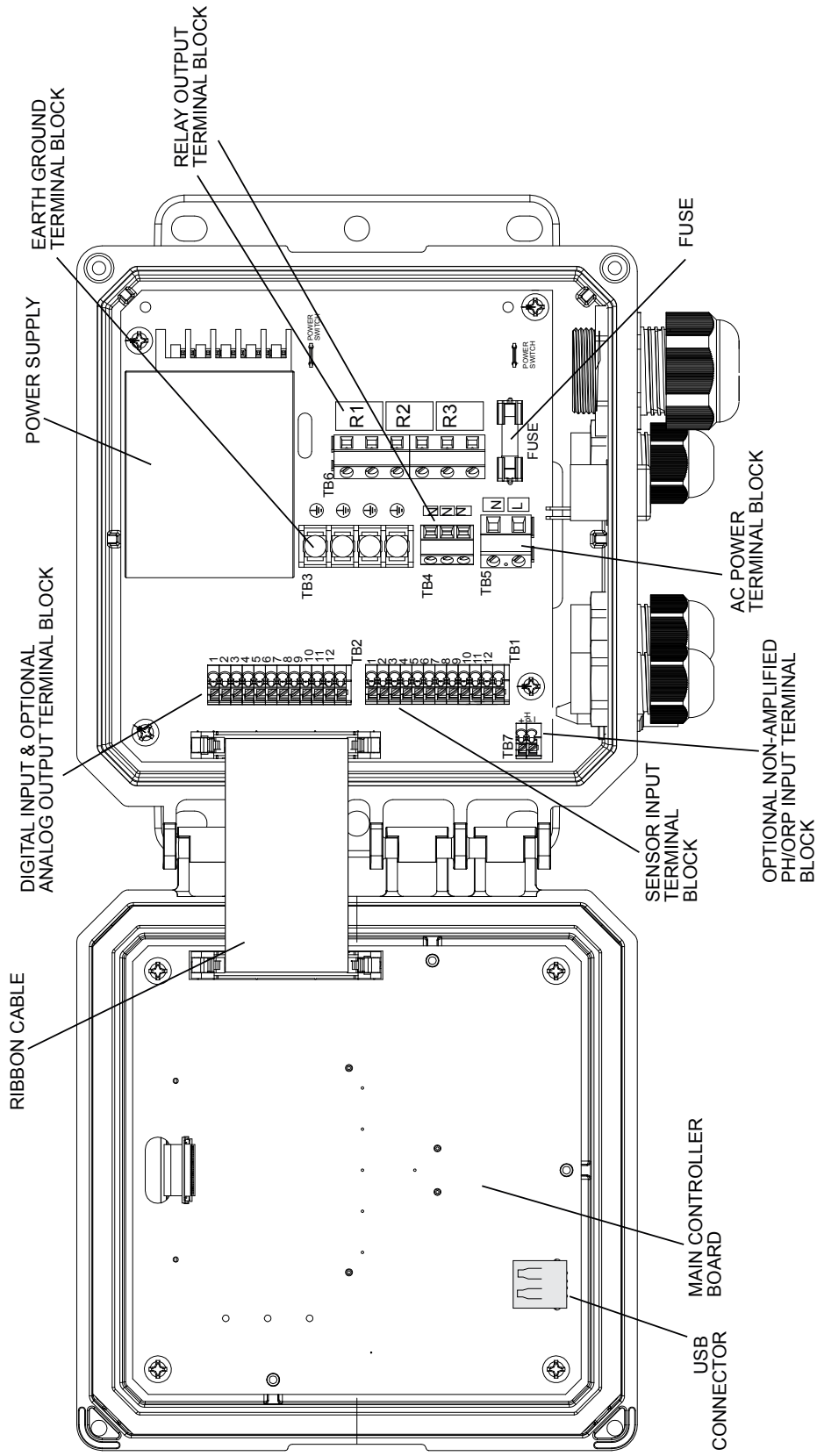


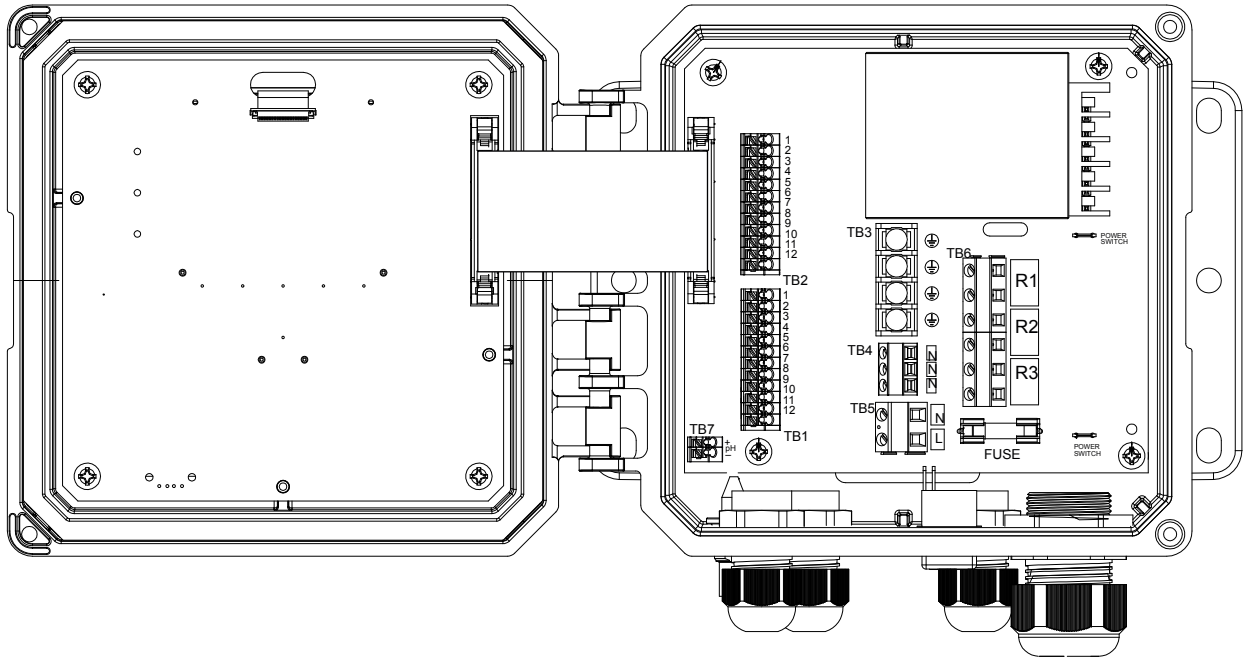
Figure 5 Typical Cooling Tower Installation Submersion Sensor



**Figure 6 Typical Cooling Tower Installation Intermittent Sampling**

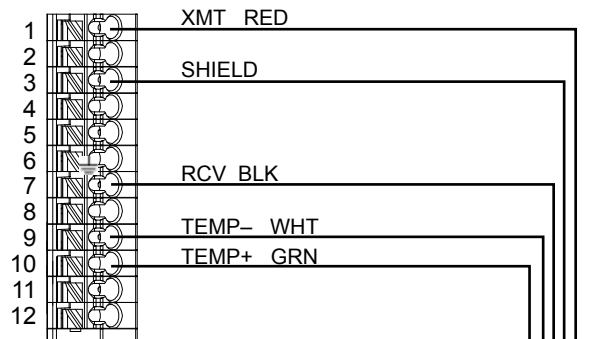


**Figure 7 Identification of Parts**



TB1	ECOND	CCOND	pH/ORP w/BNC	pH/ORP DIS	TB2	FUNCTION
1	XMT+	XMT			1	4-20 OUT-
2	XMT-				2	4-20 OUT+
3	X-SHLD	SHIELD	SHIELD	SHIELD	3	SHIELD
4			USE BNC FOR INPUT SIGNAL	+5V	4	DIG IN 2-
5	RCV-					5
6	RCV+				6	+9 VDC
7		RCV		IN+	7	SHIELD
8				-5V	8	DIG IN 1-
9	TEMP-	TEMP-	TEMP-	TEMP-	9	DIG IN 1+
10	TEMP+	TEMP+	TEMP+	TEMP+	10	+9 VDC
11	R-SHLD			IN-	11	SHIELD
12					12	

SAFETY COVER LABEL



TB1

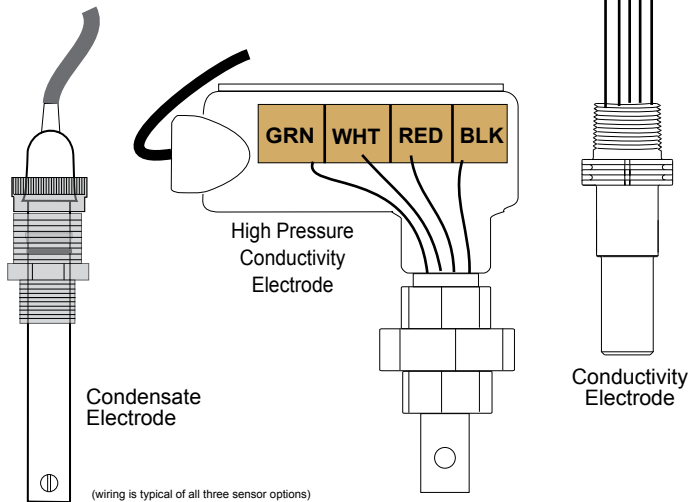
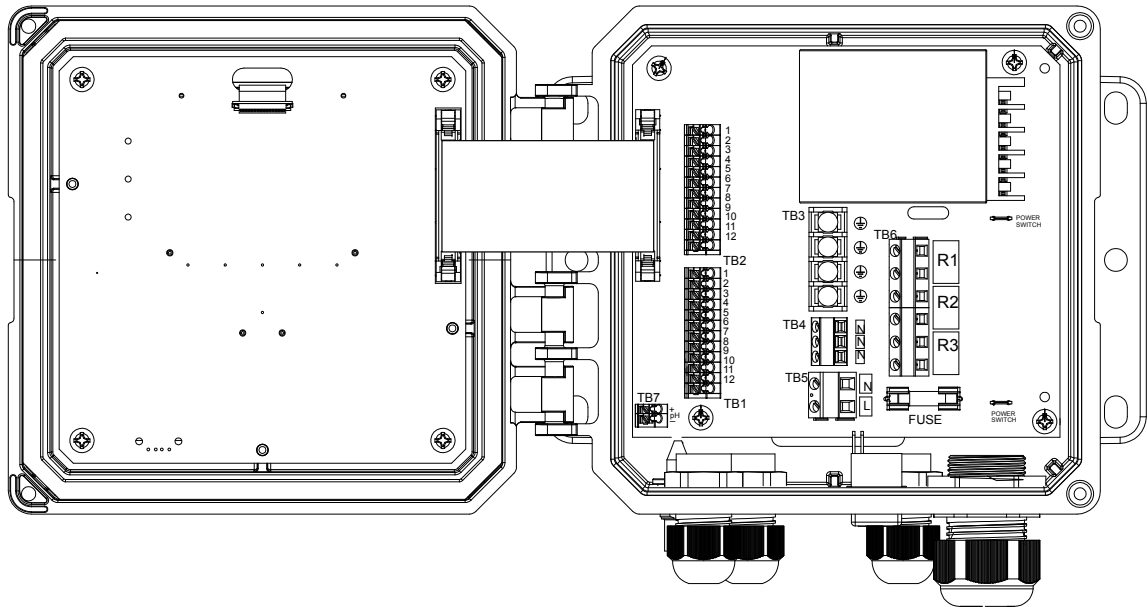


Figure 8 Contacting Conductivity Sensor Input Wiring



TB1	ECOND	CCOND	pH/ORP w/BNC	pH/ORP DIS	TB2	FUNCTION
1	XMT+	XMT			1	4-20 OUT-
2	XMT-	XMT			2	4-20 OUT+
3	X-SHLD	SHIELD	SHIELD	SHIELD	3	SHIELD
4			USE BNC FOR INPUT SIGNAL	+5V	4	DIG IN 2-
5	RCV-					5
6	RCV+				6	+9 VDC
7		RCV		IN+	7	SHIELD
8				-5V	8	DIG IN 1-
9	TEMP-	TEMP-	TEMP-	TEMP-	9	DIG IN 1+
10	TEMP+	TEMP+	TEMP+	TEMP+	10	+9 VDC
11	R-SHLD			IN-	11	SHIELD
12					12	

SAFETY COVER LABEL

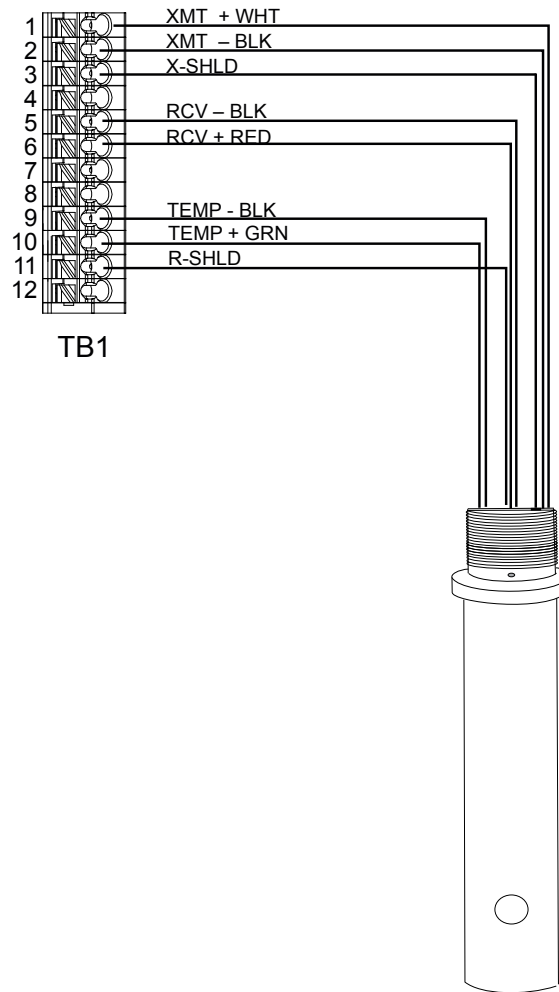
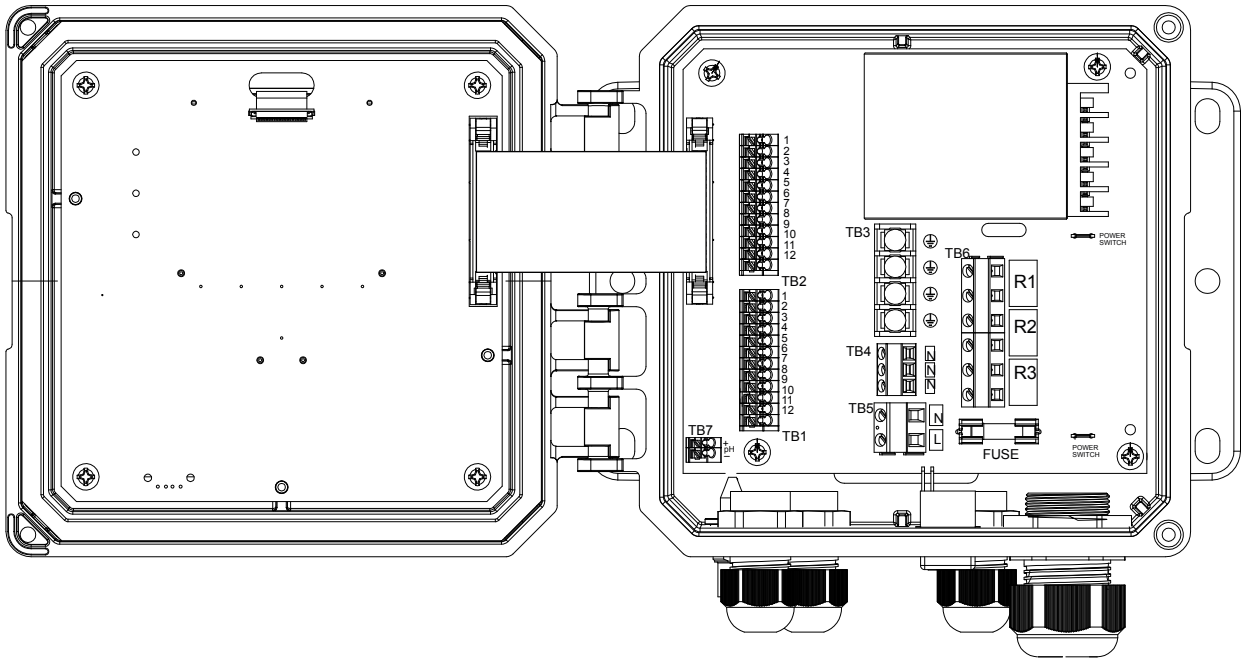


Figure 9 Electrodeless Conductivity Sensor Input Wiring



TB1	ECOND	CCOND	pH/ORP w/BNC	pH/ORP DIS	TB2	FUNCTION
1	XMT+	XMT			1	4-20 OUT-
2	XMT-				2	4-20 OUT+
3	X-SHLD	SHIELD	SHIELD	SHIELD	3	SHIELD
4			USE BNC FOR INPUT SIGNAL	+5V	4	DIG IN 2-
5	RCV-			IN+	5	DIG IN 2+
6	RCV+			-5V	6	+9 VDC
7		RCV			7	SHIELD
8					8	DIG IN 1-
9	TEMP-	TEMP-	TEMP-	TEMP-	9	DIG IN 1+
10	TEMP+	TEMP+	TEMP+	TEMP+	10	+9 VDC
11	R-SHLD			IN-	11	SHIELD
12					12	

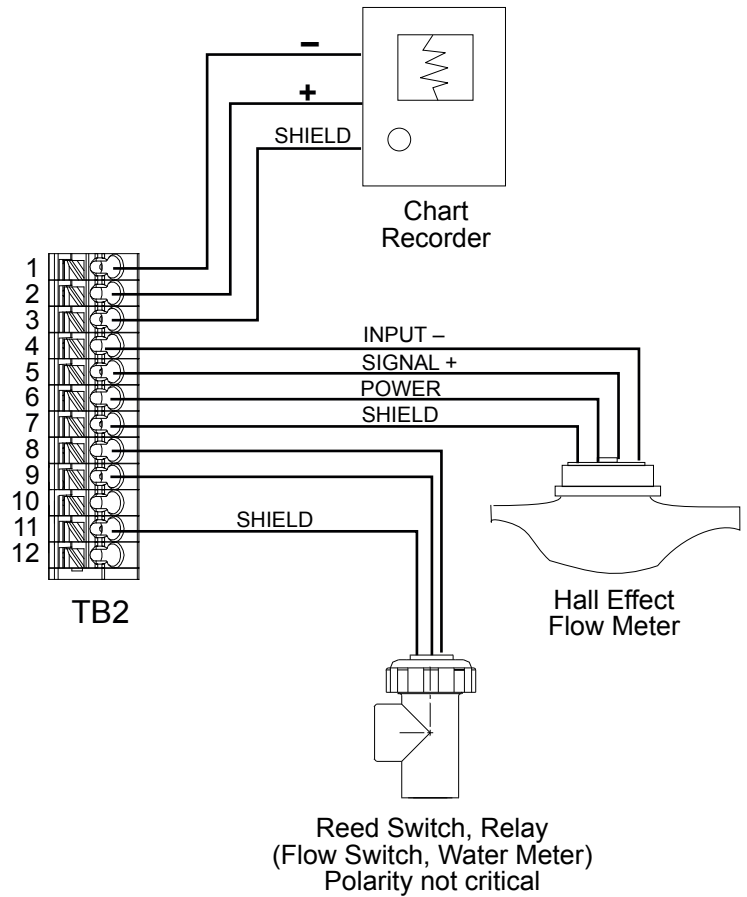
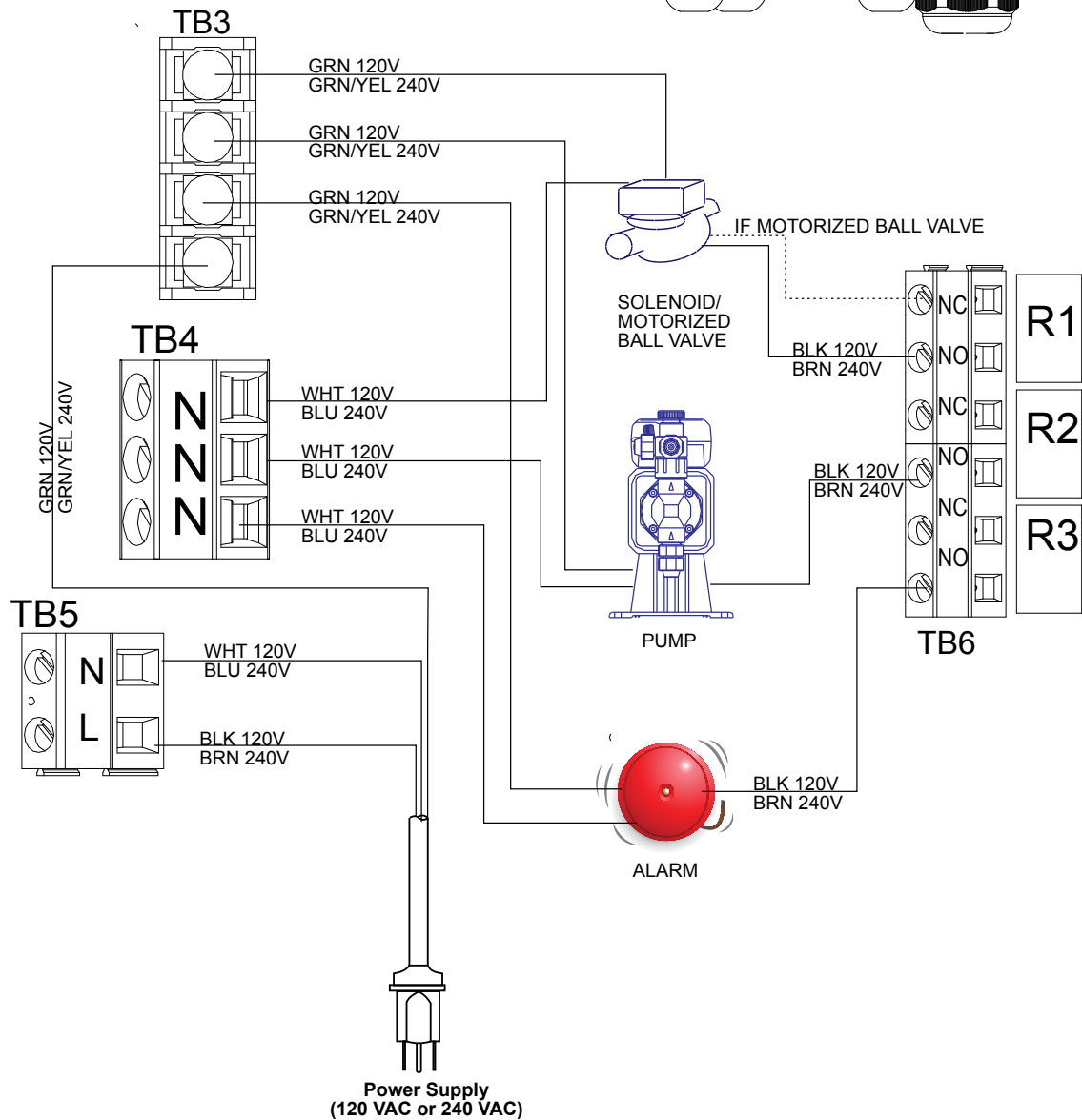
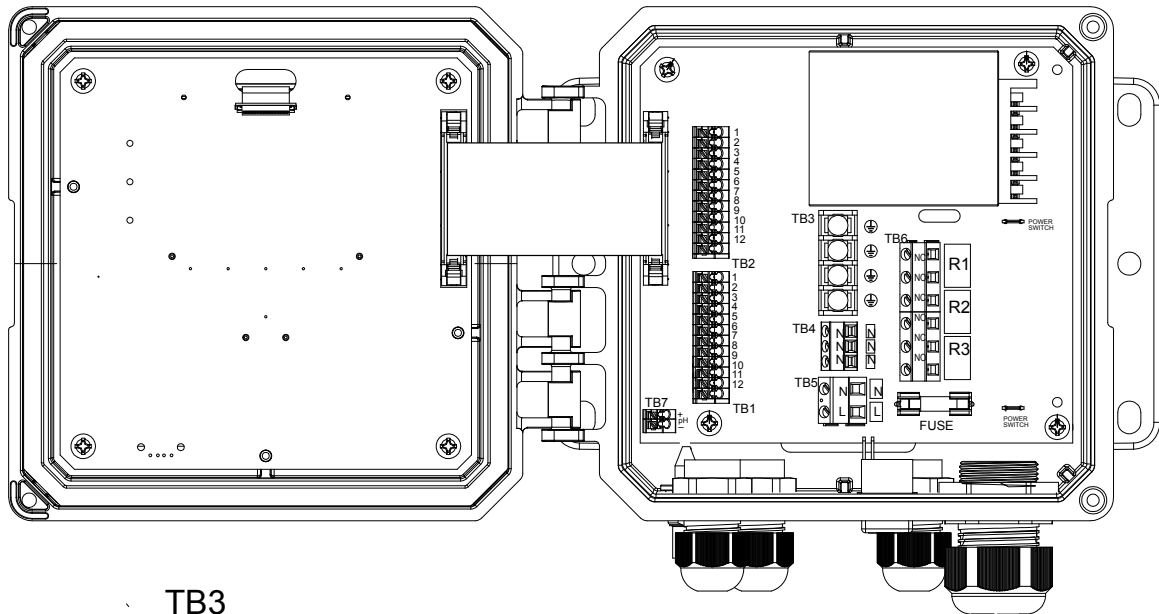


Figure 10 Digital Input and Analog Output Wiring



**Figure 11 W100 AC Power & Relay Output Wiring**



## 4.0 FUNCTION OVERVIEW

---

### 4.1 Front Panel



Figure 13 Front Panel

### 4.2 Display

A Home screen is displayed while the controller is on. This display shows the sensor readings, active alarms and a row of icons that are used to navigate to other screens.

### 4.3 Keypad

The keypad consists of 5 ATM type keys and a Home key used to return to the summary screen. The icon above the ATM keys will define its purpose on the current screen being displayed.

### 4.4 Icons

The following icons appear on the Home screen. Press the key below the icon to get to the main menu selections.



Alarm Menu



Inputs Menu



Outputs Menu



Configuration/Settings Menu

Other icons may appear in the menu screens.



Alarm Menu



Inputs Menu



Outputs Menu



Configuration/Settings Menu



Calibration key appears in sensor input menus and brings up the calibration menu



Cancel key cancels any entry



The Page Down icon scrolls down to a new page in a list of options.



The Page Up icon scrolls up to a new page in a list of options.



The Confirm icon accepts a choice and advances to the next calibration step



The Back/Return icon returns the display to the previous screen



The Make Character Higher key is used when making an alphanumeric entry



The Make Character Lower key is used when making an alphanumeric entry



The Move Cursor key is used to scroll left to right within an alphanumeric entry



The ENTER key is used to finish entering data or enter a highlighted menu choice

## ***Overview of the use of keys***

### **Changing Numeric Values**

To change a number, use the Move Cursor key to the digit to be changed. If the new number will be negative, start with the sign using the Make Character Higher key. Move the cursor to each digit and change the value using either the Make Character Higher or Lower keys. Once the value of the number is correct use the Enter key to store the new value into memory, or use the Cancel key to leave the number at its previous value and go back.

### **Changing Names**

To change the name used to identify an input or output, use the Move Cursor key to the character to be changed and change it using either the Make Character Higher or Lower keys. Upper case and lower case letter, numbers, a blank space, period, plus and minus symbols are available. Move the cursor to the right and modify each character. Once the word is correct, use the Enter key to store the new value into memory, or use the Cancel key to leave the word at its previous value and go back.

### **Choosing from a List**

Selecting the type of sensor, the units of measure of an input, or the control mode used for an output, the selection is picked from a list of available options. Use the Page Up or Down keys to highlight the desired option, and then use the Enter key to store the new option into memory, or use the Return key to leave the option at its previous value and go back.

### **Hand-Off-Auto Relay Mode**

Use the Left or Right Move Cursor keys to highlight the desired relay mode. In Hand mode the relay is forced on for a specified amount of time and when that time is up the relay returns to its previous mode, in Off mode the relay is always off until taken out of Off mode, and in Auto mode the relay is responding to control set points. Use the Confirm key to accept the option, or the Return key to leave the option at its previous value and go back.

### **Interlock and Force On Menus**

To select which outputs to force on, or which outputs to be interlocked, use the Move Cursor key to highlight the output to be selected, then use the Make Character Higher or Lower keys to check or uncheck that output. When finished, press the Confirm key to accept the changes or the Cancel key to leave the selections at the previous settings and go back.

## **4.5 Startup**

### ***Initial Startup***

After having mounted the enclosure and wired the unit, the controller is ready to be started. Plug in the controller and turn on the power switch to supply power to the unit. The display will briefly show the model number and then revert to the normal summary display. Press the Home key if necessary to get to the Home screen. Refer to section 5 below for more details on each of the settings.

### ***Settings Menu (see section 5.4)***

Choose language

Press the Configuration Settings key. Press the Enter key. Press the Scroll Down key until the English word “Language” is highlighted. Press the Enter key. Press the Scroll Down key until your language is highlighted. Press the Confirm key to change all menus to your language.

#### **Set date (if necessary)**

Press the Scroll Up key until Date is highlighted. Press the Enter key. Press the Move Cursor key to highlight the Day, and then use the Make Character Higher or Lower keys to change the date. Press the Confirm key to accept the change.

#### **Set time (if necessary)**

Press the Scroll Down key until Time is highlighted. Press the Enter key. Press the Move Cursor key to highlight the HH (hour) and/or MM (minute), then use the Make Character Higher or Lower keys to change the time. Press the Confirm key to accept the change.

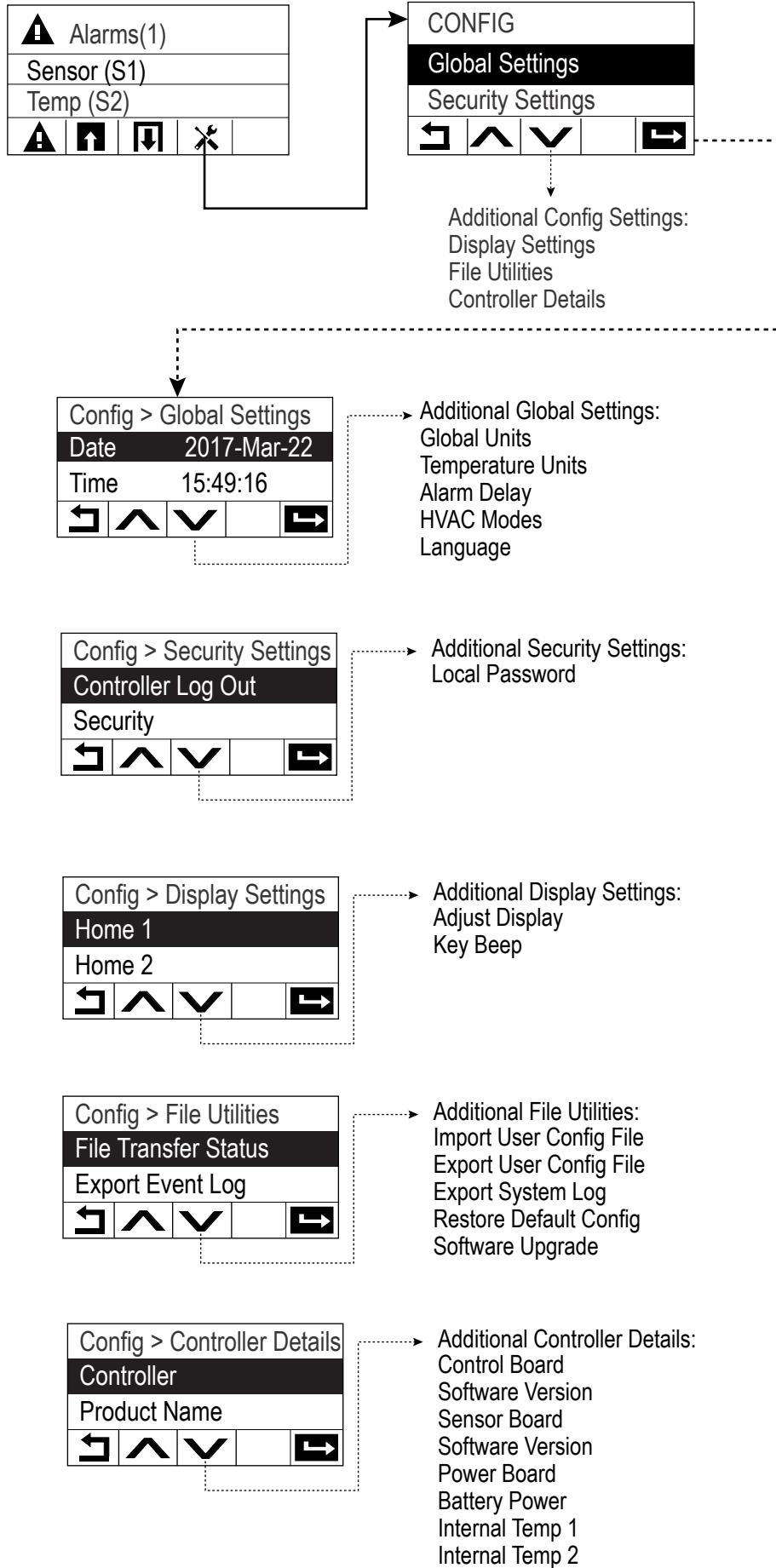
#### **Set global units of measure**

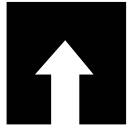
Press the Scroll Down key until Global Units is highlighted. Press the Enter key. Press the Scroll Down key until the desired units is highlighted. Press the Confirm key to accept the change.

#### **Set temperature units of measure**

Press the Scroll Down key until Temp Units is highlighted. Press the Enter key. Press the Scroll Down key until the desired units is highlighted. Press the Confirm key to accept the change.

Press the Home key. Press the Inputs key.





# INPUTS

Inputs	
CCond (S1)	0 µS/cm
Temp (S2)	74.7 °F
⏪ ⏩ ⏴ ⏵	

⚠ No Alarms (1)	
CCond (S1)	0 µS/cm
Temp (S2)	74.7°F
⚠ ⏪ ⏩ ⏴ ⏵	

- >> CCond (S1) > Calibration
- One Point Process Calibration (All)
- One Point Buffer Calibration (CCond,ECond,pH,ORP)
- Two Point Buffer Calibration (ECond,pH,ORP)
- Three Point Buffer Calibration (pH)
- One Point Analog Calibration (Cond)
- Two Point Analog Calibration (Disinfection)
- Open Air Calibration
- Zero Calibration

(All)  
(CCond,ECond,pH,ORP)  
(ECond,pH,ORP)  
(pH)  
(Cond)  
(Disinfection)

Inputs>CCond (S1)	
Details Screen	
Content varies with output type	
⏪ ⏩ ⏴ ⏵	

>>CCond (S1)	
Alarms	
Deadband	
⏪ ⏩ ⏴ ⏵	

Additional Settings for CCond:  
Reset Calibration Values  
Cal Required Alarm  
Alarm Suppression  
Smoothing Factor  
Default Temp  
Temp Compensation  
Temp Comp Factor  
Cell Constant  
Cable Length  
Gauge  
Units  
Name  
Type

>>Generic (S1)	
Alarms	
Deadband	
⏪ ⏩ ⏴ ⏵	

Additional Settings for Generic:  
Reset Calibration Values  
Cal Required Alarm  
Alarm Suppression  
Smoothing Factor  
Sensor Slope  
Sensor Offset  
Low Range  
High Range  
Cable Length  
Gauge  
Units  
Electrode (Linear or Ion Selective)  
Name  
Type

>>ECond (S1)	
Alarms	
Deadband	
⏪ ⏩ ⏴ ⏵	

Additional Settings for ECond:  
Reset Calibration Values  
Cal Required Alarm  
Alarm Suppression  
Smoothing Factor  
Default Temp  
Installation Factor  
Range  
Temp Compensation  
Temp Comp Factor  
Cell Constant  
Cable Length  
Gauge  
Units  
Name  
Type

>>DI State (D1-D2)	
Open Message	
Closed Message	
⏪ ⏩ ⏴ ⏵	

Additional Settings for DI State:  
Interlock  
Alarm  
Alarm Suppression  
Total Time  
Reset Total Time  
Name  
Type

>>Temperature (S2)	
Alarms	
Deadband	
⏪ ⏩ ⏴ ⏵	

Additional Settings for Temperature:  
Reset Calibration Values  
Cal Required Alarm  
Alarm Suppression  
Smoothing Factor  
Name  
Element

Contactor Type	
>>Flowmeter (D1-D2)	
Totalizer Alarm	
Reset Flow Total	
⏪ ⏩ ⏴ ⏵	

Additional Settings for Flowmeter:  
Set Flow Total  
Scheduled Reset  
Alarm Suppression  
Volume/Contact  
Flow Units  
Name  
Type

>>pH (S1)	
Alarms	
Deadband	
⏪ ⏩ ⏴ ⏵	

Additional Settings for pH:  
Reset Calibration Values  
Cal Required Alarm  
Alarm Suppression  
Smoothing Factor  
Buffers  
Default Temp  
Cable Length  
Gauge  
Electrode  
Name  
Type

Paddlewheel Type	
>>Flowmeter (D1-D2))	
Alarms	
Deadband	
⏪ ⏩ ⏴ ⏵	

Additional Settings for Flowmeter:  
Alarm Suppression  
Totalizer Alarm  
Reset Flow Total  
Set Flow Total  
Scheduled Reset  
K Factor  
Flow Units  
Rate Units  
Smoothing Factor  
Name  
Type

>>ORP (S1)	
Alarms	
Deadband	
⏪ ⏩ ⏴ ⏵	

Additional Settings for ORP:  
Reset Calibration Values  
Cal Required Alarm  
Alarm Suppression  
Smoothing Factor  
Default Temp  
Cable Length  
Gauge  
Name  
Type

Only Available in some models

>>Disinfection (S1)	
Alarms	
Deadband	
⏪ ⏩ ⏴ ⏵	

Additional Settings for Disinfection:  
Reset Calibration Values  
Cal Required Alarm  
Alarm Suppression  
Smoothing Factor  
Cable Length  
Gauge  
Sensor  
Name  
Type





# OUTPUT A1

**Output>Retrans (A1)**  
 Details on this page vary with type of output

Output	
On/Off (R1)	Off
<b>Retrans (A1)</b>	<b>0.0%</b>
↶	↷

⚠ No Alarms (1)	
CCond (S1)	0 μS/cm
Temp (S2)	74.7°F
⚠	⬆

**>>Retransmit (A1)**

**HOA Setting**  
4 mA Value

### Additional Settings for Retransmit:

20 mA Value	Reset Time Total
Hand Output	Input
Interlock Channels	Name
Error Output	Mode

**>>Proportional (A1)**

**HOA Setting**  
Setpoint

### Additional Settings for Proportional:

Proportional Band	Hand Time Limit
Min Output	Reset Time Total
Max Output	Off Mode Output
Output Time Limit	Error Output
Reset Output Timeout	Input
Interlock Channels	Direction
Activate with Channels	Name
Hand Output	Mode

Only available if HVAC is disabled

**>>PID (A1)**

**HOA Setting**  
Setpoint

### Additional Settings for PID:

Gain	Hand Output
Proportional Gain	Hand Time Limit
Integral Time	Off Mode Output
Integral Gain	Error Output
Derivative Time	Reset Time Total
Derivative Gain	Input
Reset PID Integral	Direction
Min Output	Input Min
Max Output	Input Max
Max Rate	Gain Form
Output Time Limit	Name
Reset Output Timeout	Mode
Interlock Channels	
Activate with Channels	

**>>Manual (A1)**

**HOA Setting**  
Interlock Channels

### Additional Settings for Manual:

Activate with Channels	Name
Min. Relay Cycle	Mode
Hand Output	
Hand Time Limit	
Reset Time Total	

**>>Flow Prop (A1)**

**HOA Setting**  
Target

### Additional Settings for Flow Prop Control Mode:

Pump Capacity	Hand Time Limit
Pump Setting	Off Mode Output
Specific Gravity	Error Output
Output Time Limit	Reset Time Total
Reset Output Timeout	Flow Input
Interlock Channels	Name
Activate with Channels	Mode
Hand Output	

## ***Inputs (see section 5.2)***

### **Program the settings for each input**

The S1 sensor input will be highlighted. Press the Enter key to get to the Details screen. Press the Settings key. If the name of the sensor does not describe the type of sensor connected, press the Scroll Down key until Type is highlighted. Press the Enter key. Press the Scroll Down key until the correct type of sensor is highlighted, then press the Confirm key to accept the change. This will bring you back to the Details screen. Press the Settings key again to finish the rest of the S1 settings. For disinfections sensors, choose the exact sensor in the Sensor menu. For contacting conductivity sensors, enter the cell constant. Select the units of measure. Enter the alarm set points and alarm deadband. Set the default temperature that will be used for automatic temperature compensation if the temperature signal becomes invalid.

When finished with S1, press the Return key until the list of inputs is displayed. Press the Scroll Down key and repeat the process for each input.

The S2 temperature input Element should be set correctly once the S1 sensor type has been set. If not, select the correct temperature element and set the alarm set points and alarm deadband. ORP and disinfection sensors do not have temperature signals and are preset to No Sensor.

To calibrate the temperature, return to the S2 Details screen, press the Calibrate key, and press the Enter key to perform a calibration.

If a flow switch or liquid level switch is connected, D1 or D2 should be set to DI State type (if no switch is connected, select No Sensor). Set the state that will possibly interlock control outputs (refer to the Outputs settings to program which outputs, if any, will be interlocked by the switch). Set the state, if any, that will result in an alarm.

If a contacting head or paddlewheel flow meter is connected, D1 or D2 should be set to that type (if no flow meter is connected, select No Sensor). Set the units of measure, volume/contact or K factor, etc.

### **Calibrate the sensor**

To calibrate the sensor, return to the list of inputs, highlight S1, press the Enter key, press the Calibrate key, and select one of the calibration routines. For disinfection sensors, start with the Zero Calibration. For electrodeless conductivity, start with the Air Calibration. Refer to section 5.2.

Press the Home key. Press the Outputs key.

## ***Outputs (see section 5.3)***

### **Program the settings for each output**

The R1 relay output will be highlighted. Press the Enter key to get to the Details screen. Press the Settings key. If the name of the relay does not describe the control mode desired, press the Scroll Down key until Mode is highlighted. Press the Enter key. Press the Scroll Down key until the correct control mode is highlighted, then press the Confirm key to accept the change. This will bring you back to the Details screen. Press the Settings key again to finish the rest of the R1 settings.

If you want the output to be interlocked by a flow switch or by another output being active, enter the Interlock Channels menu and select the input or output channel that will interlock this output.

The default is for the output to be in Off mode, where the output does not react to the settings. Once all settings for that output are complete, enter the HOA Setting menu and change it to Auto.

Repeat for each output.

## ***Normal Startup***

Startup is a simple process once your set points are in memory. Simply check your supply of chemicals, turn on the controller, calibrate the sensor if necessary and it will start controlling.

## **4.6 Shut Down**

To shut the controller down, simply turn off the power. Programming remains in memory.

## 5.0 OPERATION

---

These units control continuously while power is applied. Programming is accomplished via the local keypad and display.

To see the top level menu keys, press the Home key if not already there. The menu structure is grouped by Alarms, Inputs, Outputs, and configuration Settings. Each input has its own menu for calibration and unit selection as needed. Each output has its own setup menu including set points, timer values and operating modes as needed. Under Settings will be general settings such as the clock, the language, etc.

Keep in mind that even while moving through menus, the unit is still controlling.

### 5.1 Alarms Menu

Press the key below the Alarms icon to view a list of active alarms. If there are more than two active alarms, the Page Down icon will be shown, and this key press will bring up the next page of inputs.

Press the Back/Return button to go back to the previous screen.

### 5.2 Inputs Menu

Press the key below the Inputs icon to view a list of all sensor and digital inputs. The Page Down icon scrolls down the list of inputs, the Page Up icon scrolls up the list of inputs, the Return icon brings back the previous screen.

Press the Enter key with an input highlighted to access that input's details, calibration (if applicable) and settings.

#### Sensor Input Details

The details for any type of sensor input include the current value read, alarms, the raw (uncalibrated) signal, the sensor type, and the calibration gain and offset. If the sensor has automatic temperature compensation, then the sensor's temperature value and alarms, the temperature resistance value read, and the type of temperature element required are also displayed.

#### Calibration

Press the Calibration key to calibrate the sensor. Select the calibration to perform: One Point Process, One Point Buffer or Two Point Buffer Calibration. Not all calibration options are available for all types of sensor.

#### *One Point Process Calibration*

##### New Value

Enter the actual value of the process as determined by another meter or laboratory analysis and press Confirm.

##### Cal Successful or Failed

If successful, press Confirm to put the new calibration in memory.

If failed, you may retry the calibration or cancel. Refer to Section 7 to troubleshoot a calibration failure.

#### *One Point Buffer Calibration, Conductivity Air Cal*

##### Cal Disables Control

Press Confirm to continue or Cancel to abort

**Buffer Temperature** (only appears if no temperature sensor is detected for sensor types that use automatic temperature compensation)

Enter the temperature of the buffer and press Confirm.

**Buffer Value** (only appears for One Point Calibration except when automatic buffer recognition is used)  
Enter the value of the buffer being used

**Rinse Sensor**

Remove the sensor from the process, rinse it off, and place it in the buffer solution (or oxidizer-free water for Zero Cal, or air for the conductivity open air cal). Press Confirm when ready.

**Stabilization**

When the temperature (if applicable) and signal from the sensor is stable, the controller will automatically move to the next step. If they don't stabilize you may manually go to the next step by pressing Confirm.

**Cal Successful or Failed**

If successful, press Confirm to put the new calibration in memory.

If failed, you may retry the calibration or cancel. Refer to Section 7 to troubleshoot a calibration failure.

**Resume Control**

Replace the sensor in the process and press Confirm when ready to resume control.

***Two Point Buffer Calibration***

**Cal Disables Control**

Press Confirm to continue or Cancel to abort

**Buffer Temperature** (only appears if no temperature sensor is detected for sensor types that use automatic temperature compensation)

Enter the temperature of the buffer and press Confirm.

**First Buffer Value** (does not appear if automatic buffer recognition is used)

Enter the value of the buffer being used.

**Rinse Sensor**

Remove the sensor from the process, rinse it off, and place it in the buffer solution. Press Confirm when ready.

**Stabilization**

When the temperature (if applicable) and signal from the sensor is stable, the controller will automatically move to the next step. If they don't stabilize you may manually go to the next step by pressing Confirm.

**Second Buffer Temperature** (only appears if no temperature sensor is detected for sensor types that use automatic temperature compensation)

Enter the temperature of the buffer and press Confirm.

**Second Buffer Value**

Enter the value of the buffer being used

**Rinse Electrode**

Remove the sensor from the process, rinse it off, and place it in the buffer solution. Press Confirm when ready.

**Stabilization**

When the temperature (if applicable) and signal from the sensor is stable, the controller will automatically move to the next step. If they don't stabilize you may manually go to the next step by pressing Confirm.

**Cal Successful or Failed**

If successful, press Confirm to put the new calibration in memory. The calibration adjusts the offset and the gain (slope) and displays the new values. If failed, you may retry the calibration or cancel. Refer to Section 7 to troubleshoot a calibration failure.

**Resume Control**

Replace the sensor in the process and press Confirm when ready to resume control.

## 5.2.1 Contacting Conductivity

### Settings

Press the Settings key view or change the settings related to the sensor.

<b>Alarms</b>	Low-Low, Low, High and High-High Alarms limits may be set.
<b>Deadband</b>	This is the Alarm Deadband. For example, if the High Alarm is 3000, and the deadband is 10, the alarm will activate at 3001 and deactivate at 2990.
<b>Reset Calibration Values</b>	Enter this menu to reset the sensor calibration back to factory defaults.
<b>Cal Required Alarm</b>	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
<b>Alarm Suppression</b>	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
<b>Smoothing Factor</b>	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
<b>Default Temp</b>	If the temperature signal is lost at any time, then the controller will use the Default Temp setting for temperature compensation.
<b>Cable Length</b>	The controller automatically compensates for errors in the reading caused by varying the length of the cable.
<b>Gauge</b>	The cable length compensation depends upon the gauge of wire used to extend the cable
<b>Cell Constant</b>	Change the cell constant to match the sensor connected.
<b>Temp Comp</b>	Select between the standard NaCl temperature compensation method or a linear %/ degree C method.
<b>Comp Factor</b>	This menu only appears if Linear Temp Comp is selected. Change the %/degree C to match the chemistry being measured. Standard water is 2%.
<b>Units</b>	Select the units of measure for the conductivity.
<b>Name</b>	The name used to identify the sensor may be changed.
<b>Type</b>	Select the type of sensor to be connected.

## 5.2.2 Electrodeless Conductivity

### Settings

Press the Settings key view or change the settings related to the sensor.

<b>Alarms</b>	Low-Low, Low, High and High-High Alarms limits may be set.
<b>Deadband</b>	This is the Alarm Deadband. For example, if the High Alarm is 3000, and the deadband is 10, the alarm will activate at 3000 and deactivate at 2990.
<b>Reset Calibration Values</b>	Enter this menu to reset the sensor calibration back to factory defaults.
<b>Cal Required Alarm</b>	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
<b>Alarm Suppression</b>	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active. Typically this is used to prevent alarms if there is no sample flow past the flow switch digital input.
<b>Smoothing Factor</b>	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.

<b>Cable Length</b>	The controller automatically compensates for errors in the reading caused by varying the length of the cable.
<b>Gauge</b>	The cable length compensation depends upon the gauge of wire used to extend the cable
<b>Cell Constant</b>	Do not change unless instructed by the factory. The default value is 6.286
<b>Range</b>	Select the range of conductivity that best matches the conditions the sensor will see.
<b>Installation Factor</b>	Do not change unless instructed by the factory. The default value is 1.000.
<b>Default Temp</b>	If the temperature signal is lost at any time, then the controller will use the Default Temp setting for temperature compensation.
<b>Temp Comp</b>	Select between the standard NaCl temperature compensation method or a linear %/ degree C method.
<b>Comp Factor</b>	This menu only appears if Linear Temp Comp is selected. Change the %/degree C to match the chemistry being measured. Standard water is 2%.
<b>Units</b>	Select the units of measure for the conductivity.
<b>Name</b>	The name used to identify the sensor may be changed.
<b>Type</b>	Select the type of sensor to be connected.

### 5.2.3 Temperature

#### Settings

Press the Settings key view or change the settings related to the sensor.

<b>Alarms</b>	Low-Low, Low, High and High-High Alarms limits may be set.
<b>Deadband</b>	This is the Alarm Deadband. For example, if the High Alarm is 100, and the deadband is 1, the alarm will activate at 100 and deactivate at 99.
<b>Reset Calibration Values</b>	Enter this menu to reset the sensor calibration back to factory defaults.
<b>Cal Required Alarm</b>	To get an alarm message as a reminder to calibrate the sensor on a regular schedule, enter the number of days between calibrations. Set it to 0 if no reminders are necessary.
<b>Alarm Suppression</b>	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active.
<b>Smoothing Factor</b>	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
<b>Name</b>	The name used to identify the sensor may be changed.
<b>Element</b>	Select the specific type of temperature sensor to be connected.

### 5.2.4 DI State

#### Input Details

The details for this type of input include the current state with a custom message for open versus closed, alarms, and the status of the interlock.

#### Settings

Press the Settings key view or change the settings related to the sensor.

<b>Open Message</b>	The words used to describe the switch state may be customized.
<b>Closed Message</b>	The words used to describe the switch state may be customized.
<b>Interlock</b>	Choose whether the input should be in the interlocked state when the switch is either open or closed.

<b>Total Time</b>	Choose to totalize the amount of time that the switch has been open or closed. This will be displayed on the input details screen.
<b>Reset Total Time</b>	Enter this menu to reset the accumulated time to zero. Press Confirm to accept, Cancel to leave the total at the previous value and go back.
<b>Alarm</b>	Choose if an alarm should be generated when the switch is open, or closed, or if no alarm should ever be generated.
<b>Alarm Suppression</b>	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active.
<b>Name</b>	The name used to identify the switch may be changed.
<b>Type</b>	Select the type of sensor to be connected to the digital input channel.

## 5.2.5 Flow Meter, Contactor Type

### Input Details

The details for this type of input include the total volume accumulated through the flow meter and alarms.

### Settings

Press the Settings key view or change the settings related to the sensor.

<b>Totalizer Alarm</b>	A high limit on the total volume of water accumulated may be set.
<b>Alarm Suppression</b>	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active.
<b>Reset Flow Total</b>	Enter this menu to reset the accumulated flow total to 0. Press Confirm to accept, Cancel to leave the total at the previous value and go back.
<b>Set Flow Total</b>	This menu is used to set the total volume stored in the controller to match the register on the flow meter. Enter the desired value.
<b>Scheduled Reset</b>	Choose to automatically reset the flow total, and if so, Daily, Monthly or Annually.
<b>Volume/Contact</b>	Enter the volume of water that needs to go through the flow meter in order to generate a contact closure.
<b>Flow Units</b>	Select the units of measure for the water volume.
<b>Name</b>	The name used to identify the sensor may be changed.
<b>Type</b>	Select the type of sensor to be connected to the digital input channel.

## 5.2.6 Flow Meter, Paddlewheel Type

### Input Details

The details for this type of input include the current flow rate, total volume accumulated through the flow meter and alarms.

### Settings

Press the Settings key view or change the settings related to the sensor.

<b>Alarms</b>	Low and High Alarm limits may be set.
<b>Alarm Suppression</b>	If any of the relays or digital inputs are selected, any alarms related to this input will be suppressed if the selected relay or digital input is active.
<b>Deadband</b>	This is the Alarm Deadband. For example, if the High Alarm is 100, and the deadband is 1, the alarm will activate at 100 and deactivate at 99.
<b>Totalizer Alarm</b>	A high limit on the total volume of water accumulated may be set.
<b>Reset Flow Total</b>	Enter this menu to reset the accumulated flow total to 0. Press Confirm to accept, Cancel to leave the total at the previous value and go back.
<b>Set Flow Total</b>	This menu is used to set the total volume stored in the controller to match the register on the flow meter. Enter the desired value.
<b>Scheduled Reset</b>	Choose to automatically reset the flow total, and if so, Daily, Monthly or Annually.

<b>K Factor</b>	Enter the pulses generated by the paddlewheel per unit volume of water.
<b>Flow Units</b>	Select the units of measure for the water volume.
<b>Rate Units</b>	Select the units of measure for the flow rate time base.
<b>Smoothing Factor</b>	Increase the smoothing factor percentage to dampen the response to changes. For example, with a 10% smoothing factor, the next reading shown will consist of an average of 10% of the previous value and 90% of the current value.
<b>Name</b>	The name used to identify the sensor may be changed.
<b>Type</b>	Select the type of sensor to be connected to the digital input channel.

### 5.3 Outputs Menu



Press the key below the Outputs icon to view a list of all relay and analog outputs. The Page Down icon scrolls down the list of outputs, the Page Up icon scrolls up the list of outputs, the Return icon brings back the previous screen.

Press the Enter key with an output highlighted to access that output's details and settings.

NOTE: When the output control mode or the input assigned to that output is changed, the output reverts to OFF mode. Once you have changed all settings to match the new mode or sensor, you must put the output into AUTO mode to start control.

#### 5.3.1 Relay, Any Control Mode

##### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

##### Settings

Press the Settings key view or change the settings related to the relay. Settings that are available for any control mode include:

<b>HOA Setting</b>	Select Hand, Off or Auto mode (see section 4.4).
<b>Output Time Limit</b>	Enter the maximum amount of time that the relay can be continuously activated. Once the time limit is reached, the relay will deactivate until the Reset Output Timeout menu is entered.
<b>Reset Output Timeout</b>	Enter this menu to clear an Output Timeout alarm and allow the relay to control the process again.
<b>Interlock Channels</b>	Select the relays and digital inputs that will interlock this relay, when those other relays are activated in Auto mode. Using Hand or Off to activate relays bypasses the Interlock logic.
<b>Activate With Channels</b>	Select the relays and digital inputs that will activate this relay, when those other relays are activated in Auto mode. Using Hand or Off to activate relays bypasses the Activate With logic.
<b>Min Relay Cycle</b>	This menu allows for the use of a motorized ball valve that needs time to fully open and close. Enter the number of seconds that the valve needs to fully actuate.
<b>Hand Time Limit</b>	Enter the amount of time that the relay will activate for when it is in Hand mode.
<b>Reset Time Total</b>	Press the Confirm icon to reset the total accumulated on-time stored for the output back to 0.
<b>Name</b>	The name used to identify the relay may be changed.
<b>Mode</b>	Select the desired control mode for the output.

#### 5.3.2 Relay, On/Off Control Mode

##### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

##### Settings

Press the Settings key view or change the settings related to the relay.

<b>Set point</b>	Enter the sensor process value at which the relay will activate.
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<b>Deadband</b>	Enter the sensor process value away from the set point at which the relay will deactivate.
<b>Duty Cycle Period</b>	Using a duty cycle helps to prevent overshooting the set point in applications where the response of the sensor to chemical additions is slow. Specify the amount of time for the cycle, and the percentage of that cycle time that the relay will be active. The relay will be off for the rest of the cycle, even if the set point has not been satisfied. Enter the length of the duty cycle in minutes:seconds in this menu. Set the time to 00:00 if use of a duty cycle is not required.
<b>Duty Cycle</b>	Enter the percentage of the cycle period that the relay will be active. Set the percentage to 100 if use of a duty cycle is not required.
<b>Input</b>	Select the sensor to be used by this relay.
<b>Direction</b>	Select the control direction.

### 5.3.3 Relay, Flow Timer Control Mode

#### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

#### Settings

Press the Settings key view or change the settings related to the relay.

<b>Feed Duration</b>	Enter the amount of time for the relay to activate for once the accumulated volume through the water meter has been reached.
<b>Accumulated Volume</b>	Enter the volume of water to pass through the water meter required to trigger the chemical feed.
<b>Flow Input</b>	Select the input to be used to control this output.
<b>Reset Timer</b>	Use this menu to cancel the current feed cycle.

### 5.3.4 Relay, Bleed and Feed Control Mode

ONLY AVAILABLE IF HVAC MODES ARE ENABLED IN CONFIG MENU – GLOBAL SETTINGS

#### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

#### Settings

Press the Settings key view or change the settings related to the relay.

<b>Feed Time Limit</b>	Enter the maximum amount of feed time per bleed event
<b>Bleed</b>	Select the relay to be used for Bleed/Blowdown

### 5.3.5 Relay, Bleed then Feed Control Mode

ONLY AVAILABLE IF HVAC MODES ARE ENABLED IN CONFIG MENU – GLOBAL SETTINGS

#### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

#### Settings

Press the Settings key view or change the settings related to the relay.

<b>Feed Percentage</b>	Enter the % of bleed relay activation time to use for the feed relay activation time
<b>Feed Time Limit</b>	Enter the maximum amount of feed time per bleed event
<b>Reset Timer</b>	Use this menu to cancel the current feed cycle.
<b>Bleed</b>	Select the relay to be used for Bleed/Blowdown

### 5.3.6 Relay, Percent Timer Control Mode

#### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, cycle time, accumulated on-time, alarms, current cycle on time and relay type.

#### Settings

Press the Settings key view or change the settings related to the relay.

<b>Sample Period</b>	Enter the duration of the sample period.
<b>Feed Percentage</b>	Enter the % of the sample period time to use for the feed relay activation time

### 5.3.7 Relay, Biocide Timer Control Mode

ONLY AVAILABLE IF HVAC MODES ARE ENABLED IN CONFIG MENU – GLOBAL SETTINGS

#### Basic Biocide Operation

When a biocide event triggers, the algorithm will first prebleed (if a prebleed is programmed) for the set amount of prebleed time or down to the set prebleed conductivity. Then the biocide relay is turned on for the set duration. This is followed by a post-bio add lockout that blocks the bleed relay from turning on for a set amount of bleed lockout time.

#### Special Condition Handling

##### Prebleed

If both a time limit and a conductivity limit are set, the time limit takes precedence. The bleed relay will turn off once the time limit is reached or when the prebleed conductivity limit is reached (whichever occurs first). If the prebleed has a conductivity limit set, then the time limit can't be set to zero, as this would allow the prebleed to last forever if the conductivity limit is never reached.

##### Overlapping biocide events

If a second biocide event occurs while the first one is still active (in pre-bleed, biocide add or lockout), the second event will be ignored. An Event Skipped alarm will be set.

##### Interlock Conditions

Interlocks override the relay control, but do not change the operation of the timer control.

A no-flow (or other interlock) condition does not delay a biocide add. The biocide add duration timer will continue even if the relay is locked out due to a no-flow or other interlock condition. This will prevent delayed biocide adds which can potentially cause higher than expected biocide concentrations in the system when two biocides adds occur close to the same time. Not allowing delayed biocide adds will also prevent incompatible biocides getting added at close to the same time.

##### “Activate With” Conditions

“Activate with channels” settings override the relay control, but do not change the operation of the timers or related bleed control. The biocide timer continues counting biocide add time when the biocide relay is forced on, and ends at the expected time (biocide event start time plus duration). If the “activate with” condition continues after the end of the biocide feed time, the relay remains activated.

##### Alarms

An Event Skipped alarm is set when a second biocide event occurs while one event is still running (either in prebleed, biocide add or post-biocide add lockout). An Event Skipped alarm is also set when the biocide add relay never turns on during a biocide add because of an interlock condition.

The alarm is cleared when the relay is next activated for any reason (the next timer event or HAND mode or “activate with” force on condition).

#### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type. The current week number and day of the week is displayed (even if there is no multi-week repetition event programmed). Cycle Time shows the time counting down of the currently active part of the biocide cycle (pre-bleed, biocide feed, or post biocide feed lockout of the bleed).

## Settings

Press the Settings key view or change the settings related to the relay.

<b>Event 1 (through 10)</b>	Enter these menus to program timer events via the menus below:
<b>Repetition</b>	Select the time cycle to repeat the event: Daily, 1 Week, 2 Week, 4 Week, or None. An event means that the output is turned on at the same time of day, for the same amount of time, and except for the Daily cycle, on the same day of the week.
<b>Week</b>	Only appears if Repetition is longer than 1 Week. Select the week during which the event will occur.
<b>Day</b>	Only appears if Repetition is longer than Daily. Select the day of the week during which the event will occur.
<b>Start Time</b>	Enter the time of day to start the event.
<b>Duration</b>	Enter the amount of time that the relay will be on.
<b>Bleed</b>	Select the relay to be used for Bleed/Blowdown
<b>Prebleed Time</b>	If lowering the conductivity prior to feeding biocide is desired using a fixed time instead of a specific conductivity setting, enter the amount of time for the prebleed. Also may be used to apply a time limit on a conductivity based prebleed.
<b>Prebleed To</b>	If lowering the conductivity prior to feeding biocide is desired, enter the conductivity value. If no prebleed is required, or if a time-based prebleed is preferred, set the conductivity value to 0.
<b>Cond Input</b>	Select the sensor to be used to control the prebleed relay selected above.
<b>Bleed Lockout</b>	Enter the amount of time to lockout bleed after the biocide feed is complete.
<b>Add Last Missed</b>	Select Enabled if the controller should delay start the most recent Biocide cycle until immediately after an Interlock clears, or Disabled if all Biocide feed should be skipped if there is an Interlock condition at the time the add was due to start.

### 5.3.8 Relay, Alarm Mode

#### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

## Settings

Press the Settings key view or change the settings related to the relay.

<b>Alarm Mode</b>	Select the alarm conditions that will put the relay into the alarm state:
	All Alarms
	S1 Low Alarms (+LoLo Alarm, Sensor Range Error, or Sensor Fault)
	S1 High Alarms (+HiHi Alarm, Sensor Range Error, or Sensor Fault)
	S2 (Temperature) Low Alarms (+LoLo Alarm, Sensor Range Error, or Sensor Fault)
	S2 (Temperature) High Alarms (+HiHi Alarm, Sensor Range Error, or Sensor Fault)
	D1 Alarms (Flowswitch/State, Flow Total, Flowmeter Range)
	D2 Alarms (Flowswitch/State, Flow Total, Flowmeter Range)
<b>On Delay Time</b>	Enter the delay time for relay activation in hours:minutes:seconds. Set the time to 00:00:00 to immediately activate the relay.
<b>Off Delay Time</b>	Enter the delay time for relay deactivation in hours:minutes:seconds. Set the time to 00:00:00 to immediately deactivate the relay.
<b>Output</b>	Select if the relay will be active when in the alarm state (Normally Open) or if the relay will be active when not in the alarm state (Normally Closed).

### 5.3.9 Relay, Time Proportional Control Mode

#### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

#### Settings

Press the Settings key view or change the settings related to the relay.

<b>Set point</b>	Enter the sensor process value at which the relay will be off for the entire Sample Period.
<b>Proportional Band</b>	Enter the distance that the sensor process value is away from the set point at which the relay will be on for the entire Sample Period.
<b>Sample Period</b>	Enter the duration of the sample period.
<b>Input</b>	Select the sensor to be used by this relay.
<b>Direction</b>	Select the control direction.

### 5.3.10 Relay, Intermittent Sampling Control Mode

ONLY AVAILABLE IF HVAC MODES ARE ENABLED IN CONFIG MENU – GLOBAL SETTINGS

In an Intermittent Sampling with Proportional Blowdown control mode, the controller reads an analog input on a timed schedule, and the relay responds to maintain the conductivity value at the set point by activating for a programmable amount of time that varies with the deviation from the set point.

The relay goes through a sequence of activation/deactivation as described below. The intended purpose of this algorithm is boiler blowdown. A sample cannot be supplied to the sensor continuously in many boilers because a recirculating loop is not possible, and it would be a waste of hot water to constantly run a sample to a drain. A valve is opened intermittently to supply a sample to the sensor.

Where a non-ideal installation of the sensor can cause the sample to flash to steam, and give a false low reading, this can be corrected by taking the reading with the sample held in the pipe with the sampling valve closed, so the sample is at boiler pressure and therefore back in the liquid state. Enable Trap Sample if this is the case. Because the conductivity reading cannot be trusted while the valve is open, the blowdown is timed rather than in direct response to a sensor reading. Rather than relying upon a fixed time, where the blowdown could be much longer than necessary if the reading is just barely off the set point value, proportional blowdown adjusts the time appropriately.

If Trap Sample is Disabled, then the blowdown is not timed, and the Hold Time and Maximum Blowdown time are not used. The blowdown valve will stay open until the conductivity is below set point. In this case the Output Time Limit menu is available to stop the blowdown if the sensor is unresponsive.

Note that the software will not allow two relays using Intermittent Sampling to be assigned to the same sensor input; the previous relay set up will change to Off mode.

#### Output Details

The details for this type of output include the relay on/off state, relay status (HOA mode, Interlock status, Intermittent Sampling cycle step, etc.), time remaining for the active Intermittent Sampling cycle step, alarms, current cycle on time and relay type.

#### Settings

Press the Settings key view or change the settings related to the relay.

<b>Set point</b>	Enter the conductivity value below which the controller will not start a blowdown cycle.
<b>Proportional Band</b>	(only shown if trap sample is enabled) Enter the conductivity value above the set point at which the maximum blowdown time will occur. For example, if the Set point is 2000 uS/cm, and the Proportional Band is 200 uS/cm, then if the conductivity is above 2200 uS/cm the blowdown valve will open for the Maximum Blowdown time described below. If the conductivity of the trapped sample is 2100 uS/cm, the blowdown valve will open for half the Maximum Blowdown time.

<b>Deadband</b>	(only shown if trap sample is disabled) Enter the sensor process value away from the set point at which the relay will deactivate.
<b>Sample Time</b>	Enter the length of time the blowdown valve will be open in order to capture a fresh sample of boiler water.
<b>Hold Time</b>	(only shown if trap sample is enabled) Enter the length of time the blowdown valve will be closed in order to ensure that the captured sample is at boiler pressure.
<b>Maximum Blowdown</b>	(only shown if trap sample is enabled) Enter the maximum length of time that the blowdown valve will be open, when the conductivity of the captured sample is above the set point plus the proportional band.
<b>Cond Input</b>	Select the sensor to be used by this relay.
<b>Wait Time</b>	Enter the time to wait to sample the water again once the captured sample is below set point.
<b>Trap Sample</b>	Enable or disable trapping of the sample.

### 5.3.11 Relay or Analog Output, Manual Mode

#### Output Details

The details for this type of output include the relay on/off state or analog output %, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

#### Settings

A Manual relay will activate if the HOA mode is Hand, or if it is Activated With another channel. There are no additional programmable parameters.

### 5.3.12 Relay, Pulse Proportional Control Mode

ONLY AVAILABLE IF W120 MODEL/POWER RELAY BOARD IS INSTALLED

#### Output Details

The details for this type of output include the relay pulse rate, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

#### Settings

Press the Settings key view or change the settings related to the relay.

<b>Set point</b>	Enter the sensor process value at which the output will pulse at the Minimum Output % set below.
<b>Proportional Band</b>	Enter the distance that the sensor process value is away from the set point beyond which the output will be pulsing at the Maximum Output % set below.
<b>Minimum Output</b>	Enter the lowest possible pulse rate as a percentage of the Maximum Stroke Rate set below (normally 0%).
<b>Maximum Output</b>	Enter the highest possible pulse rate as a percentage of the Maximum Stroke Rate set below.
<b>Maximum Rate</b>	Enter the maximum pulse rate that the metering pump is designed to accept (10 - 2400 pulse/minute range).
<b>Input</b>	Select the sensor to be used by this relay.
<b>Direction</b>	Set the control direction.

### 5.3.13 Relay, Dual Set Point Mode

#### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

#### Settings

Press the Settings key view or change the settings related to the relay.

<b>Set point</b>	Enter the first sensor process value at which the relay will activate.
<b>Set point 2</b>	Enter the second sensor process value at which the relay will activate.
<b>Deadband</b>	Enter the sensor process value away from the set point at which the relay will deactivate.
<b>Duty Cycle Period</b>	Using a duty cycle helps to prevent overshooting the set point in applications where the response of the sensor to chemical additions is slow. Specify the amount of time for the cycle, and the percentage of that cycle time that the relay will be active. The relay will be off for the rest of the cycle, even if the set point has not been satisfied.  Enter the length of the duty cycle in minutes:seconds in this menu. Set the time to 00:00 if use of a duty cycle is not required.
<b>Duty Cycle</b>	Enter the percentage of the cycle period that the relay will be active. Set the percentage to 100 if use of a duty cycle is not required.
<b>Input</b>	Select the sensor to be used by this relay.
<b>Direction</b>	Select the control direction. In Range will activate the relay when the input reading is between the two set points. Out of Range will activate the relay when the input reading is outside the two set points.

### 5.3.14 Relay, Probe Wash Control Mode

#### Basic Timer Operation

When a Probe Wash event triggers, the algorithm will activate the relay for the programmed time. The relay will activate a pump or valve to supply a cleaning solution to the sensor or sensors. The output of the selected sensors will either be held or disabled during the cleaning cycle, and for a programmable hold time after the cleaning cycle.

#### Special Condition Handling

##### Overlapping timer events

If a second timer event occurs while the first one is still active, the second event will be ignored. An Event Skipped alarm will be set.

##### Interlock Conditions

Interlocks override the relay control, but do not change the operation of the timer control.

A digital input or output interlock condition does not delay the relay activation. The relay activation duration timer will continue even if the relay is deactivated due to an interlock condition. This will prevent delayed events which can potentially cause problems in they do not occur at the correct time.

##### “Activate With” Conditions

“Activate with channels” settings override the relay control, but do not change the operation of the timer control. The relay activation duration timer continues counting when the timer relay is forced on, and ends at the expected time (event start time plus duration). If the “activate with” condition continues after the end of the event time, the relay remains activated.

##### Alarms

An Event Skipped alarm is set when a second timer event occurs while one event is still running. An Event Skipped alarm is also set when the timer relay never turns on during an event because of an interlock condition.

The alarm is cleared when the relay is next activated for any reason (the next timer event or HAND mode or “activate with” force on condition).

#### Output Details

The details for this type of output include the relay on/off state, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type. The current week number and day of the week is displayed (even if there is no multi-week repetition event programmed). Cycle Time shows the time counting down of the currently active part of the cycle.

#### Settings

Press the Settings key view or change the settings related to the relay.

<b>Event 1 (through 10)</b>	Enter these menus to program timer events via the menus below:
<b>Repetition</b>	Select the time cycle to repeat the event: Hourly, Daily, 1 Week, 2 Week, 4 Week, or None. An event means that the output is turned on at the same time of day, for the same amount of time, and except for the Daily cycle, on the same day of the week.
<b>Week</b>	Only appears if Repetition is longer than 1 Week. Select the week during which the event will occur.
<b>Day</b>	Only appears if Repetition is longer than Daily. Select the day of the week during which the event will occur.
<b>Events Per Day</b>	Only appears if Repetition is Hourly. Select the number of events per day. The events occur on the Start Time and then evenly spaced throughout the day.
<b>Start Time</b>	Enter the time of day to start the event.
<b>Duration</b>	Enter the amount of time that the relay will be on.
<b>Input</b>	Select the sensor that will be washed.
<b>Input 2</b>	Select the second sensor, if applicable, that will be washed.
<b>Sensor Mode</b>	Select the effect that the probe wash event will have on any control outputs that use the sensor(s) being washed. The options are to either Disable the sensor readings (turn the control output off) or Hold the sensor reading at the last valid sensor reading prior to the start of the probe wash event.
<b>Hold Time</b>	Enter the amount of time needed to hold the sensor reading after the event has finished, in order for the wash solution to be replaced by process solution.

### 5.3.15 Analog Output, Retransmit Mode

#### Output Details

The details for this type of output include the output %, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type

#### Settings

Press the Settings key view or change the settings related to the analog output.

<b>4 mA Value</b>	Enter the process value to correspond to a 4 mA output signal.
<b>20 mA Value</b>	Enter the process value to correspond to a 20 mA output signal.
<b>Hand Output</b>	Enter the output % desired when the output is in Hand mode.
<b>Input</b>	Select the sensor input to retransmit.
<b>Error Output</b>	Enter the output mA desired when the sensor is not giving the controller a valid signal. The acceptable range is 0 to 21 mA.

### 5.3.16 Analog Output, Proportional Control Mode

#### Output Details

The details for this type of output include the output %, HOA mode or Interlock status, accumulated on-time, alarms, current cycle on time and relay type.

#### Settings

Press the Settings key view or change the settings related to the analog output.

<b>Set point</b>	Enter the sensor process value at which the output % will be the programmed minimum %.
<b>Proportional Band</b>	Enter the sensor process value away from the set point at which the output % will be the programmed maximum %.
<b>Minimum Output</b>	Enter the lowest output %. If the output should be off at the set point, this will be 0%.
<b>Maximum Output</b>	Enter the highest output %.

<b>Hand Output</b>	Enter the output % desired when the output is in Hand mode.
<b>Input</b>	Select the sensor input to use for proportional control.
<b>Direction</b>	Select the control direction.
<b>Off Mode Output</b>	Enter the output mA value desired when the output is in Off mode, or being Interlocked, or during a calibration of the sensor being used as an input. The acceptable range is 0 to 21 mA.
<b>Error Output</b>	Enter the output mA desired when the sensor is not giving the controller a valid signal. The acceptable range is 0 to 21 mA.

### 5.3.17 Analog Output, Flow Proportional Mode

#### Output Details

In Flow Proportional control mode, the controller monitors the rate of flow through a digital flow meter, and continuously adjusts the analog (4-20 mA) output proportional band to achieve a target PPM level.

The user enters the target PPM and the data necessary to calculate the proportional band (the water flow rate at which the maximum pulse rate will occur) required to maintain the target PPM with that flow rate of water.

$$\% \text{ output} = \frac{\text{Target PPM} \times \text{Water Flow Rate (liter/min or gal/min)}}{\text{Pump Capacity (liter or gal/hr)} \times \text{Pump Setting (\%)} \times \text{Specific Gravity} \times 166.67}$$

$$\% \text{ output} = \frac{\text{Target PPM} \times \text{Water Flow Rate (m}^3\text{/min)}}{\text{Pump Capacity (liter/hr)} \times \text{Pump Setting (\%)} \times \text{Specific Gravity} \times 0.16667}$$

#### Control Operation

If the output is continuously on for longer than the Output Time Limit, then output will deactivate.

#### Output Details

The details for this type of output include the output %, HOA mode or Interlock status, alarms related to this output, current cycle on time, total accumulated on-time, mA output, and the current control mode setting.

#### Settings

Touch the Settings icon to view or change the settings related to the relay.

<b>Target</b>	Enter the desired PPM set point for the product.
<b>Pump Capacity</b>	Enter the maximum flow rate for the metering pump.
<b>Pump Setting</b>	Enter the stroke length setting for the metering pump, in percent.
<b>Specific Gravity</b>	Enter the specific gravity of the product to be added.
<b>Hand Output</b>	Enter the output % desired when the output is in Hand mode.
<b>Off Mode Output</b>	Enter the output mA value desired when the output is in Off mode, or being Interlocked, or during a calibration of the sensor being used as an input. The acceptable range is 0 to 21 mA.
<b>Error Output</b>	Enter the output mA desired when the sensor is not giving the controller a valid signal. The acceptable range is 0 to 21 mA.
<b>Flow Input</b>	Select the flow meter to be used as an input for this control relay.

## 5.4 Settings Menu

The configuration Settings Menu is used for settings and activities that are not tied to Inputs or Outputs.

### 5.4.1 Global Settings

<b>Date</b>	Enter the current year, month and day.
<b>Time</b>	Enter the current hour (military time), minute, and second.
<b>Global Units</b>	Select the units to be used for cable length and wire gauge settings, metric or Imperial.
<b>Temperature Units</b>	Select between Fahrenheit and Celsius.
<b>Alarm Delay</b>	Enter how much time to wait after powering up the controller before alarm conditions are considered valid.
<b>HVAC Modes</b>	Enable HVAC modes for cooling tower and boiler applications where the relay control modes for Biocide timer, Bleed and Feed, Bleed then Feed, and Intermittent Sampling are required. Disable HVAC Modes if these control modes are not necessary and a more generic timer control mode will replace the Biocide timer.
<b>Language</b>	Select the language the software will use

### 5.4.2 Security Settings

<b>Controller Log Out</b>	When Security is Enabled, and after the password has been entered, the controller requires immediate use of a password to calibrate or change settings. Once finished making changes, log out to prevent unauthorized changes by someone else. If not manually logged out, the controller will automatically log out after 10 minutes of inactivity.
<b>Security</b>	Select Enable to require a password in order to calibrate or change settings, or Disable to allow calibration and set point changes without a password. In order to Enable security, the default password must be entered first, then select Enable, then press the Confirm key.
<b>Local Password</b>	Used to change the password needed for full configuration capability if Security has been enabled. The default local password is 5555. This can and should be changed using this menu if Security is enabled.

### 5.4.3 Display Settings

<b>Home 1</b>	Select the input or output to display on the 1 <sup>st</sup> line of the display Home screen.
<b>Home 2</b>	Select the input or output to display on the 2 <sup>nd</sup> line of the display Home screen.
<b>Adjust Display</b>	Change the contrast using the arrow keys.
<b>Key Beep</b>	Select enable to hear a beep when a key is pressed, or disable for silence

### 5.4.4 File Utilities

<b>File Transfer Status</b>	Displays the status of the last attempt to export a file
<b>Export Event Log</b>	Save the Event Log file to a USB stick. This records set point changes, user calibrations, alarms, relay state changes, file exports, etc.
<b>Export System Log</b>	Save the System Log file to a USB stick. This records hardware changes, software upgrades, automatic calibrations, power loss, system-level issues, etc.
<b>Import User Config File</b>	Remove power from the controller and insert a USB stick that contains the settings that you want to import to this controller (see Export User Config file below). Press the Enter key and then press the Confirm key to transfer those settings to this controller.

<b>Export User Config File</b>	The User Configuration file contains all settings for the controller. Enter this menu to save the controller's settings to a USB stick for using later to restore settings to this controller, or to program additional controllers with the same settings as this one. It takes several minutes to create the file and transfer it to the stick. Remove power from the controller and insert a USB stick. Press the Enter key and then press the Confirm key to transfer a file containing the controller's settings to the USB stick.
<b>Restore Default Config</b>	Enter this menu to restore all of the settings to the factory default values. Any changes to settings that were previously made will be lost!
<b>Software Upgrade</b>	Remove power from the controller and insert an USB stick that has the upgrade file stored in the root directory into the USB connector (see figure 7). Restore power, press the Enter key from the software upgrade menu, and then press the Confirm key to start the upgrade.

NOTE: Remove power before inserting or removing the USB stick!

### 5.4.5 Controller Details

<b>Controller</b>	Displays the name for the group of default settings used as built
<b>Product Name</b>	Displays the model of the controller as built
<b>Control Board</b>	Displays the revision number of the front panel circuit board
<b>Software Version</b>	Displays the software version on the control board
<b>Sensor Board</b>	Displays the revision number of the sensor board
<b>Software Version</b>	Displays the software version on the sensor board
<b>Power Board</b>	Displays the revision number of the power/relay board
<b>Battery Power</b>	Displays the VDC output of the battery that is used to hold the date and time. The acceptable range is 2.4-3.2 VDC.
<b>Processor Temp</b>	Displays the temperature of the main processor. The acceptable range is -10 to 65 C.
<b>Sensor Temp</b>	Displays the temperature of the sensor input processor. The acceptable range is -10 to 65 C.

## 6.0 MAINTENANCE

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The controller itself requires very little maintenance. Wipe with a damp cloth. Do not spray down the controller unless the enclosure door is closed and latched.

### 6.1 Conductivity Sensor Cleaning

NOTE: The controller must be recalibrated after cleaning the sensor.

#### *Frequency*

The sensor should be cleaned periodically. The frequency required will vary by installation. In a new installation, it is recommended that the sensor be cleaned after two weeks of service. Electrodeless conductivity sensors are much less sensitive to coatings and should go longer between cleanings. To determine how often the sensor must be cleaned, follow the procedure below.

1. Read and record the conductivity.
2. Remove, clean and replace the conductivity sensor.
3. Read conductivity and compare with the reading in step 1 above.

If the variance in readings is greater than 5%, increase the frequency of sensor cleaning. If there is less than 5% change in the reading, the sensor was not dirty and can be cleaned less often.

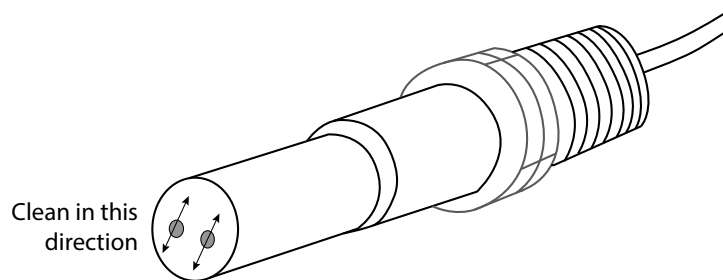
#### *Cleaning Procedure*

The sensor can normally be cleaned using a cloth or paper towel and a mild detergent. If coated with scale, clean with a dilute (5%) solution of hydrochloric acid solution.

Occasionally an electrode may become coated with various substances that require a more vigorous cleaning procedure. Usually the coating will be visible, but not always.

To clean a severely coated electrodeless conductivity sensor, scrub with a toothbrush or stiff bottlebrush. Soap or hand cleaner may help. If coated with scale, clean with a dilute (5%) hydrochloric acid solution. Harsh abrasives should be avoided. Rinse the sensor thoroughly before returning to service.

To clean a severely coated flat surface cooling tower electrode, use fine grit abrasive, such as emery paper. Lay the paper on a flat surface and move the electrode in a back and forth motion. The electrode should be cleaned parallel to the carbon electrodes, not perpendicular.



**Figure 14** Cleaning a flat contacting conductivity electrode

#### *Replacing the Fuse*



**CAUTION: Disconnect power to the controller before opening front panel!**

Models that include powered relays have a fuse to protect the controller from devices connected to the relays that draw excessive current. Locate the fuse on the circuit board at the back of the controller enclosure, underneath the clear cover (see figure 7). Gently remove the old fuse from its retaining clip and discard. Press the new fuse into the clip, replace the clear cover, secure the front panel of the controller and return power to the unit.

**Warning: Use of non-approved fuses can affect product safety approvals.** Specifications are shown below. To insure product safety certifications are maintained, it is recommended that a Walchem fuse be used.

F1 Fuse	Walchem P/N
5 x 20 mm, 6.3A, 250V	102834

## 7.0 TROUBLESHOOTING



**CAUTION: Disconnect power to the controller before opening front panel!**

Troubleshooting and repair of a malfunctioning controller should only be attempted by qualified personnel using caution to ensure safety and limit unnecessary further damage. Contact the factory.

### 7.1 Calibration Failure

Calibrations will fail if the adjustments to the reading are outside of the normal range for a properly functioning system. Refer to the instruction manual for the specific sensor being used for further information.

#### 7.1.1 Contacting Conductivity Sensors

The calibration will fail if the adjustment to the gain is outside of 0.5 to 2.0.

Possible Cause	Corrective Action
Dirty electrode	Clean electrode
Improper wiring of sensor to controller	Correct wiring
Wrong cell constant entered	Program the controller cell constant setting at the value that matches the electrode being used
Incorrect temperature reading or setting	Ensure that the temperature is accurate
Incorrect cable length or wire gauge setting	Set to the correct values
Faulty electrode	Replace electrode

#### 7.1.2 Electrodeless Conductivity Sensors

The calibration will fail if the adjustment to the gain is outside of 0.2 to 10, or the offset is outside of -10,000 to 10,000.

Possible Cause	Corrective Action
Dirty sensor	Clean sensor
Improper wiring of sensor to controller	Correct wiring
Sensor placed too close to container walls	Relocate sensor
Sensor placed in the direct path of electrical current flow	Relocate sensor
Incorrect temperature reading or setting	Ensure that the temperature is accurate
Incorrect cable length or wire gauge setting	Set to the correct values
Faulty sensor	Replace sensor

## 7.2 Alarm Messages

Alarm messages will include the Name of the input or output as defined in the Settings menu, the hardware identifying type and number (S for sensor input, D for digital input, R for relay output, A for analog output), and the type of alarm.

### **HIGH or HIGH-HIGH ALARM**

**Occurs if the conductivity rises above the high conductivity alarm set points. If your unit is programmed for an alarm relay output, the alarm relay will activate. The controller will continue to check the conductivity, and any outputs using the conductivity sensor will remain active.**

Possible Cause	Corrective Action
Dirty sensor	Clean sensor (see Section 6.1)
Faulty bleed solenoid valve	Repair or replace solenoid valve
Faulty sensor	Replace sensor
Improper wiring of valve or controller	Correct wiring
Conductivity rose over alarm limit while biocide lockout occurred	Allow normal bleed to occur
Clogged Y-strainer in bleed line	Clean Y-strainer
Infrequent intermittent sampling	Sample more often
Faulty bleed relay	Replace power relay board

### **LOW or LOW-LOW ALARM**

**Occurs if the conductivity drops below the low conductivity alarm set points. If your unit is programmed for an alarm relay output, the alarm relay will activate. The controller will continue to check the conductivity, and any outputs using the conductivity sensor will remain active.**

Possible Cause	Corrective Action
Sensor disconnected	Reconnect. Check cable for continuity.
Sensor dry	Check tee for obstruction. Verify flow. Change location of electrode.
Pre-bleed set too low	Check pre-bleed setting
Solenoid valve stuck open	Repair or replace solenoid valve
Faulty electrode	Replace sensor
Improper wiring of electrode	Correct wiring
Faulty bleed relay	Replace relay
In boilers, flashing to steam	Make sure plumbing is done according to the recommended installation diagram
Too frequent intermittent sampling	Sample less often

### **DI STATE CUSTOM MESSAGE**

**A digital input that is a DI State type can be set such that either the open or closed state generates an alarm. The alarm message may be customized. The most common use for this will be a Flow Switch.**

Possible Cause	Corrective Action
No flow	Check piping for closed valves, blockage, etc. Check recirculation pump.
Faulty flow switch/cable	Check with ohmmeter.
Faulty controller	Check by shorting digital input in controller.

### **TOTAL ALARM**

**Occurs if the flowmeter totalizer alarm limit is exceeded.**

Possible Cause	Corrective Action
Normal operation	Reset the total to clear alarm
AC coupled onto flowmeter cable	Route cable at least 6 inches (150 mm) away from any AC voltage
Noise coupled onto flowmeter cable	Shield cable

**OUTPUT TIMEOUT**

This error condition will stop control. It is caused by the output (either relay or analog) being activated for longer than the programmed Time Limit.

Possible Cause	Corrective Action
Programmed value too low for normal conditions	Increase Time Limit.
Bleed flow rate too low	Check for clogged strainer. Check for insufficient pressure differential.
Bleed valve not opening	Check for faulty bleed valve. Check bleed valve wiring. Check controller relay.
Sensor not responding	Clean sensor, check wiring, replace sensor

**RANGE ALARM**

It indicates that the conductivity signal from the sensor is out of the normal range of 0-30,000. This error condition will stop conductivity control. This prevents controlling based upon a false conductivity reading. If the temperature sensor goes into range alarm (outside -5 to 90 C for tower, -5 to 220 C for boiler), then the controller will go into manual temperature compensation using the Default Temperature setting.

Possible Cause	Corrective Action
Sensor wires shorted	Disconnect short
Faulty sensor	Replace sensor
Faulty controller	Replace or repair controller

**SENSOR FAULT**

This error indicates that the signal from the sensor is no longer valid at all. This error condition will stop conductivity control.

Possible Cause	Correction Action
Sensor wires shorted	Disconnect short
Faulty sensor	Replace sensor
Faulty controller	Replace or repair controller

**INPUT FAILURE**

This alarm indicates that the sensor input circuit is no longer working. This error condition will stop conductivity control.

Possible Cause	Correction Action
Faulty controller	Replace or repair controller

**BATTERY POWER LOW**

This alarm indicates that the battery which holds the date and time in memory is below 2.4 VDC.

Possible Cause	Correction Action
Faulty battery	Replace battery

<b>SYSTEM TEMP LOW</b>	
This alarm indicates that the temperature inside the controller is below -10 °C.	
<b>Possible Cause</b>	<b>Correction Action</b>
Low ambient temperatures	Provide heat for the controller
<b>SYSTEM TEMP HIGH</b>	
This alarm indicates that the temperature inside the controller is above 75 °C.	
<b>Possible Cause</b>	<b>Correction Action</b>
High ambient temperatures	Provide cooling for the controller
<b>DISPLAY ERROR</b>	
This alarm occurs if the user interface gets lost	
<b>Possible Cause</b>	<b>Correction Action</b>
Pressing keys very quickly	Exit out of the screen and continue programming
<b>CONTROLLER, POWER, DISPLAY, OR SENSOR BOARD ERROR</b>	
This alarm occurs if the board listed is not recognized	
<b>Possible Cause</b>	<b>Correction Action</b>
Poor ribbon cable connection	Remove and reseat ribbon cable, cycle power
Faulty board	Return the controller for repair
<b>CONTROLLER, POWER, SENSOR, DISPLAY, NETWORK OR ANALOG OUTPUT BOARD VARIANT</b>	
This alarm occurs if the type of board that is detected is not a valid type	
<b>Possible Cause</b>	<b>Correction Action</b>
Poor ribbon cable connection	Reseat ribbon cable
Faulty ribbon cable	Replace ribbon cable
Faulty Board	Replace the board listed in the error message
<b>INVALID CONTROL MODE</b>	
This alarm occurs if the programmed control mode is not possible for the installed power relay board	
<b>Possible Cause</b>	<b>Correction Action</b>
The power relay board has been removed and replaced with an incorrect model	Reinstall the correct board or reprogram the output to a valid type for the board installed
<b>SENSOR, DIGITAL INPUT, RELAY OR ANALOG OUTPUT DISABLED</b>	
This alarm occurs if software for that input or output did not start correctly	
<b>Possible Cause</b>	<b>Correction Action</b>
The software is not functioning	If the error message clears on its own, no action is required.
	If the error message persists, cycle power.
	If the error message still persists, return the controller for repair.
<b>RELAY OR ANALOG OUTPUT CONTROL FAILURE</b>	
This alarm occurs if software for that output did not run correctly	
<b>Possible Cause</b>	<b>Correction Action</b>
The software is not functioning	If the error message clears on its own, no action is required.
	If the error message persists, cycle power.
	If the error message still persists, return the controller for repair.
<b>FRAM FILE SYSTEM ERROR</b>	
This alarm occurs if the FRAM is not detected at power up	
<b>Possible Cause</b>	<b>Correction Action</b>
The FRAM was or is not functioning	If the error message clears on its own, no action is required.
	If the error message persists, cycle power.
	If the error message still persists, replace the controller board.

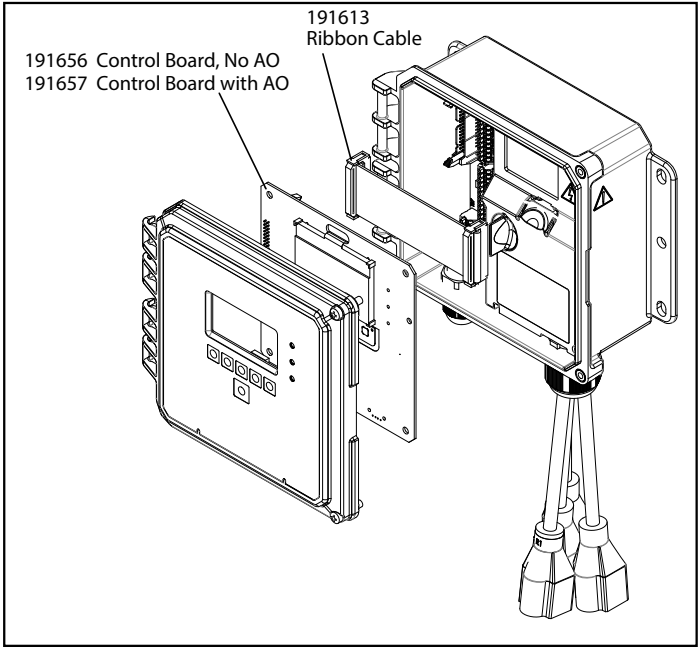
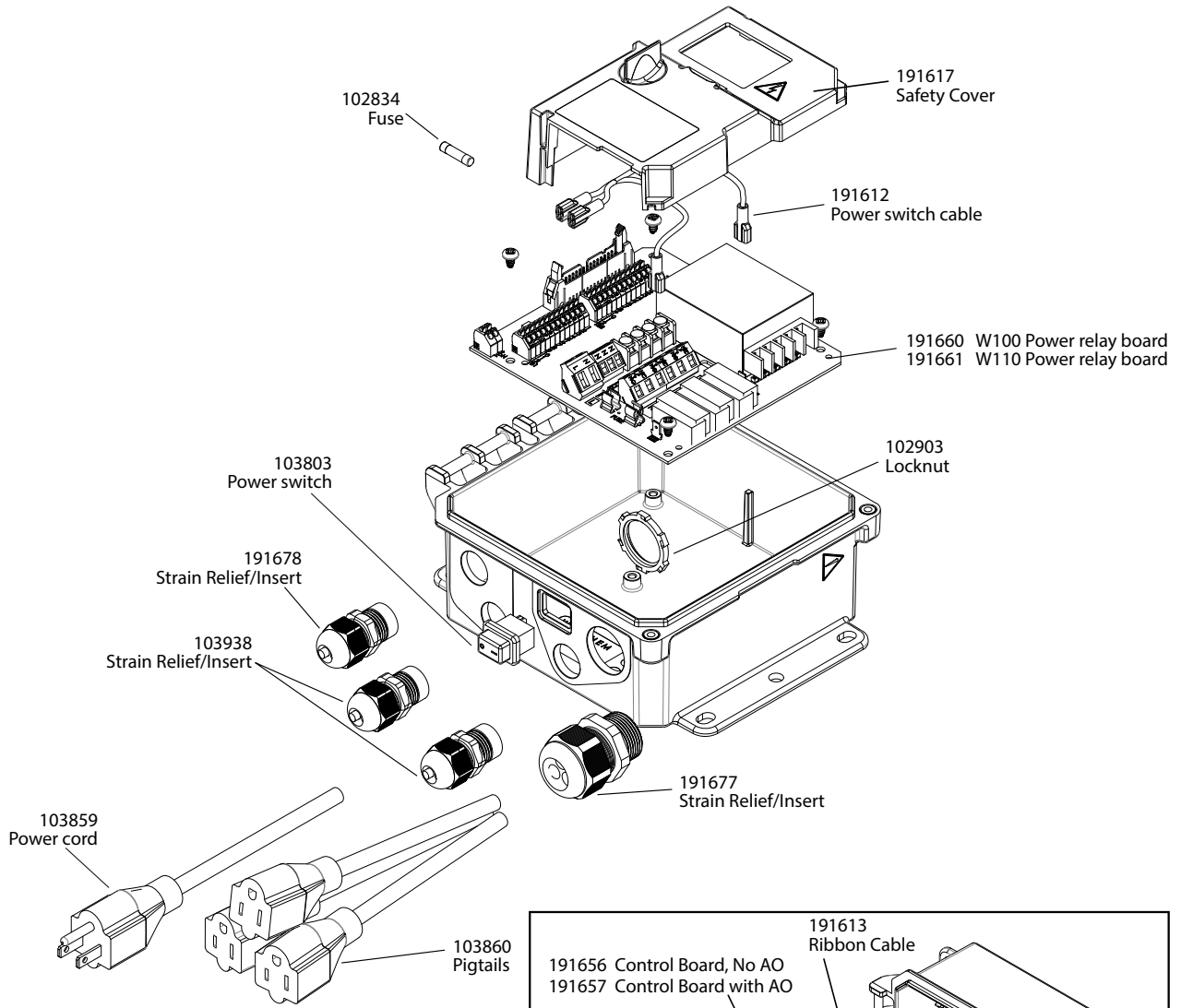
## 8.0 SERVICE POLICY

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Walchem controllers have a 2-year warranty on electronic components and a 1-year warranty on mechanical parts and electrodes. See Statement of Limited Warranty in front of manual for details.

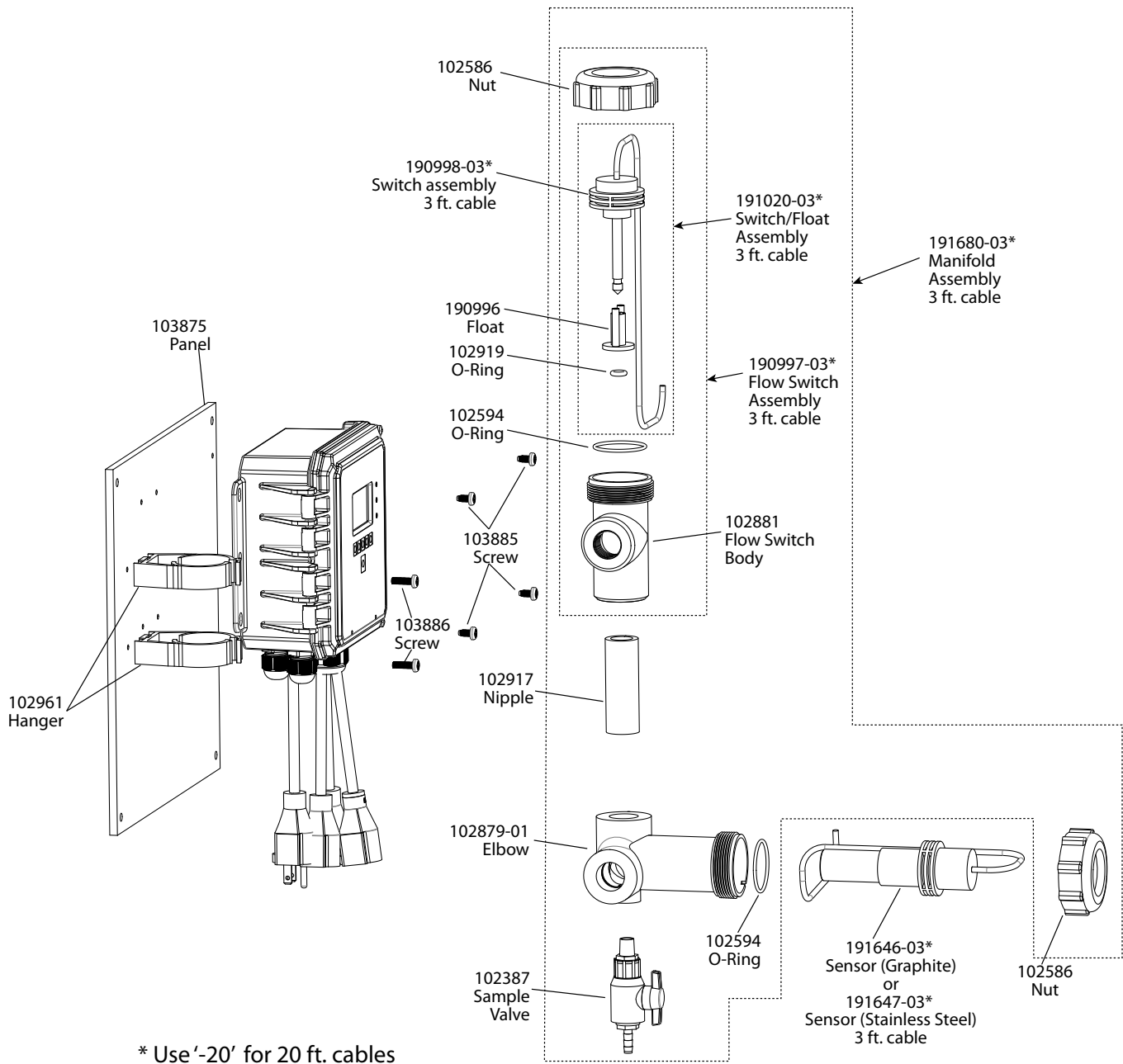
Walchem controllers are supported by a worldwide network of authorized master distributors. Contact your authorized Walchem distributor for troubleshooting support, replacement parts, and service. If a controller is not functioning properly, circuit boards may be available for exchange after the problem has been isolated. Authorized distributors will provide a Return Material Authorization (RMA) number for any products being returned to the factory for repair. Repairs are generally completed in less than one week. Repairs that are returned to the factory by next-day-air freight will receive priority service. Out-of-warranty repairs are charged on a time and material basis.

# 9.0 SPARE PARTS IDENTIFICATION

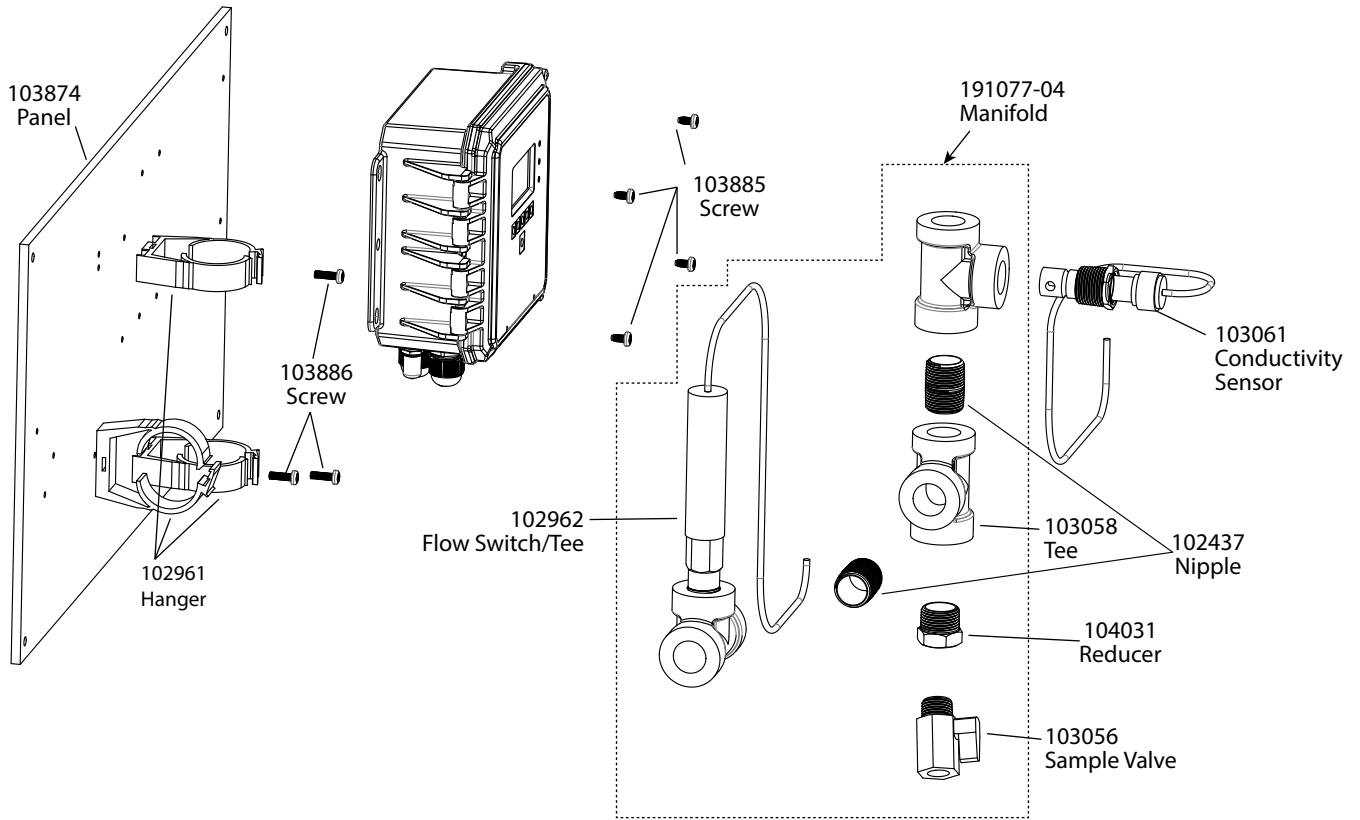


## Controller Parts

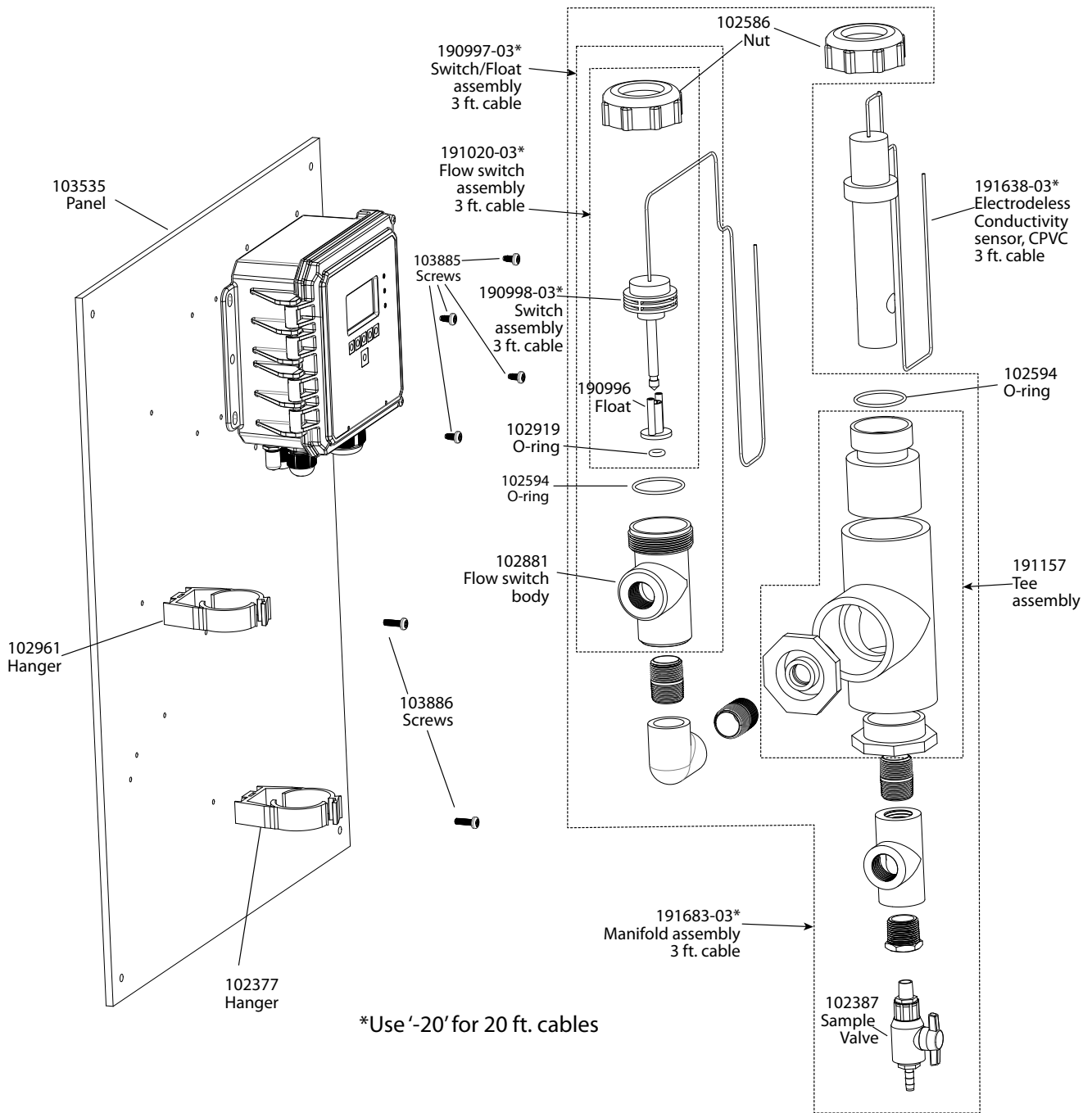
191608 No BNC Spare Parts (CT-BL)



**WCTW Sensor Option B or F**



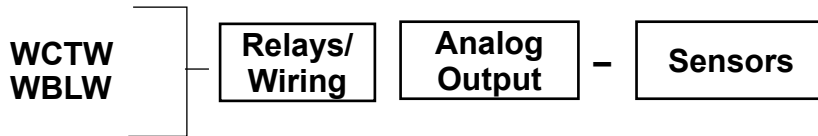
**WCTW Sensor Option D**



W100-CT-H Spare Parts  
WCNW Sensor Option E

### WCTW Sensor Option H

## Model Code



### Relays/Wiring

- 100H= 3 powered relays, hardwired
- 100P = 3 powered relays, prewired USA power cord & pigtails
- 100D= 3 powered relays, prewired DIN power cord, no pigtails
- 110H= 3 dry relays, hardwired
- 110P = 3 dry relays, prewired USA power cord, no pigtails
- 110D= 3 dry relays, prewired DIN power cord, no pigtails

### Analog Output

- N = No analog output
- A = One isolated analog (4-20 ma) output

### Sensors (WCTW)

- N = No sensor
- A = Inline/submersion graphite contacting conductivity
- B = Graphite contacting conductivity + Flow Switch manifold on panel
- C = High pressure contacting conductivity
- D = High pressure contacting cond + Flow Switch manifold on panel
- E = Inline/submersion 316SS contacting conductivity
- F = 316SS contacting conductivity + Flow Switch manifold on panel
- G = Inline/submersion electrodeless conductivity
- H = Electrodeless conductivity + Flow Switch manifold on panel

### Sensors (WBLW)

- N = No sensor
- A = Boiler sensor with ATC, 250 psi, 20 ft cable
- B = Boiler sensor without ATC, 250 psi, 20 ft cable
- C = Condensate sensor with ATC (cell constant 0.1), 200 psi, 10 ft cable
- D = Boiler sensor with ATC, up to 100 mS/cm (cell constant 10), 250 psi, 20 ft cable