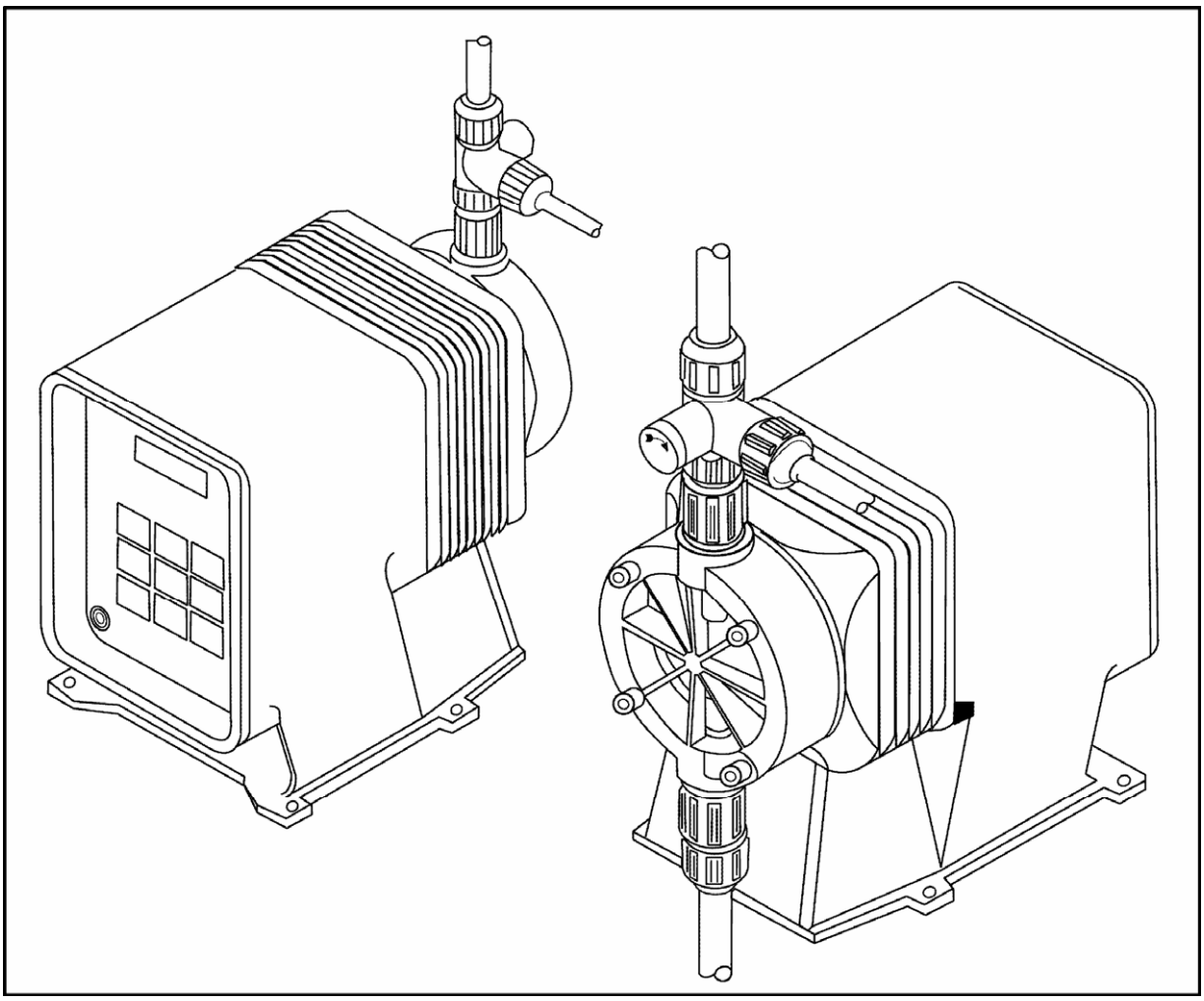
Series CL/CW

ELECTRONIC METERING PUMPS

Installation
Operation
Maintenance
Instruction



READ ALL WARNINGS CAREFULLY
BEFORE INSTALLING

SAFETY INSTRUCTIONS

WHEN USING CHEMICAL FEED PUMPS, BASIC SAFETY PRECAUTIONS SHOULD ALWAYS BE FOLLOWED TO REDUCE RISK OF FIRE, ELECTRIC SHOCK, AND PERSONAL INJURY. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN DEATH OR SERIOUS INJURY.

GENERAL SAFETY CONSIDERATIONS

- Always wear protective clothing including gloves and safety glasses when working on or near chemical metering pumps.
- Inspect tubing regularly for cracking or deterioration and replace as necessary. **(Always wear protective clothing and safety glasses when inspecting tubing.)**
- When the pump is exposed to direct sunlight use UV resistant tubing.
- Follow directions and warnings provided with the chemicals from the chemical manufacturer. The customer is responsible for determining chemical compatibility with the chemical metering pump.
- Secure chemicals and metering pumps making them inaccessible to children and pets.
- Make sure voltage on chemical metering pump tag matches the voltage at the installation.
- Do not cut plug off electrical cord or the ground lug – consult a licensed electrician for proper installation.
- Pump is **NOT** to be used to handle **flammable liquids**.
- During the approval process, water was used for testing purposes. The use of this product with certain chemicals may present hazardous conditions that are beyond the scope of this approval. Contact your chemical provider / safety agency for further information.

SAFETY OPERATING PROCEDURES

- All pumps are tested with water before shipment. Remove head and dry thoroughly if you are pumping chemicals that will react with water (e.g., sulfuric acid). Valve seats, ball checks, gaskets and diaphragms should also be dried.
- Finger tighten connections on the pump head. DO NOT USE A WRENCH. Plumbers tape is only necessary when the pump is equipped with NPT connections.
- Before repairing or moving the pump, disconnect the power cord or turn off power to the pump. De-pressurize the system and drain chemical(s). **Always wear protective clothing and safety glasses when working on a metering pump.**
- Always consult a licensed plumber and electrician before installation and make sure to conform to local codes.
- Consult with local health officials and a qualified water conditioning specialist when treating potable water.
- Be sure to depressurize the system prior to hooking up or disconnecting a metering pump.
- If the point of injection is lower than the chemical tank and pump, install an anti–siphon valve.
- **DO NOT MODIFY** the pump. This poses a potentially dangerous situation and will void the warranty.

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Conventions:

The following conventions are used in this document.

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

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

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

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

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

- Text that has been formatted ***bold*** and ***italicized*** (e.g., ***Figure 2-C***) indicates reference text.
- Text that has been formatted in UPPER CASE letters, and surrounded by brackets [ ] indicates a button to be pressed (e.g., [TIMER]).
- Text that has been formatted in **Title Case** letters, using the **Arial - Bold** Font indicates a mode selection (e.g., **Forced On**).

1. INTRODUCTION

These installation, operation and maintenance instructions cover your electronic metering pump. Refer to the pump nameplate to determine the actual model.

1.1 Principle of Operation

This solenoid activated diaphragm metering pump includes a built-in conductivity control. It is designed to control conductivity and inhibitor in an open air cooling tower. It measures the conductivity of the re-circulating water and activates a relay output (typically attached to a solenoid activated blow down valve) when it exceeds a set point value.

The pump can be programmed with one of four timer types:

- Limit – The pump operates with the bleed up to a programmable limit time.
- Pulse – The pump receives pulses from an external source (either dry contact or open collector) and operates for a programmable time period.
- Percent – The pump operates for a percentage of a programmable time period.
- Percent Post – The pump operates for a percentage of the bleed time up to a limit time value.

The actual pumping is accomplished by pulsing an electromagnetic drive mechanism (solenoid) attached to a diaphragm. When the solenoid is pulsed by the circuit, it displaces the diaphragm. This pushes fluid out the discharge check valve. When the solenoid is de-energized, it retracts pulling fluid in the suction check valve.

1.2 Materials of Construction

The wetted materials (those parts that contact the solution being pumped) available for construction are polypropylene, PVC, SAN, Hypalon, Viton, PTFE, 316 Stainless Steel, PVDF, Ceramic, and Alloy C. These materials are very resistant to most chemicals. There are some chemicals, such as strong acids or organic solvents, which cause deterioration of some elastomer and plastic parts, such as diaphragm, valve seat, or head. Consult a Chemical Resistance Guide or Supplier for information on chemical compatibility.

Various manufacturers of plastics, elastomers and pumping equipment publish guidelines that aid in the selection of wetted materials for pumping commercially available chemicals. Two factors must always be considered when using an elastomer or plastic part to pump chemicals. They are:

1. The temperature of service: Higher temperatures increase the effect of chemicals on wetted materials. The increase varies with the material and the chemical being used. A material quite stable at room temperature might be affected at higher temperatures.
2. Material choice: Materials with similar properties may differ greatly from one another in performance when exposed to certain chemicals.

1.3 Manufacturer's Product Warranty

The manufacturer warrants its equipment to be free of defects in material or workmanship. Liability under this policy extends for eighteen (18) months from the date of purchase or one (1) year from the date of installation, whichever comes first. The electronic components will be covered under this policy for a period which extends for twenty four (24) months from the date of purchase. The manufacturer's liability is limited to repair or replacement of any device or part which is returned, prepaid, to the factory and which is proven defective upon examination. This warranty does not include installation or repair cost and in no event shall the manufacturer's liability exceed its selling price of such part.

The manufacturer disclaims all liability for damage to its products through improper installation, maintenance, use or attempts to operate such products beyond their functional capacity, intentionally or

otherwise, or any unauthorized repair. Replaceable elastomeric parts are expendable and are not covered by any warranty either expressed or implied. The manufacturer is not responsible for consequential or other damages, injuries, or expense incurred through the use of its products.

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

The European Union Warranty address is listed below, however, please note that the seller should be contacted first.

Pulsafeeder Europe
Marssteden 68
7547 AD. Enschede

1.4 European Technical File Location

P.O. Box 91
Washington
NE37 1YH
United Kingdom

1.5 Unpacking the Pump

Check all equipment for completeness against the order and for any evidence of shipping damage. Shortages and damages should be reported immediately to the carrier and to the manufacturer.

The carton should contain the following:

1. Metering Pump
2. Stiff White Discharge Tubing
3. Clear Flexible Suction Tubing
4. Instruction Manual
5. Injector Valve Assembly
6. Foot Valve/Strainer Assembly
7. Stabilizer Weight (part of Foot Valve/ Strainer assembly)
8. Conductivity Sensor (with Tee if no flow assembly)
9. Bleed Valve Assembly

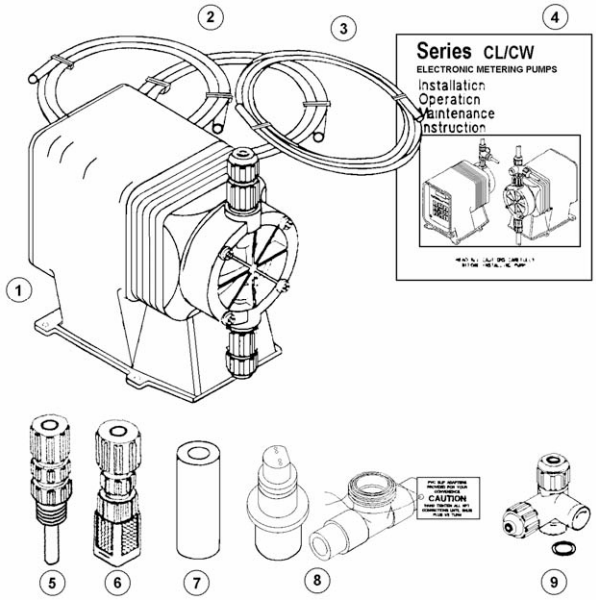
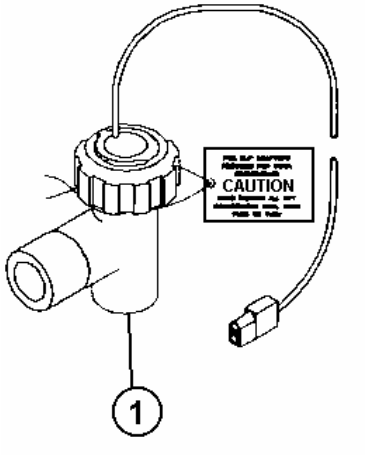


Figure 1

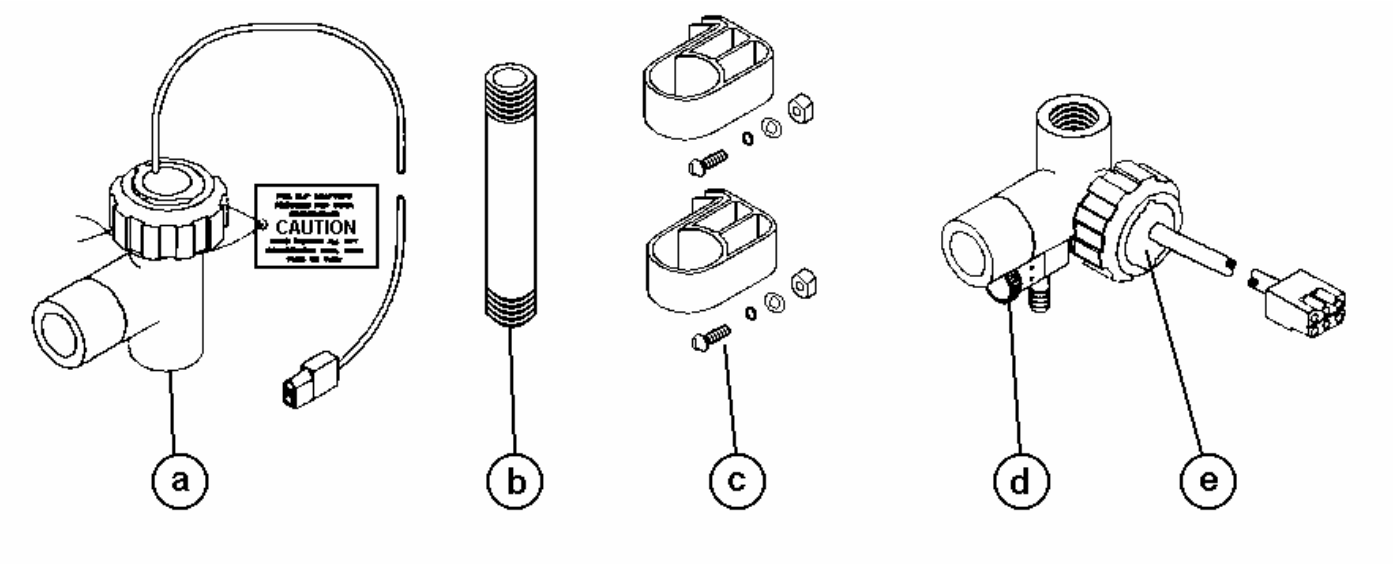
Before you get started it is recommended that you condition your conductivity sensor to the system water by soaking the sensor for at least two hours. If you do not condition your sensor, expect to recalibrate your system within 24 hours.

The carton may also include the following optional assemblies:

1. Flow switch



2. Flow Assembly



a) Flow switch
b) Polypropylene Nipple
c) Mounting brackets and hardware
d) Sample valve (Sample Port)
e) Conductivity sensor

Make sure that all items have been removed from the shipping carton before it is discarded.

1.6 Precautions for Operation

Each Electronic Metering Pump has been tested to meet prescribed specifications and safety standards. Proper care in handling, installation and operation will help in ensuring a trouble free installation.

Read these cautionary notes prior to the installation and start-up to achieve the best performance from your metering pump.

1. **Important: The Pump must be installed and used with the supplied back pressure/ injection valve. Failure to do so could result in excessive pump output flow**.
2. Handle the pump with care. Dropping or heavy impact may cause not only external damage to the pump, but also to electrical parts inside the pump enclosure.
3. Install the pump in a place where the ambient temperature does not exceed 40°C (104°F) and the relative humidity is below 90%. The pump is water resistant and dust proof by construction and can be used outdoors. **Do not operate the pump submerged**. To avoid high internal pump temperatures, do not operate in direct sunlight.
4. Install the pump in a place convenient for its future maintenance and inspection. Mount the pump in such a manner to prevent vibration.
5. Protective caps must be removed prior to installing tubing onto valve assemblies. Use the correct tubing sizes. Connect the tubing to the suction side securely to prevent the entrance of outside air. Verify that there is no liquid leakage on the discharge side.
6. Be careful to check the voltage of the installation matches the voltage indicated on the pump nameplate. Each pump is equipped with a three-prong plug. Always be sure that the pump is grounded. To disconnect, do not pull the wire, but grip the plug and pull out. Do not use the receptacle in common with heavy electrical equipment that generates surge voltage. A line surge could cause the failure of the electronic circuit inside the pump.
7. Tampering with electrical devices can be potentially hazardous. Always place chemicals and install the pump well out of the reach of children.
8. Never repair or move the metering pump while it is operating. Always disconnect electrical power. **For safety, always wear protective clothing (protective gloves and safety glasses) when working on or near chemical metering pumps.**
9. An air bleed valve is available for all models with a tubing connection. Air purges should be performed when the pump chamber contains no fluid at the time of start-up. As a safety measure, connect the return tubing to the air bleed valve and bypass fluid back to a storage tank or a suitable drain.
10. Chemicals used may be dangerous and should be used carefully and according to warnings on the label. Follow the directions given with each type of chemical. Do not assume chemicals are the same because they look alike. Always store chemicals in a safe location away from children. We cannot be responsible for the misuse of chemicals being fed by the pump. Always have the material safety data sheet (MSDS) available for any fluid being pumped.
11. All pumps are pre-tested with water before shipment. Remove the head and dry thoroughly if you are pumping material that will react with water (e.g., sulfuric acid). Valve seats, ball checks, gaskets, and the diaphragm should also be dried. **Verify that this procedure has been completed prior to placing the pump into service.**
12. Valve cartridges are stamped to indicate fluid flow direction. Always install so that markings read from top to bottom, with the arrow pointing in the direction of flow.
13. When metering hazardous material **DO NOT** use plastic tubing. Use only proper rigid pipe. Consult your supplier for special adapters or valve assemblies.
14. **The pump is NOT to be used to handle or meter flammable liquids or materials**.
15. Standard (white translucent) discharge tubing is not recommended for installations exposed to direct sunlight. Consult your supplier for UV resistant (black) tubing.

16. The factory will not be held responsible for improper installation of the pump, or plumbing. All cautions are to be read thoroughly prior to hook-up and plumbing. For all installations a professional plumber should be consulted. Always adhere to local plumbing codes and requirements.
17. When using the pump with pressurized systems, make sure the pressure of the system does not exceed the maximum pressure rating on the pump nameplate. Be sure to de-pressurize the system prior to hookup or disconnecting the pump.
18. Electronic power modules (i.e. solenoids) are equipped with automatic reset thermal-overload devices and may reset unexpectedly.
19. The pump is designed to operate using a back pressure/injection valve. If the discharge point is below the liquid level of the source or if the discharge pressure is less than the suction pressure, siphoning may occur. To correct this condition, install an anti-siphon valve or other anti-siphon device. Check local regulations for any that may apply.

1.7 Installation, Piping and Wiring

The metering pump should be located in an area that allows convenient connections to both the chemical storage tank and the point of injection. The pump is water resistant and dust proof and can be used outdoors in a protected area. Do not operate this pump submerged. Avoid continuous temperatures in excess of 40°C (104°F), direct sunlight and rain. To do otherwise will result in damage to the pump.

1.7.1 Mounting

Typical mounting arrangements are shown in *Figures 2-A, 2-B, & 2-C.*

NOTE **Important: The injection point must be higher than the top of the solution supply tank to prohibit gravity feeding, unless suitable back pressure is always present at the injection point. An anti-siphon valve may be installed to prevent gravity feeding.**

1. For wall or shelf mounting refer to *Figure 2-A.* Connect suction tubing to the suction valve of the chemical pump. (The suction valve is the lower valve.) The tubing should be long enough that the foot valve/ strainer assembly hangs about 2-3 inches (5-8cm) above the bottom of the chemical (solution) tank. To keep the chemical from being contaminated, the tank should have a cover.
2. Flooded suction mounting (installing the pump at the base of the solution storage tank, *Figure 2-B*) is the most trouble free type of installation and is recommended for very low output requirements. Since the suction tubing is filled with chemical, priming is accomplished quickly and the chance of loosing the prime is reduced.

   To mount the pump, drill four 1/4" (6.3mm) diameter holes in the shelf as shown in the dimension drawing (*Figure 3*). Attach the pump securely using four #10 (4mm) bolts, nuts and lock washers.

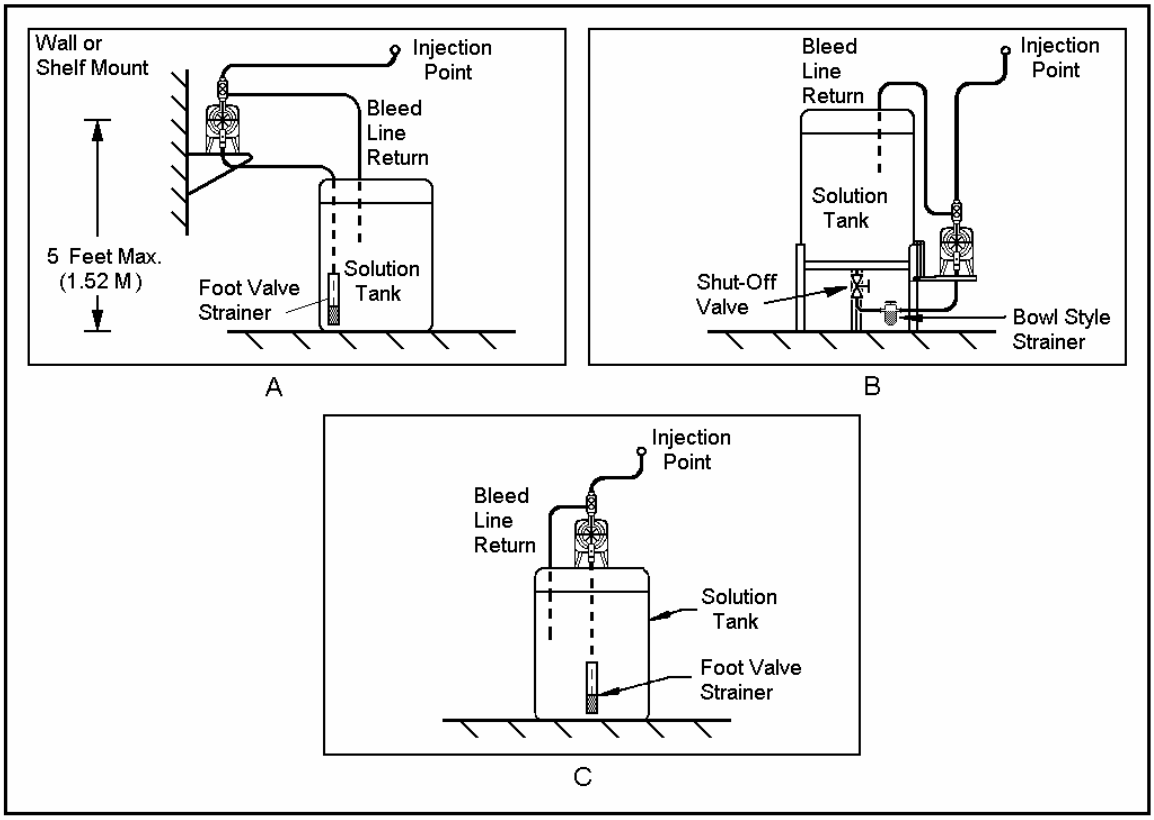


Figure 2

3. The pump can be mounted to a wall as shown in *Figure 2-A*. A wall mount bracket kit is available which includes all necessary hardware to mount the pump to the bracket and the bracket to the wall. Mounting dimensions for the pump are provided in *Figure 3*.
4. The pump can be mounted on top of a solution tank as shown in *Figure 2-C*. Install the chemical pump on the cover. Insert suction tubing through the center hole and cut the tubing so that the foot valve/strainer hangs about 2-3 inches (5-6cm) above the bottom of the tank. To mount the pump, drill four 1/4" (6.3mm) diameter holes as shown in the dimension drawing (*Figure 3*). Attach the pump securely using four #10 (4mm) bolts, nuts and lock washers.

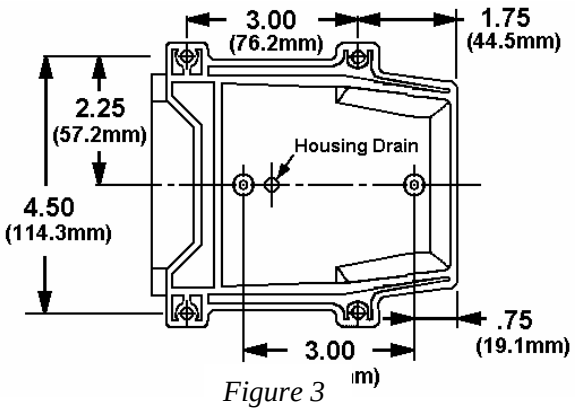


Figure 3

5. Use an anti-siphon valve in the discharge line whenever the fluid pressure in the discharge line is below atmospheric pressure. This can occur if the injection point is on the suction side of a water pump or against a "negative" head.

1.7.2 Piping

1. Use provided tubing of specified size for connection. Connect tubing securely to prevent chemical leakage or the entrance of outside air. Plastic nuts are used for fittings and should only be hand tightened. NPT suction and discharge valves must **NOT** be over tightened. Hold fittings in place while adding piping and fittings. NPT suction and discharge valves should only be tightened 25 to 35 in. lbs. (3.80 to 3.96 Nm).
2. If the air bleed valve assembly is being used, a return line (tubing) should be securely connected and routed back to the storage tank. **To avoid possible injury from chemicals do not attempt to prime using a bleed valve without installing a return line.**
3. When the pump is shelf mounted, or top mounted on a tank, suction tubing should be kept as short as possible.
4. To maintain metering performance, a back pressure/injection valve is provided. The injection valve must be installed in the discharge line. It is recommended that the back pressure/injection valve be installed at the point of chemical injection.
5. If the discharge tubing is going to be exposed to direct sunlight, black tubing should be used instead of the standard (white translucent) tubing supplied with each pump. To obtain UV resistant (black) tubing contact your supplier.

6. To prevent clogging or check valve malfunction, always install a strainer assembly to the end of the suction tubing. (*Figure 2-C*). This foot valve/strainer assembly should always be installed 2 to 3 inches (5-8cm) above the bottom of the chemical tank. This will help prevent clogging the strainer with any solids that may settle on the tank bottom. The chemical tank and foot valve/strainer should be cleaned regularly, to ensure continuous trouble operation. If the chemical being pumped regularly precipitates out of solution or does not dissolve easily or completely (e.g. calcium hydroxide), a mixer should be used in the chemical tank. These are available in many motor configurations and mountings. To obtain a mixer, contact your supplier.
7. A flooded suction (tank liquid level always at a higher elevation than the pump) is recommended when pumping sodium hypochlorite (NaOCl) and hydrogen peroxide (H_2O_2) etc. which are liable to produce air bubbles. Maintaining a low liquid temperature will also help eliminate this problem.
8. Pipe corrosion can result if dilution at the injection point does not occur rapidly. This problem is easily prevented by installing an injection fitting so that the end is in the center of the flow stream of the line being treated. Trim the injector tip as required. Refer to *Figure 4*.

NOTE **Extended injection assemblies are available for large water lines. Consult your supplier for more information.**

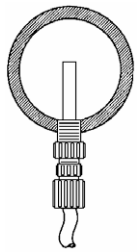


Figure 4

1.7.3 Wiring

1. The metering pump should be wired to an electrical source that conforms to those on the pump nameplate. (Applying higher voltage than the pump is rated for will damage the internal circuit.)

WARNING **RISK OF ELECTRICAL SHOCK. THIS PUMP IS SUPPLIED WITH A THREE PRONG GROUNDING TYPE POWER PLUG. TO REDUCE RISK OF ELECTRICAL SHOCK, CONNECT ONLY TO A PROPERLY GROUNDED, GROUNDING TYPE RECEPTACLE.**

2. In the electronic circuit of the control unit, protection from surge voltage is made by means of surge absorbing elements and high voltage semiconductors. Nevertheless, excessive surge voltage may cause failure in some areas. Therefore the pump should never share a branch circuit that supports heavy electrical equipment (e.g. large motors). The use of a surge suppression device in line with the pump is strongly recommended! The device should meet or exceed the following minimum requirements:

Response:	<1nS
Energy Dissipation:	400 Joules
Protection:	L-N, L-G, N-G

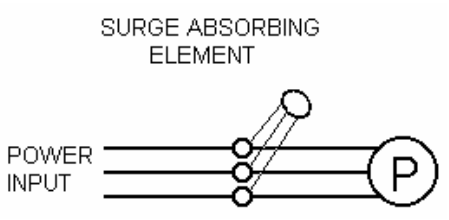


Figure 5

1.8 Cooling Tower Installation

Install the pump and sensors in the Cooling Tower system as depicted in *Figure 6* below.

Refer to ***Section 1.7.1*** for pump installation details. Make sure that all fittings and connections are secure. Plumbing of the conductivity electrode, flow switch and water meter is critical to the successful operation of the pump. Installation should comply with all national state and local codes.

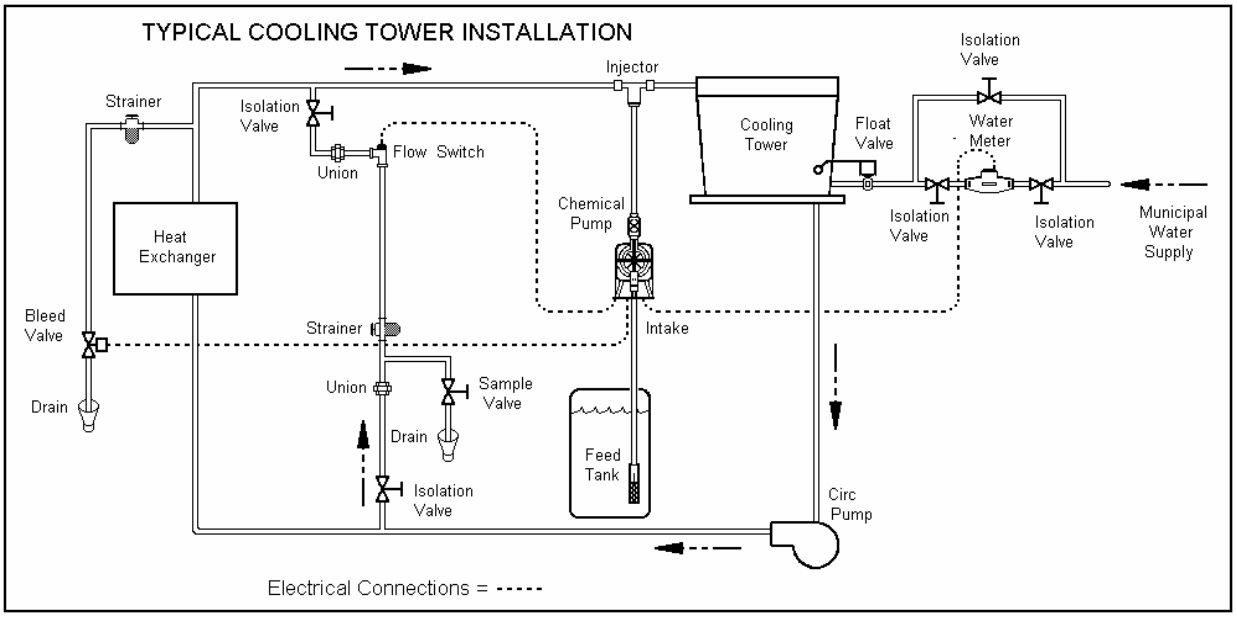


Figure 6

Refer to *Figure 6* above to install the pump and sensors in your cooling tower system. Make sure all fittings and connections are secure. Plumbing of the conductivity electrode, and flow switch is critical to the successful operation of the pump.

1.8.1 Flow Assembly

A sample line with between 1 to 5GPM (4 to 19LPM) of flow is required for installation of the Flow Switch and Conductivity Sensor. It is a good idea to install isolation valves and unions around these items to allow easy service. An up-stream strainer should be installed to block debris that could foul the sensor. If the pump is to inject directly into this line (not recommended), always use a back check valve to prevent chemical backup around the sensors.

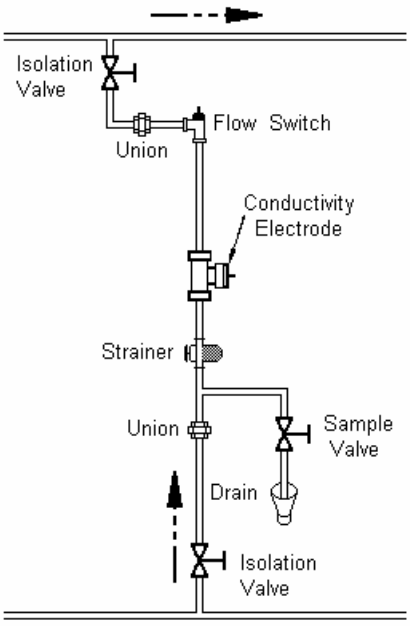
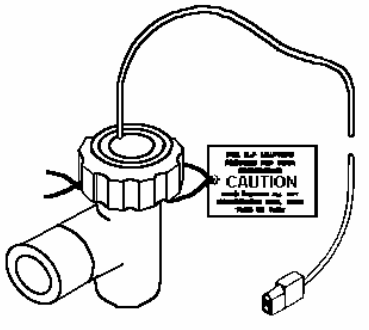


Figure 7

1.8.1.1 Flow Switch (Optional)

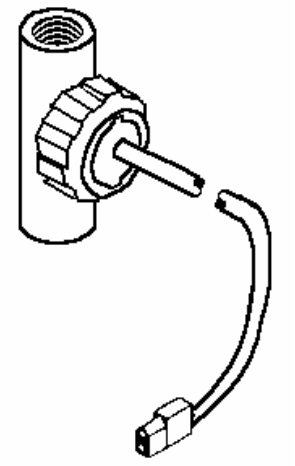


The Flow Switch accessory consists of a clear body, a red flow shuttle and a sensing cap. Flow causes the shuttle to rise activating a switch in the sensing cap.

Install the Flow Switch in the sample stream piping so that the cap is at the top and the flow shuttle is vertical. Flow should enter the bottom and exit the top to the right or left. There must be at least 1 GPM (3.81 LPM) of flow across the switch for it to activate properly. It is also advisable to check the line to assure that siphoning will not occur (holding the flow switch).

The Flow Switch to pump cable length should not exceed 60ft (18m).

1.8.1.2 Conductivity Sensor



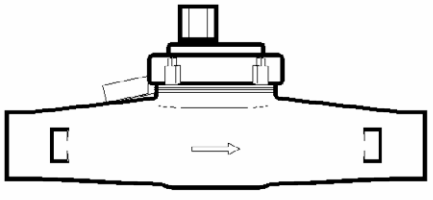
Install the Conductivity Sensor in the sample line using the supplied tee or elbow. Install upstream of any chemical injection points (use a check valve to prevent back flow). The tee or elbow should be installed with the sensor surfaces below the water level. The Tee should be installed in a vertical run of pipe, or if installed in a horizontal run, the tee with the sensor in it should point either horizontally or straight down.

The elbow should be installed so flow enters horizontally at the left leg of the elbow and exits vertically to the flow switch.

NOTE **If installed incorrectly, the sensor will trap air around its sensing surfaces. Make sure the sensor body is below the water level in the line. Carbon graphite sensors should have their slot oriented in the direction of flow.**

The Sensor to pump cable length should not exceed 35ft (16.5m).

1.8.1.3 Water Meter (Series CW only - Accessory)



Install the Water Meter in the makeup line in accordance with the manufacture's instructions. To operate properly with the pump the water meter must generate a dry contact switch closure or open collector switch (sinking) proportion to the flow (e.g., 1 pulse per 100 gallons). If the water meter generates more than one pulse per gallon it's "K" factor should be set. Refer to the ***Operation*** section for details on configuring the "K" factor. Refer to the ***Wiring and Connections*** section for Water Meter wiring details.

The Water Meter to pump cable length should not exceed 60ft (18m).

2. Controls

This pump uses a microprocessor to control its operation. All adjustments and changes to pump operation are made through the 9-key touch-pad (refer to *Figure 8*). The pump displays operating information through numeric and status LED's.

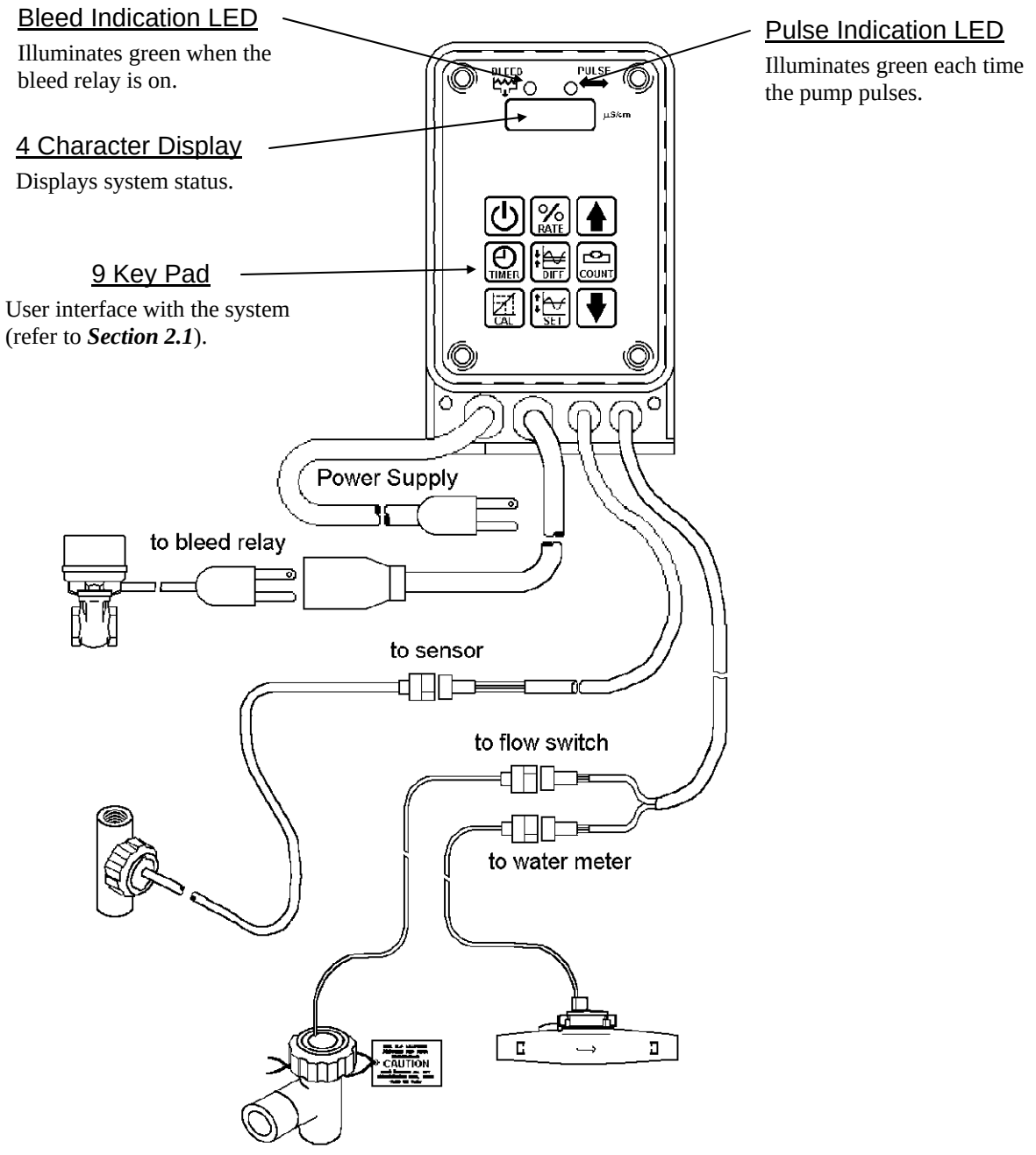


Figure 8

2.1 Key Pad Definitions

ON/Standby Activates/Deactivates Automatic Control (Control Mode) – display reflects current reading.
Forces pump on.
Forces pump off.

UP/DOWN Used in conjunction with a function key to increase [UP] or decrease [DOWN] the displayed value by a fixed amount.

SET Sets the conductivity setpoint in µS/cm.
Range = 0 – 6000 µS/cm
10µS/cm per single [UP] / [DOWN] key press.
100µS/cm auto increment when key is held.

DIFF Sets the differential value used to determine the Bleed relay shut-off point.
Range = 0 – 6000 µS/cm
10µS/cm per single [UP] / [DOWN] key press.
100µS/cm auto increment when key is held.

CAL Sets the reading of the installed conductivity sensor to a known value.
Range = 0 – 6000 µS/cm
10µS/cm per single [UP] / [DOWN] key press.
100µS/cm auto increment when key is held.

RATE Sets the pump stroke rate (in percent).
Range = 0 – 100%
1% per single [UP] / [DOWN] key press.
10% auto increment when key is held.

TIMER Dependant on timer setup:

Limit Timer
Sets the pump limit time in HH:MM format.
Range = 00:00 to 23:59
0:01 per single [UP] / [DOWN] key press.
1:00 auto increment when key is held.

Water Meter Timer (Series CW only)
Sets the pump run time in MM:SS format.
Range = 00:00 to 59:59
0:01 per single [UP] / [DOWN] key press.
1:00 auto increment when key is held.

Percent Post Timer
Sets the pump limit time in MM:SS format.
Range = 00:00 to 59:59
0:01 per single [UP] / [DOWN] key press.
1:00 auto increment when key is held.

Percent Timer
Sets the percent time base in MM:SS format
Range = 00:00 to 59:59
0:01 per single [UP] / [DOWN] key press.
1:00 auto increment when key is held.

COUNT Dependant on timer setup:

Limit Timer

No function (display will blank).

Water Meter Timer (Series CW only)

Sets the number of water meter counts (or gallons or liters if the “K” factor is set).
Range = 1 to 9999
1 count per single [UP] / [DOWN] key press.
10 count auto increment when key is held.

Percent Post Timer

Sets the percent of Bleed Time to operate the pump.
Range = 0 to 100%
1% per single [UP] / [DOWN] key press.
10% auto increment when key is held.

Percent Timer

Sets the percent on time.
Range = 0 to 100%
1% per single [UP] / [DOWN] key press.
10% auto increment when key is held.

3. Operation

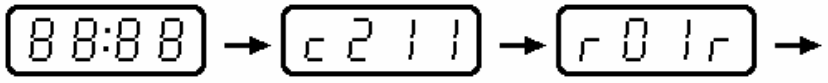
This section describes initialization and operation of the Series CL/CW pump.

3.1 Power Up (Initialization)

WARNING **BEFORE APPLYING POWER, INSURE THAT THE DEVICES BEING CONTROLLED ARE NOT IN A POSITION TO CAUSE HARM OR DAMAGE IF ACTIVATED UPON INITIAL STARTUP.**

1. With the pump installed and connected to the Cooling Tower as discussed in the previous section, apply power.
2. When power is applied, the following occurs:
   - All of the display elements are illuminated for 1 second.
   - The configuration number is displayed for 1 second.
   - The software revision number is displayed as "r X X r" for 1 second.
   - The timer is reset.

   This sequence is displayed as follows:



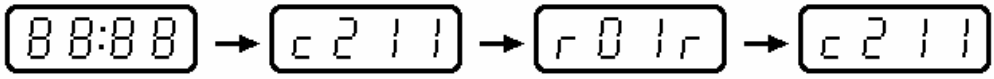
3. The pump then determines its last mode of operation (i.e., **Off** (Standby), **Conductivity Monitor**, **Forced On** or **Forced On Run**). Then, based on the mode, it will display:
   - OFF (for **Off** (Standby)),
   - ON (for **Forced On**), or
   - Current conductivity reading (e.g., 2540 for **Conductivity Monitor**), or
   - Pump rate percentage (e.g.75 for **Forced On-Run**)

3.2 Pump Setup

A configuration string is used to define the operation of the pump. The value entered in this string selects:

1. Timer type
2. Setpoint type
3. Water meter type (Series CW only)

The configuration string is displayed whenever power is applied to the pump.



In the example above, the configuration string is “211”. Each digit in this string is significant.

The string is pre-configured at the factory to your order.

NOTE **Refer to *Section 9 – Wiring & Connection Drawings* for additional information on wiring the water meter inputs.**

CONFIGURATION STRING

C _ _ _

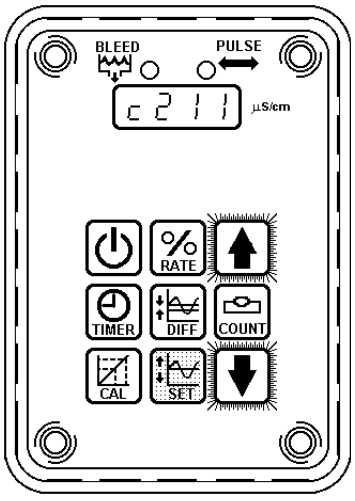
		TIMER	VALUE
TIMER TYPE	1 = LIMIT	HH:MM	N/A
	2 = PULSE *	MM:SS	1 - 9999
	3 = PERCENT POST	MM:SS	0 - 100%
	4 = PERCENT	MM:SS	0 - 100%
SETPOINT	1 = RISING 2 = FALLING		
WATER METER *	1 = CONTACTING 2 = OPEN COLLECTOR (TURBINE)		

* The Water Meter input must be present for this option (Series CW only).

Example: c212 is a Pulse Timer with a rising setpoint that accepts an open collector (Turbine) water meter input.

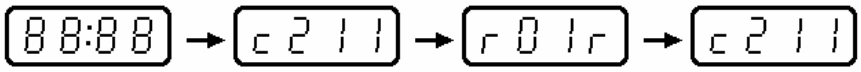
TIP **If you are unfamiliar with the settings described here, completely read section 3 then return here.**

Follow this procedure to reconfigure the software.



1. Remove power from the pump (by unplugging it) for a minimum of 5 seconds.
2. With the pump unplugged, press and hold [SET] and plug the pump back in.
3. Continue to hold [SET]. The pump will go through the normal power-up sequence:
   - All of the display elements are illuminated for 1 second.
   - The configuration number (e.g., c211) is displayed for 1 second.
   - The software revision number is displayed as "r X X r" for 1 second.

   This sequence is displayed as follows:



4. Continue to hold [SET]. The display will show the configuration value (e.g., ‘c211’) constantly.
5. Continue to hold [SET]. Press [UP] to increase the configuration value (e.g., ‘c211’ to ‘c212’). Press [DOWN] to lower the displayed value (e.g., ‘c211’ to ‘c122’).
6. Upon releasing [SET] the new configuration is stored and the pump resets.
7. Observe the power-up sequence and verify that the configuration value (e.g., ‘c211’) appears as set in step 5.

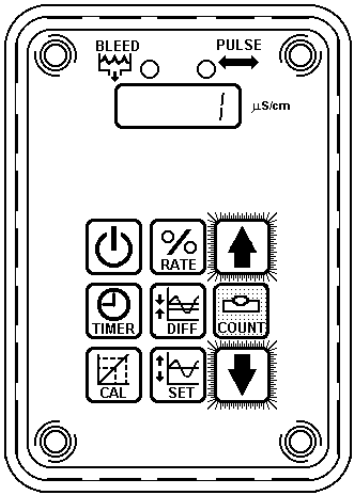
NOTE **Pump calibration is not affected by reconfiguration (i.e., you do not have to re-calibrate).**

NOTE **Timer values are re-set to factory defaults with reconfiguration. Re-check all settings after reconfiguration.**

3.2.1 K - Factor Setup

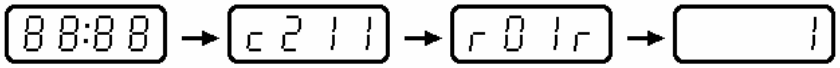
If the pump configuration string is set to c212 or c222 then a K-Factor is required to convert the pulse received into gallons or liters.

❖ **Follow this procedure to set the K-Factor:**



1. Remove power from the pump (by unplugging it) for a minimum of 5 seconds.
2. With the pump unplugged, press and hold [COUNT] and plug the pump back in.
3. Continue to hold [COUNT]. The pump will go through the normal power-up sequence:
   - All of the display elements are illuminated for 1 second.
   - The configuration number (e.g., c211) is displayed for 1 second.
   - The software revision number is displayed as "r X X r" for 1 second.

   This sequence is displayed as follows:



4. Continue to hold [COUNT]. The display will show the K-Factor value (e.g., '1') constantly.
5. Continue to hold [COUNT]. Press [UP ARROW] to increase the K-Factor value by 1.
6. Continuing to hold [COUNT] and [UP ARROW] will cause the K-Factor to increase by factors of 10.
7. Continuing to hold [COUNT] and [UP ARROW] for more than 10 cycles will cause the K-Factor to increase by factors of 100.
8. The setup is the same with the [DOWN ARROW]. Single presses will lower the K-Factor by 1. Continuous pressing and holding the [DOWN ARROW] will decrease the K-Factor by 10, then by 100 after 10 cycles, if you continue to hold down the [COUNT] and [DOWN ARROW].
9. Upon releasing the keys, the new configuration is stored and the pump continues with normal operation.

NOTE **The K-Factor translates the pulses generated by the flow meter into gallons or liters (depending on your setting). When you configure the Pulse Timer value setting you are specifying the number of pulses per gallon, or liter. For example, if your Water Meter has a "K" factor of 991 (on the gallons scale) it will generate 991 pulses for every gallon of fluid that flows past it. In this case you would set the "K" factor value to 991. You would then set the %/value setting in gallons.**

3.3 Pump Setup (Initialization)

Once the unit has completed the Power-Up procedure successfully, you are ready to perform the pump setup. This consists of:

1. Priming the pump.
2. Calibrating the sensor.
3. Programming the pump.

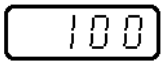
3.3.1 Priming the pump

The first time you use the pump you will need to prime the pump head. Use the following procedure:

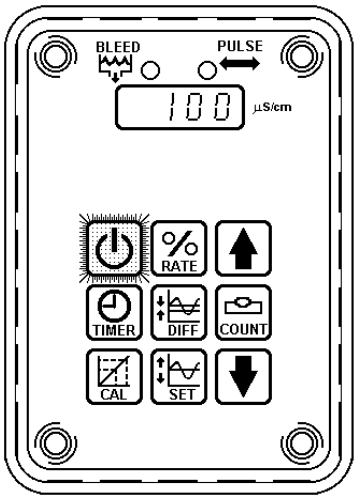
NOTE **If the air bleed valve assembly is being used, a return line (tubing) should be securely connected and routed back to the storage tank. To avoid possible injury from chemicals do not attempt to prime using a bleed valve without installing a return line.**

1. Press and hold [ON/STANDBY] for 5 seconds to enter the **Forced On** mode.

   The display will read 100 and the pump will begin to stroke.

2. Watch the intake tubing for evidence of liquid coming from the feed tank (refer to *Figure 2*).
3. Once flow is seen coming out of the pump through the discharge tubing with no bubbles present, the pump is primed and is ready to be placed in an operational mode.
4. Press [ON/STANDBY] to enter the **Off** (Standby) mode.
5. Press [ON/STANDBY] a second time to enter the normal operating mode.



3.4 Conductivity Sensor Calibration

A 2-point calibration is performed on the pump prior to shipment. Additional calibration will depend on the desired accuracy. The conductivity sensor must be calibrated to your system during the initial power up phase, and any time the sensor is cleaned or replaced. To calibrate the conductivity sensor, perform the following procedure:

TIP **Before you get started it is recommended that you condition your conductivity sensor to the system water by soaking the sensor for at least two hours. If you do not condition your sensor, expect to recalibrate your system within 24 hours.**

Tools required – Hand Held Conductivity meter

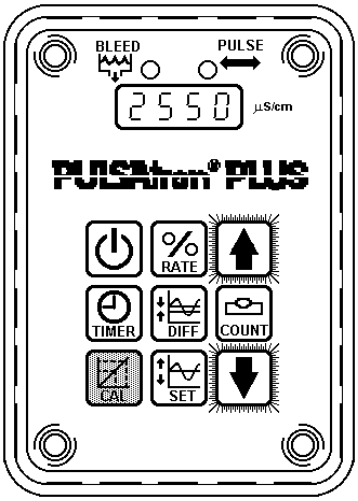
1. Close the isolation valves located before and after the conductivity sensor (refer to *Figure 6*).
2. Open the Sample Valve, and drain the line.
3. Close the Sample Valve.

Zero Calibration

The zero calibration removes any offset present in the electronics. In most cases the zero calibration performed at the factory will be sufficient for the life of the pump.

NOTE **A zero calibration should not be performed on carbon graphite sensors. These sensors show some conductance even when dry which prevents an accurate zero.**

NOTE **DO NOT do a zero calibration in "AIR" on the Stainless Steel sensor when using the 25 ft. extension cable.**



1. Remove the conductivity sensor from the system.
   a) Flush the sensor with tap water and dry it off. Then hold the sensor in the air.

   – or –

   b) Flush the sensor and then install it in a flow tee or elbow filled with distilled water.

NOTE **Do not touch the electrodes. Oil from your skin can effect the sensor's ability to read conductivity correctly. If you calibrate your zero point using a water sample, the Conductivity Sensor must be installed in a flow tee or elbow. If necessary, obtain a cal-tee from your representative.**

TIP **Distilled water is used in the factory for the zero calibration point.**

2. Calibrate the zero or 'nil' point, by pressing [ON/STANDBY] to place the pump in the **Conductivity Monitor** mode.
3. Wait a minimum of 60 seconds for the sensor to stabilize to the sample (even if both are at room temperature).
4. Press and hold [CAL].

   The display reads as shown below for 10 seconds while the conductivity is determined.

   If the conductivity is less than 100µS/cm, the display is changed to nil.

   If the conductivity is greater than 100, the actual value is displayed. Press [DOWN] to adjust the value to 0.
5. Release [CAL] and the Zero value is stored.
6. Install the sensor in the system.

System Calibration

System Calibration lets the pump display and control a value that is meaningful to you and conforms to some standard (like your hand held meter).

1. Verify the Sample Valve is closed.

NOTE **The conductivity sensor must be installed in a flow tee or elbow to obtain a proper reading. We recommend using system water for the system calibration point. If you must calibrate using standard solutions, obtain a Cal-Tee from your representative.**

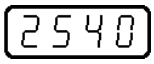
2. Slowly open the Isolation Valves.
3. Wait a minimum of 60 seconds for the sensor to stabilize to the sample (even if both are at room temperature).
4. Open the Sample Valve and fill the sample cup of the hand held conductivity meter.
5. Close the Sample Valve.
6. Test and record the conductivity reading.

   System conductivity must be greater than 100 µS/cm for the calibration to be valid.
7. Press and hold [CAL].

   The display reads as shown below until system conductivity is determined.

   If the solution is greater than 100µS/cm, the value is displayed (e.g., 2540).

8. Press either [UP] or [DOWN] to adjust the displayed value to the value determined in step 5 (e.g., in the example above press [UP] to change 2540 to 2550).
9. Release [CAL] and the tested calibration point is stored.
10. Check the system conductivity with the hand held conductivity meter again. If the result does not match the last value entered, repeat this procedure.

3.5 Programming the Pump

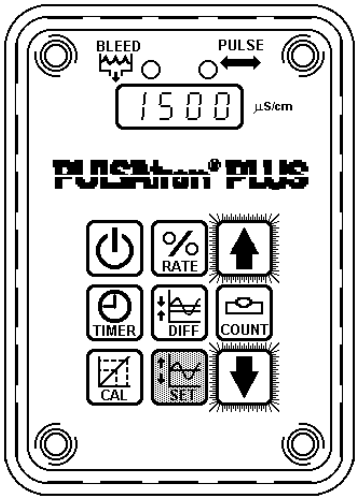
Now that you have completed the Sensor Calibration, you are ready to program the pump.

3.5.1 Setpoint (SET)

A Setpoint is a setting at which the pump activates an output – such as a solenoid valve and/or a bleed valve. The type of setpoint – **Rising/HIGH** or **Falling/LOW** defines which side of the setpoint the relay and solenoid activates. A **Rising/HIGH** setpoint activates when the input goes above the setpoint and is commonly used in conductivity control (where you want to keep the conductivity under a certain value). A **Falling/LOW** setpoint activates the output when the value goes below the setpoint.

NOTE **The setpoint type can be set using the pump configuration string. Refer to *Section 3.2* for further information.**

The factory default setpoint is 1500 µS/CM.



Follow this procedure to configure your setpoint.

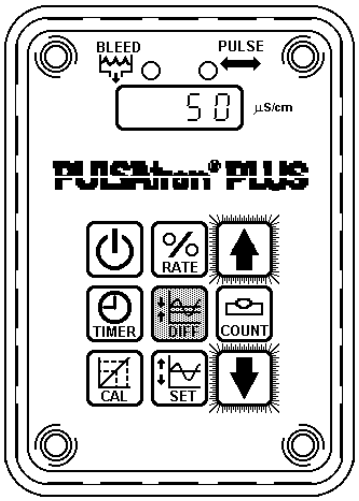
1. Press and hold [SET] to view the current setpoint.

   The factory default is 1500µS/cm.
2. While holding [SET], press [UP] to increase the setpoint value. Press [DOWN] to lower the displayed value.
3. Upon releasing [SET] the new setpoint is stored and takes effect immediately.

NOTE **Should you make a change to the setpoint while the pump is in the Forced On or Forced On-Run mode, the new setpoint will not take effect until you are in the Conductivity Monitor mode.**

3.5.2 Differential (DIFF)

The Differential (DIFF) is also referred to as dead band or hysteresis. The differential is the offset applied to a setpoint to prevent chattering of the Bleed Relay around the setpoint. For example, if the setpoint is set to 1500 and the differential is set to 50, the Bleed Relay will turn on at 1500 and turn off at 1450. The factory default Differential value is 50 µS/CM.



❖ **Follow this procedure to configure the differential.**

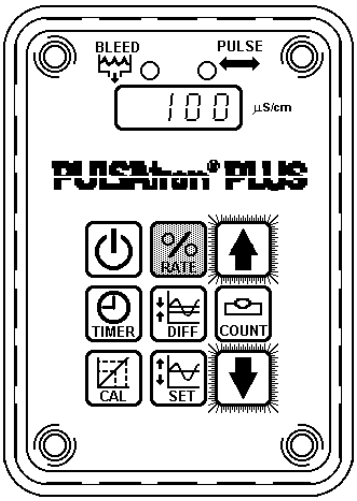
1. Press and hold [DIFF] to view the current differential setting.

   The factory default is 50µS/cm.
2. While holding [DIFF], press [UP] to increase the differential value. Press [DOWN] to lower the value.
3. Upon releasing [DIFF] the new differential is stored and takes effect immediately.

NOTE **Should you make a change to the differential while the pump is in the Forced On or Forced On-Run mode, the new setpoint will not take effect until you are in the Conductivity Monitor mode.**

3.5.3 RATE

The Rate setting determines the pump's stroke rate. **Rate** is displayed as a percentage of stroking frequency (typically 125 strokes/min). The factory default Rate is 100%.



❖ **Follow this procedure to configure your stroke rate.**

1. Press and hold [RATE] to view the current stroke rate percentage.
2. While holding [RATE], press [UP] to increase the rate. Press [DOWN] to lower the displayed value.
3. Upon releasing [RATE] the new percentage is stored in long term memory and takes effect immediately.

   While you are in the **Forced On-Run** mode, stroke rate is the only item you can change that takes effect immediately.

NOTE **Should you make a change to the stroke rate while the pump is in the Forced On mode, the new rate will not take effect until you are in the Forced On-Run or Conductivity Monitor mode.**

3.5.4 Timer

The pump configuration string allows the selection of one of four timer types:

- Limit
- Pulse
- Percent Post
- Percent

Refer to ***Section 3.2*** for further information on selecting a timer type.

3.5.5 Limit

When the timer is configured as a limit timer the pump operates with the blowdown relay. If the continuous on time exceeds the limit time setting, the pump will stop stroking while the bleed continues.

The Limit Timer is used to limit the length of time that the pump will inject a chemical. It is possible for a system upset (e.g. clogged blowdown strainer) to prevent the control of conductivity. Pumping chemical under these circumstances is counter-productive. Having the ability to set a time limit prevents the over feed of chemicals in these situations. The timer value is displayed in an hours and minutes format (HH:MM).

To setup this timer one parameter is required:

Time The maximum amount of time to continuously stroke the pump.
Range = 00:00 to 23:59 – (HH:MM)
Default: 01:30

Example: Timer is set to 00:15. Conductivity rises above the setpoint and the blowdown relay activates. Simultaneously the pump begins to stroke. The blow down continues until conductivity drops below the set point plus or minus the differential, but the pump only strokes for 15 (00:15) minutes.

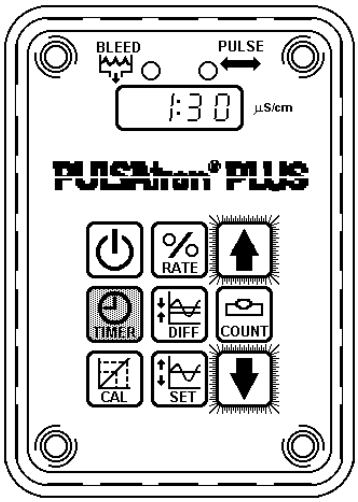
A time value always has the colon character ':' displayed.

❖ **Follow this procedure to configure your timer.**

1. Press and hold [TIMER] to view the current setting in an hour/minute format.
2. While holding [TIMER], press and release [UP] to increase the Limit Time value by one minute. Press [DOWN] and release to lower the displayed value. You can also press and hold [UP] or [DOWN] to automatically scroll the hours value.
3. Upon releasing [TIMER] the new value is stored in long term memory and takes effect immediately.

Should you make a change to the Timer while the pump is in the Forced On or Forced On-Run mode, the new duration will not take effect until you are in the Conductivity Monitor mode.

If the timer value is set to 00:00 the pump will operate without any limit.



3.5.5.1 Pulse (Series CW only)

The pulse timer is typically used in conjunction with a contacting head (or open collector turbine style) water meter to add a chemical in proportion to the added water. The value setting specifies the number of water meter pulses (or gallons or liters if a "K" factor is set) to accumulate before running the pump the length of time specified in the timer setting.

To setup this timer, two parameters are required:

Count The value setting represents the number of pulses (or gallons/liters if a "K" factor is set) to count before activating the pump.
Range = 1 to 9999
Default: 1

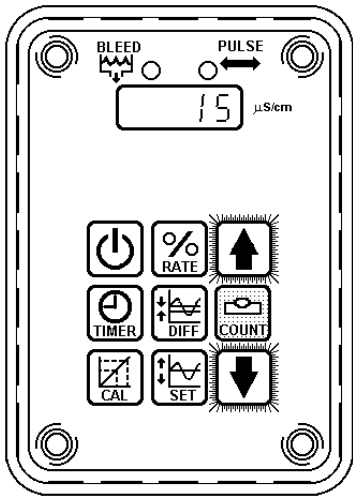
Time The amount of time to operate the pump in minutes and seconds.
Range = 00:00 to 59:59 – (MM:SS)
Default: 01:30

Example: The Count is set to 15 and the run time (Timer) is set to 02:00. When the pump receives the 15th pulse the pump will stroke for 2 minutes (02:00). The pump will continue to accumulate strokes during this time.

Refer to *Section 3.2 – Pump Setup* and *Section 3.2.1 K – Factor Setup* for additional information on configuring the "K" factor. Refer to *Section 9 – Wiring & Connection Drawings* for additional information on wiring the water meter inputs.

A time value always has the colon character ':' displayed.

Follow this procedure to configure your timer.



1. Press and hold [COUNT] to view the pulse count value. This is the number of pulses (or gallons/liters if the "K" factor is set) to accumulate before running the pump.
2. While holding [COUNT], press and release [UP] or [DOWN] to adjust the value by 1. You can also press and hold [UP] or [DOWN] to automatically increment the value by 10.
3. Release [COUNT]. The setting is stored in long term memory and takes effect immediately.
4. Press and hold [TIMER] to view the run time in minute/second format.
5. While holding [TIMER], press and release [UP] or [DOWN] to adjust the value by 1 second. You can also press and hold [UP] or [DOWN] to automatically increment the value by 1 minute (01:00).
6. Release [TIMER]. The setting is stored in long term memory and takes effect immediately.

The pulse accumulator is cleared whenever the count is satisfied. The pump will only accumulate pulses up to the count setting.

3.5.5.2 Percent Post

The Percent Post timer feeds for a proportion of the bleed time up to a limit value after the bleed cycle completes.

It is used to feed chemical in proportion to the bleed time with the advantage of maximum chemical retention.

To set up this timer, two parameters are required:

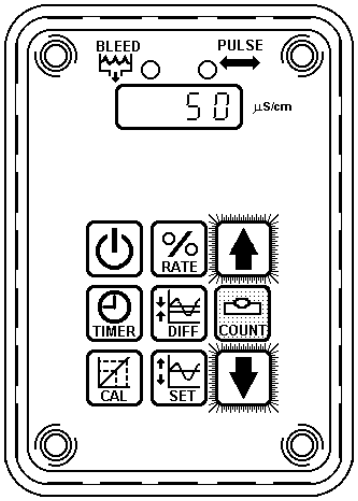
Count The percent of the bleed time the pump should operate.
Range = 1 to 100%
Default: 100

Time The maximum run time in minutes and seconds.
Range = 00:00 to 59:59 – (MM:SS)
Default: 01:30

Example: Value is set to 50 (50% of Bleed time) and Timer is set to 02:00 (will not operate for more than 2 minutes). If conductivity rises above the setpoint and the blow down relay activates for 8 minutes. When blow down stops the pump will operate for 02:00 (maximum run time setting is 2:00).

A time value always has the colon character ':' displayed.

❖ **Follow this procedure to configure your timer.**



1. Press and hold [COUNT] to view the percent bleed time value.
2. While holding [COUNT], press and release [UP] or [DOWN] to adjust the value by 1%. You can also press and hold [UP] or [DOWN] to automatically increment the value by 10%.
3. Release [COUNT]. The setting is stored in long term memory and takes effect immediately.
4. Press and hold [TIMER] to view the limit time in minute/second format.
5. While holding [TIMER], press and release [UP] or [DOWN] to adjust the value by 1 second. You can also press and hold [UP] or [DOWN] to automatically increment the value by 1 minute (01:00).
6. Release [TIMER]. The setting is stored in long term memory and takes effect immediately.

Should you make a change to the Timer while the pump is in the Forced On or Forced On-Run mode, the new duration will not take effect until you are in the Conductivity Monitor mode.

If the timer value is set to 00:00 the pump will not operate.

3.5.5.3 Percent

The Percent timer feeds for a percentage of a time period. The cycle repeats indefinitely. It is used to continuously feed a chemical.

To set up this timer, two parameters are required:

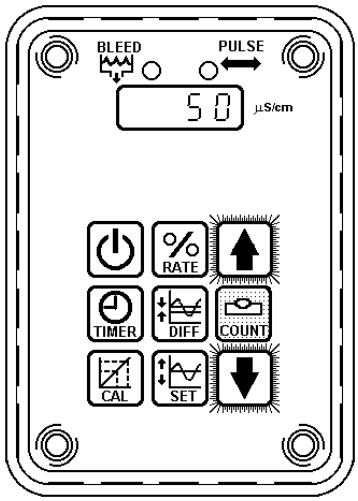
Count The percent of the time cycle the pump should operate.
Range = 1 to 100%
Default: 100

Time The length of the time cycle in minutes and seconds.
Range = 00:00 to 59:59 – (MM:SS)
Default: 01:30

Example: Value is set to 50 and Timer is set to 02:00. The pump will stroke for 1 minute (50% of 02:00 = 01:00) then wait for 1 minute. The cycle repeats.

A time value always has the colon character ':' displayed.

❖ **Follow this procedure to configure your timer.**



1. Press and hold [COUNT] to view the percent value.
2. While holding [COUNT], press and release [UP] or [DOWN] to adjust the value by 1%. You can also press and hold [UP] or [DOWN] to automatically increment the value by 10%.
3. Release [COUNT]. The setting is stored in long term memory and takes effect immediately.
4. Press and hold [TIMER] to view the time cycle in minute/second format.
5. While holding [TIMER], press and release [UP] or [DOWN] to adjust the value by 1 second (00:01). You can also press and hold [UP] or [DOWN] to automatically increment the value by 1 minute (01:00).
6. Release [TIMER]. The setting is stored in long term memory and takes effect immediately.

Should you make a change to the Timer while the pump is in the Forced On or Forced On-Run mode, the new duration will not take effect until you are in the Conductivity Monitor mode.

If the timer value is set to 00:00 the pump will not operate.

3.6 Operating Modes

The pump has four operating modes:

- **Off** (Standby)
- **Conductivity Monitoring***
- **Forced On**
- **Forced On - Run**

* When the **Conductivity Monitoring** mode is active, there are four possible sub-modes:

- Bleed & Feed
- Feed
- Bleed
- No Flow

Each of the modes and sub-modes of operation will be covered in this section.

3.6.1 Off (Standby)

Off (Standby) represents the mode that the pump is in when it is not cycling (i.e. discharging fluid) and the relay output is disabled. To place the pump in the **Off (Standby)** mode press [ON/STANDBY].

To exit **Off (Standby)** to **Conductivity Monitor**, press [ON/STANDBY].

While it is the intent of the manufacturer to ship all pumps in the Off (Standby) mode, it is possible that the pump could be in an active mode. Be sure that you take all safety precautions.

Press [ON/STANDBY] to activate this mode.

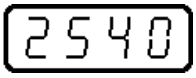
When the pump is in the **Off** (Standby) mode the following occurs:

1. The display reads ' OFF'
2. The pump is stopped.
3. The relay output is disabled.

Press [ON/STANDBY] to exit this mode.

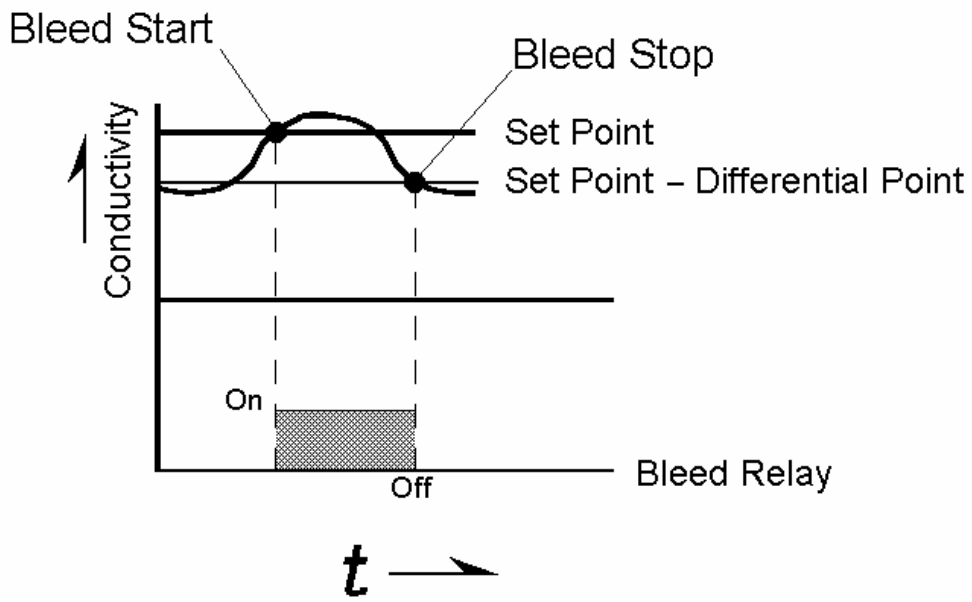
3.6.2 Conductivity Monitor

Conductivity Monitor is the most common mode of operation. While in this mode the current conductivity reading (e.g., 2540) is displayed. The operation of the pump and Bleed Relay is controlled by previously defined parameters.



3.6.2.1 Bleed

Bleed starts when a conductivity reading is greater or less than or equal to the defined setpoint. It ends when the conductivity falls below the defined setpoint minus the Differential point (if your system is configured as a Rising Setpoint). The **Bleed** mode is a sub-mode of **Conductivity Monitoring.**



Referring to the diagram above, you will see that at **Bleed Start**, the Bleed Relay is energized.

Press [ON/STANDBY] to activate this mode.

While the pump is in the **Bleed** mode:

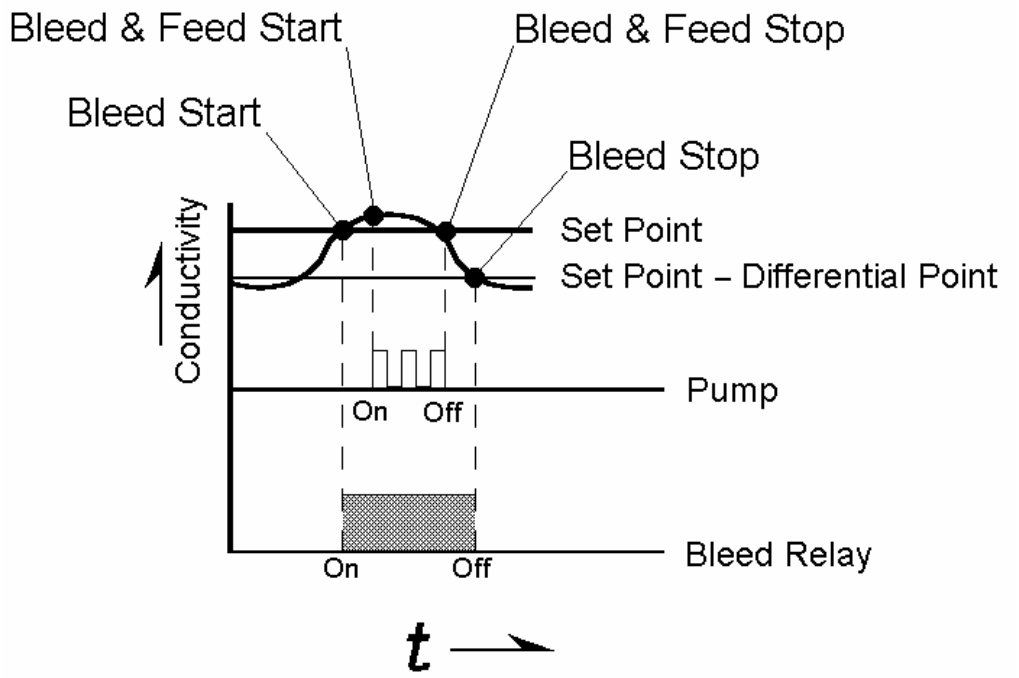
1. The display will alternate between the current reading (e.g., 2540) and the status (e.g. bLEd) every two seconds.

The pump remains in the **Bleed** mode until:

a) A Timer activates causing the pump to enter the **Bleed & Feed** mode.
b) The conductivity level drops below the setpoint minus the differential point. (As shown in the figure above.)
c) [ON/STANDBY] is pressed.
d) Power is cycled.

3.6.2.2 Bleed & Feed

Bleed & Feed starts when a conductivity reading is greater or less than or equal to the defined setpoint and the timer activates (e.g., the pulse count exceeds the setpoint). It ends when the conductivity falls below the defined setpoint minus the Differential point (if your system is configured as a Rising Setpoint) or the pump timer stops. The **Bleed & Feed** mode is a sub-mode of **Conductivity Monitoring.**



Press [ON/STANDBY] to activate this mode.

While the pump is in the **Bleed & Feed** mode:

1. The display will alternate between the status (e.g. bLEd), current reading (e.g., 2540), status (e.g., FEEd) and the accumulated run time (e.g., 00:03 in mm:ss format) every four seconds.

2. The count-up timer (run time) is incremented every second from the 00:00 start value.

The pump remains in the **Bleed & Feed** mode until:

a) The conductivity level drops below the setpoint minus the differential point (as shown in the figure above).
b) [ON/STANDBY] is pressed.
c) Power is cycled.
d) The pump Timer expires (e.g., the pump runs for the length of time set in the Timer).

3.6.2.3 Feed

The **Feed** mode is a sub-mode of **Conductivity Monitor**. It starts when the conductivity is below the setpoint and the timer activates.

Press [ON/STANDBY] to activate this mode.

While the pump is in the **Feed** mode:

The display will alternate between the conductivity reading (e.g., 2540), the phrase “FEEd” and the accumulated run time (e.g., 00:03 in MM:SS format) every three seconds.

The pump exits the **Feed** mode when one of the following occurs:

a) The pump timer expires (e.g., the pump runs for the length of time set in the Timer).
b) The conductivity level rises above the setpoint (causing the pump to enter the **Bleed & Feed** mode).
c) [ON / STANDBY] is pressed.
d) Power is cycled.

NOTE **Upon exiting the Feed mode, the system returns to the Conductivity Monitor mode.**

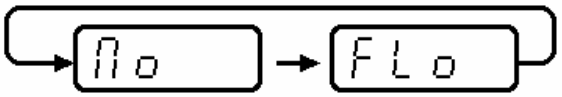
3.6.2.4 No Flow

When the Flow input detects “No Flow” (open circuit) the pump and Bleed Relay will not operate.

NOTE **Pumps supplied without a flow switch include a jumper to close the circuit.**

When the pump is in the **No Flow** mode the following occurs:

1. The display alternates (2 seconds) between the phrase ' No ' and ' FLo '.
2. The Bleed Relay output is set to the off state.
3. The pump stops cycling.



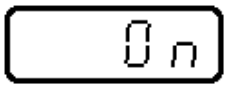
The pump will exit the **No Flow** mode when the flow input is restored. The **Forced On** and **Forced On Run** modes ignore the Flow input.

3.6.3 Forced-On

In the **Forced-On** mode the bleed relay is activated and the pump operates at its maximum rate for 5 minutes. It is useful for priming the pump after replacing the chemical supply.

Press and hold [ON/STANDBY] for more than 1 second but less than 5 seconds when in the **OFF** (Standby) mode to activate this mode.

When the pump is in the **Forced-On** mode:



1. The display reads ' On '.
2. The pump operates at its maximum rate (100%).

The pump exits the **Forced-On** mode when one of the following occurs:

a) The **Forced-On** mode is active for 5 minutes.
b) [ON/STANDBY] is pressed

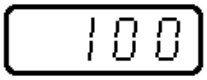
NOTE **Upon exiting the Forced-On mode, the system is returned to the Conductivity Monitoring mode.**

3.6.3.1 Forced-On Run

The **Forced-On Run** mode allows you to operate the pump at a selected frequency (RATE) with no time limit imposed. This mode is useful if you want the pump to operate without regard to conductivity.

Press and hold [ON/STANDBY] for more than 5 seconds when in the OFF (Standby) mode to activate this mode.

While the pump is in the **Forced-On Run** mode:



1. The display shows the rate value (e.g., 100).
2. The pump cycles at the specified Rate.

NOTE **You can use the [RATE] setting to change the Rate while operating in Forced-On Run. Refer to *Section 3.4.3 Rate* for further information.**

The pump exits the **Forced-On Run** mode when one of the following occurs:

a) [ON/STANDBY] is pressed

NOTE **Upon exiting the Forced-On Run mode, the system is returned to the Off mode.**

NOTE **The Pump Mode is stored in Long Term memory. In the event the pump loses power, when power is restored, the pump returns to the mode it was in at the time of the power loss.**

3.7 Loss of Power

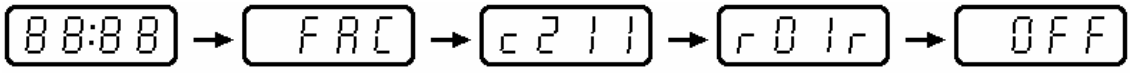
If power is lost while the pump is operating, when power is restored, the pump will return to the mode that was active at the time of the power loss. If the pump was operating in the **Forced-On** mode, when power is re-applied, the unit will enter the **Forced-On** mode and operate for a full five minutes (i.e., the timer is reset).

If a timer is active at power loss, it is re-set at power-up (i.e., it will not resume where it left off).

3.8 Factory Initialization

If [TIMER], [DIFF] and [COUNT] are pressed simultaneously, the pump performs a **Factory Initialization**. When the pump is in the **Factory Initialization** mode, the following occurs:

1. All factory defaults are moved from permanent memory (i.e., Flash), to long term memory (i.e., EEPROM).
2. The processor re-sets causing the program to re-execute power-up and the following sequence is displayed:



The factory initialization mode will not change the configuration setting (e.g., 'c301).

Specifications

All pumps will conform to the following specifications:

Unit Power:

- Operating voltage: 120VAC +/- 10%, 5AMP's maximum.
- Protection, Fuse: 250VAC, 5A Slo-Blow removable (circuit board mounted).
- Cordage: 8' length 16AWG 3-Wire Domestic120 VAC power cord set.

High Voltage Output (Bleed Relay):

- Operating voltage: Same as supplied to unit.
- Capacity: 4AMP at 240VAC maximum.
- Protection: None. Fused at power cord.
- Status: Normally Open.
- Cordage: 12" (min) Pigtail with Female Duplex Plug.

Analog Input (Conductivity):

- Sensor: 4-electrode cell with 9' cord length and 3/4"Tee (threaded).
- Sensor Connector: External 2X6 Molex® style with shrink over-wrap and double O-ring seals.
- Operating Range:
  - Conductivity: 0 – 6000µS/cm (Temperature Compensated). Unit will read 0-4000µS/cm at 100°C, 0 – 5000µS/cm at 75°C and 0-9999µS/cm at 25°C.

  Isolation: Isolated from Earth Ground only.

Flow Input:

- Input Type: Isolated Dry Contact only.
- Switching Technique: 5VDC supplied by pump.
- Sensor: None (Optional). Shorting jumper provided.
- Sensor Connector: External 1X2 Molex style with shrink over wrap.

Water Meter Input: (Series CW only)

- Input Type: Open collector (sinking) Isolated only
- Switching Technique: Open collector provided in device. 5VDC and ground provided by connection.
- Sensor: None – pigtail provided.
- Sensor Connection: External 1X3 Molex style with shrink over wrap.
- Minimum Closure: 125ms closed / 125ms open (Configuration String = cXX1)
  2ms closed / 2ms open (Configuration String = cXX2)

User Interface:

- Display: 4 Character LED (Red Characters)
- Stroke LED: Green LED. Illuminated when the Solenoid pulses
- Relay LED: Green LED. Illuminated when relay is on.
- Keypad: Membrane style, 9 Keys: On/Standby, Up, Down and 6 Function keys.

Enclosure:

- IP Rating: IP54 (Protected against dust and splashing water)
- NEMA Rating: Type 3R (Vented enclosure protected against dust, rain, sleet and ext. ice)

Environment:

Maximum Ambient Temperature: 104° F (40° C)

4. Options

The following options are available:

- 230 VAC international power cord set (230 VAC international power cord and cord with stripped ends for wiring controls with relay options).
- Flow Switch
  - Flow Tee
  - Flow cap with 2-pin female style molded connector. 8' cord.
  - Shuttle
  - 3" nipple (assembled to Sensor Tee)
- Flow Assembly
  - Flow Switch
  - Right Angle Sensor Tee
  - Sample Cock
  - 6" nipple
  - (2) mounting brackets
  - 3/4" slip fit couplings
  - Elbow Tee
- CE Approval
- Agency Approval
  - ETL/ETLC
- Rising/Falling Setpoint
  - Set at the factory.
- Flow & Pressure Range
  - @100psi = 22 or 30 GPD (83.28 or 113.56 LPD)
  - @150psi = 6 or 12 GPD (22.71 or 45.43 LPD)
  - All standard wet end components are available.

5. Maintenance

WARNING **BEFORE PERFORMING ANY MAINTENANCE OR REPAIRS ON CHEMICAL METERING PUMPS, BE SURE TO DISCONNECT ALL ELECTRICAL CONNECTIONS AND INSURE THAT ALL PRESSURE VALVES ARE SHUT OFF AND PRESSURE IN THE PUMP AND LINES HAS BEEN BLED OFF.**

NOTE **Always wear protective clothing, gloves and safety glasses when performing any maintenance or repairs on chemical metering pumps.**

5.1 Routine Maintenance

1. Routinely check the physical operating condition of the pump. Look for the presence of any abnormal noise, excessive vibration, low flow and pressure output or high temperatures [when running constantly at maximum stroke rate, the pump housing temperature can get up to 160°F (70°C)].
2. For optimum performance, cartridge valve assemblies should be changed every 4-6 months. Depending on the application, more frequent changes may be required. Actual operating experience is the best guide in this situation. Repeated short-term deterioration of valve seats and balls usually indicates a need to review the suitability of wetted materials selected for the application. Contact the supplier for guidance.
3. Check for leaks around fittings or as a result of deteriorating tubing (i.e., when standard white translucent discharge tubing is exposed to direct sunlight). Take appropriate action to correct leaks by tightening fittings or replacing components.
4. Keep the pump free of dirt and debris as this provides insulation and can lead to excessive pump temperatures.
5. If the pump has been out of service for a month or longer, clean the pumphead/valve assemblies by pumping fresh water for approximately 30 minutes. If the pump does not operate normally after this “purging run”, replace the cartridge assemblies.

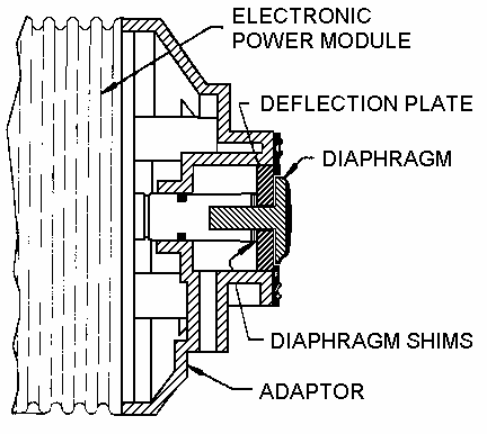
5.2 Disassembly and Assembly

5.2.1 Diaphragm Removal

1. Flush pumphead and valve assemblies out by running water or any other suitable neutralizing solution through the pump. Wash the outside of the pump down if chemical has dripped on the pump case.
2. Disconnect tubing or piping from the pump.
3. Remove the four pumphead screws and then remove the pumphead assembly.
4. Remove the diaphragm by grasping it at the outer edges and turning it counterclockwise until it unscrews from the electronic power module (EPM). Don’t lose the deflection plate or diaphragm shims which are behind the diaphragm. Take note of the shim quantity (can be from 0 to 2).
5. Inspect the diaphragm if it is intended to be used again. Look for indications of the PTFE face being over stretched (localized white areas) or the elastomer on the back of the diaphragm being worn. Excessive amounts of either condition require diaphragm replacement.

5.2.2 Diaphragm Replacement

1. When replacing the diaphragm, it's always a good idea to replace the valve cartridges and other worn parts. A kit is available from your supplier with all parts necessary to completely rebuild your pump's wet end. All your supplier needs to know is the "KOPkit No." on your pumps nameplate to supply this kit.
2. If you kept the shims from the original diaphragm or know the original quantity, skip Step #3 (shimming the diaphragm) and go to Step #5.
3. Shimming the diaphragm
   a) Slide the diaphragm deflection plate onto the back of the diaphragm stud, radius side towards the diaphragm.
   b) Slide two shims onto the diaphragm stud.
   c) Screw the diaphragm/shim assembly into the EPM unit.
   d) Turn the diaphragm/shim assembly clockwise until the deflection plate and shims are screwed down tight against the solenoid shaft and the diaphragm stops turning.
   e) If there is a gap between the adaptor and diaphragm, repeat the procedure removing one shim each time until the diaphragm just touches the adaptor or is slightly recessed.
   f) Remove the diaphragm/shim assembly from the adaptor.



4. Apply grease to areas of the diaphragm that contact the deflection plate or radius on the adaptor.
5. Re-assemble the diaphragm/shim assembly.
   a) Slide the diaphragm deflection plate onto the back of the diaphragm stud, radius side towards the diaphragm.
   b) Slide the number of shims determined from steps 3-a through 3-e onto the diaphragm stud.
6. Screw the diaphragm/shim assembly into the EPM unit.
7. Place the pump head onto the adaptor with the flow arrows pointing up and install and tighten the four pump head screws. Tighten the screws until the pumphead pulls up against the adaptor.
8. Place the pump back into service.

5.2.3 Valve Replacement

1. Flush the pump to clean any chemical from the pumphead.
2. Unplug the pump and disconnect any tubing or piping.
3. Unscrew valve cartridges and discard.
4. Remove O-Rings located inside the pumphead.
5. Using new O-Rings, install new valve cartridges with stamped letters reading from top to bottom and the arrow pointing in the direction of flow. Hand tighten only, do not use wrenches or pliers. This is especially important when the pump head is SAN material.
6. Reconnect tubing or piping and reinstall the pump.

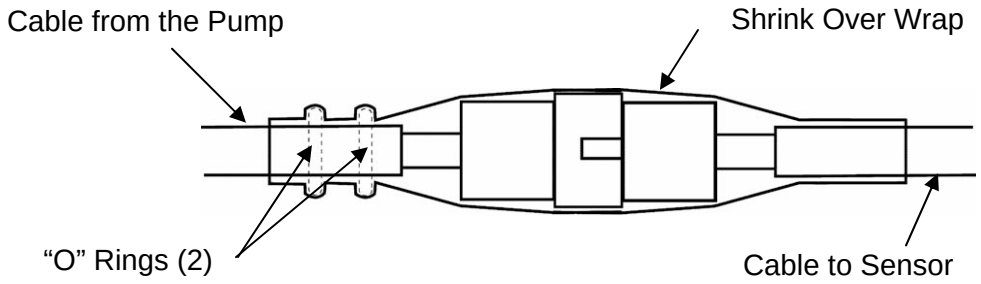
5.2.4 Sensor Removal/Replacement

In the event the Conductivity sensor requires replacement, perform the following.

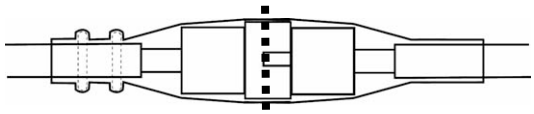
NOTE **Changing the sensor material (e.g., carbon graphite to stainless steel) requires a jumper setting change on the mother board (Cell Constant). Refer to section 6.2.4.1 Cell Constant jumper setting procedure and the Cell Constant selection diagram for further details.**

Replacing a Sensor

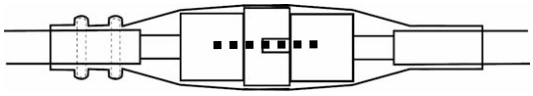
1. Remove power from the pump.
2. Close the Isolation valves located before and after the Conductivity electrode (refer to *Figure 6*).
3. Open the Sample valve to drain the line and verify no flow through the line.
4. Once the line has drained, close the Sample valve.



5. Use a knife to carefully remove the black shrink over wrap from the connector.
   a) Make your first cut across the cable connectors as shown by the dotted line below:



   b) Make a second cut perpendicular to the first cut as shown below. Be careful not to cut the "O"-rings on the pump side of the cable.



   c) Peel the black shrink over wrap away from the connectors.
6. Disconnect the electrical connection from the Conductivity electrode to the Chemical pump.
7. Remove the coupling nut from the sensor to be replaced. Remove the sensor by gently pulling straight down (refer to *Figure 9 – A*). The sensor is held in place by a rubber "O" ring.

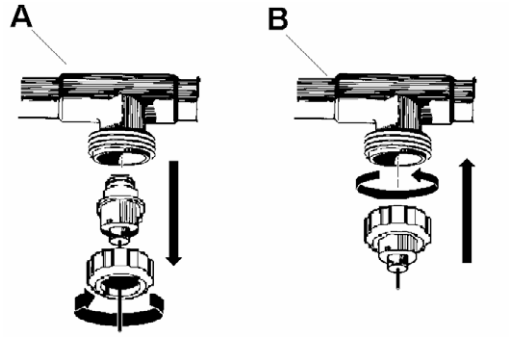


Figure 9

8. Gently install the new sensor into the tee. Verify that the sensor is firmly seated in the housing.

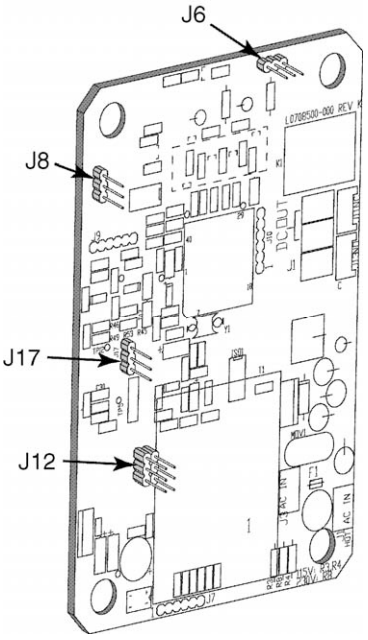
NOTE **It may be necessary to rotate the sensor to align its "flat" with the mating feature on the Tee.**

9. Slip the coupling nut over the electrical connector and then onto the housing threads and hand tighten the coupling nut (refer to *Figure 9 – B*).
10. Locate the electrical connector that was disconnected in step 6.
11. Slide the over wrap onto one side of the electrical connection.
12. Re-connect the electrical connection to the Chemical pump.
13. Position and shrink the over wrap using a heat gun, or yellow flame torch.
14. Verify the sample valve is closed.
15. Apply power to the Chemical pump
16. Open the Isolation valves that you closed in step 2.

NOTE **Open the Isolation valves slowly to avoid water hammer.**

5.2.4.1 Cell Constant Jumper Selection

Changing the sensor material (e.g., carbon graphite to stainless steel) requires a jumper setting change on the mother board.

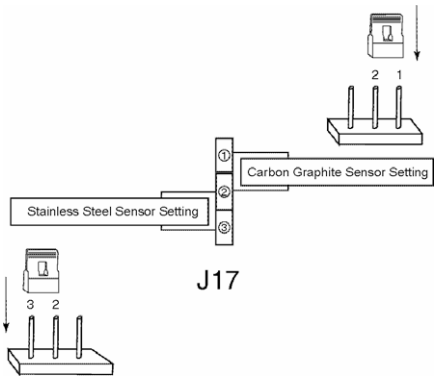


❖ **Use the following procedure to change the Cell Constant Jumper selection.**

1. Remove power from the pump.
2. Remove the four screws from the pump cover.
3. Pull the front cover away and down from the pump case. As the front cover is moved away from the case, the motherboard will begin to come out of the case as well.
4. Gently rotate the motherboard approximately 45 degrees from the case as shown in the figure to the right. Using excessive force to move the motherboard can possibly cause J6, J8, and J12 to become unplugged. Should this happen, reconnect each plug as follows:

J6	2 – wire connector	(Red/Black)
J8	2 – wire connector	(White/Black) or
	3 – wire connector	(Green/Black-White/White)
J12	6 – wire connector	N/A

5. Pull the jumper element straight up to remove it from its factory position, and reposition it on its new position.
6. Return the motherboard to its position in the case.
7. Replace the front cover taking care to not pinch the ribbon cable.
8. While holding the front cover in place, insert and tighten the four cover screws.
9. Return power to the pump.



5.2.5 Cleaning the sensor

By design, the 4-element conductivity electrode can overcome most forms of fouling. It is possible that in severe cases, periodic cleaning may be required.

5.2.5.1 Before you clean

Sensors can take up to 3 days to fully condition and stabilize to your system. If you experience conductivity drift during this period it is recommended that you recalibrate your sensor rather than blaming the drift on a fouled sensor and replacing it.

5.2.5.2 To clean the Stainless Steel conductivity sensor:

Some staining of the electrode surface is normal and will not effect sensor performance. To clean the electrodes try one of these techniques:

1. Wipe the sensors with a clean cloth.
2. Agitate the sensor in a solution of water and mild detergent. Rinse the sensor with tap water.
3. For stubborn stains, dip in a mild solution of muriatic acid then rinse with tap water.

USE PROPER HANDLING PROCEDURES INCLUDING RUBBER GLOVES, EYE PROTECTION AND PROTECTIVE CLOTHING, WHEN HANDLING ANY ACID SOLUTION.

Oils can affect sensor performance. Do not touch sensor surface. The sensor should be agitated in a mild solution of dish washing soap and water to remove oils transferred during handling.

IMPORTANT!: After cleaning, allow 3 days for the electrode surface to re-oxidize and the readings to fully stabilize.

5.2.5.3 To clean the Carbon Graphite sensor:

1. Immerse sensor in a solution of water and mild detergent.

   When a stronger cleaning solution is required use concentrated hydrochloric acid mixed into 50% isopropanol.
2. Rinse the cell several times with distilled or deionized water.

IMPORTANT!: After cleaning, allow 3 days for the electrode surface to re-oxidize and the readings to fully stabilize.

USE PROPER HANDLING PROCEDURES INCLUDING RUBBER GLOVES, EYE PROTECTION AND PROTECTIVE CLOTHING, WHEN HANDLING ANY ACID SOLUTION.

6. Troubleshooting

Problem	Probable Cause	Remedy
Loss of chemical residual	Pump rate too low	Adjust to higher setting.
	Scale at injection point	Clean injection parts with 8% muriatic acid or undiluted vinegar.
	Solution container allowed to run dry	Refill the tank with solution and prime.
Too much chemical	Pump setting too high	Lower pump rate.
	Chemical in solution tank too rich	Dilute chemical solution. NOTE: For chemicals that react with water, it may be necessary to purchase a more dilute grade of chemical direct from your chemical supplier.
	Siphoning of chemical into line	Test for suction or vacuum at the injection point. If suction exists, install an anti-siphon valve.
Leakage at tubing connection	Worn tube ends	Cut off end of tubing (about 1") and then replace as before.
	Chemical attack	Consult your seller for alternate material.
Failure to pump	Leak in suction side of pump	Examine suction tubing. If worn at the end, cut approximately an inch off and replace.
	Valve seats not sealing	Clean valve seats if dirty or replace with alternate material if deterioration is noted.
	Low solution level	Solution must be above foot valve.
	Diaphragm ruptured	Replace diaphragm as shown in the ***Maintenance*** section. Check for pressure above rated maximum at the injection point. NOTE: Chemical incompatibility with diaphragm material can cause diaphragm rupture and leakage around the pump head.
	Pumphead cracked or broken	Replace the pumphead as shown in the ***Maintenance*** section. Make sure fittings are hand tight only. Using pliers and/or wrenches can crack the pumphead. Chemical incompatibility can cause cracking and subsequent leakage.
	Pumphead contains air or chlorine gas	After turning off all pressure lines, following all normal safety precautions, disconnect discharge tubing and install a bleed valve assembly.
	Breakdown or disconnection of wiring	Connect wiring properly. Check fuse or circuit breaker.
	Voltage drop	Take measures after investigation of cause.
	Malfunction of electronic control board	Contact supplier.

Problem	Probable Cause	Remedy
Pump loses prime	Dirty check valve	Remove and replace check valves.
	Ball checks not seating or not seating properly	Flush the check valve with fresh water or other suitable material. If this does not correct the problem, replace the check valves. Crystals can hold check valves open, therefore the valves should be replaced as needed.
	Solution allowed to run dry	Refill container with proper chemical.
Fitting Leakage	Loose fittings	All fittings can be **hand tightened** to prevent leakage. Clean off chemicals that have spilled on the pump.
	Broken or twisted gasket	Check gaskets and replace if broken or damaged.
	Chemical attack	Consult your pump supplier for alternate material.
Pump will not prime	Too much pressure at discharge	Turn off all pressure valves, loosen outlet tubing connection at the discharge point. Remove discharge valve cartridge. Dampen ball check and valve seats with a few drops of solution. When the pump is primed, reconnect all tubing connections.
	Check valves not sealing	Disassemble, loosen, clean and check for deterioration or swelling. Reassemble and wet the valve assembly.
	Suction lift height too much	Decrease suction lift or pull a vacuum on the pump discharge until the pump is primed.
	Pump equipped with spring loaded high viscosity valves	Loosen discharge valve to aid in priming, take necessary safety precautions, or apply vacuum to pump discharge.
Bleed LED Stays On.	Conductivity of water is above setpoint, Bleed restricted	Check Bleed line and do one of the following: • Clean strainer. • Clean solenoid. • Replace solenoid.
	Treatment chemicals or process liquid at sensor	Check sample stream injection of treatment chemicals/process liquid at sensor. Injection should be down stream.
	Conductivity of sample stream higher than system conductivity, sample stream restricted	Check for flow in sample stream and do one of the following: • Clean strainer. • Clean sample line.
Conductivity of Pump Decreases while System Conductivity Increases.	Fouled sensor	Clean sensor.

Problem	Probable Cause	Remedy
Conductivity of System Stays Lower Than Setpoint, Never Or Rarely Bleeds.	Uncontrolled Bleed	Bleed valve leaking. Do one of the following: • Realign ball valve; if leaking by the ball valve. • Clean solenoid valve; if leaking by the solenoid valve. Close manual Bleed valve. Fix leaks in cooling system.
Conductivity Reading Drifts Lower than Sample Tested.	Sensor fouled Calibration procedure not carefully followed	Clean sensor. Perform calibration. Follow stabilization time cautions. If decrease continues, necessitating frequent cleanings, try calibrating without cleaning. Slight coatings can be compensated for with re-calibration.
	Calibration point not near setpoint	Re-calibrate with solution near setpoint.
	Poor grounding of water sample	Tie flow assembly near sensor to earth ground.
Front Panel Bleed LED Cycles On and Off.	Air in sample line	Bleed air off. Close isolation valves. Loosen flow switch to bleed. Re-tighten before opening valves.
	Differential (dead band) too tight	Widen differential. Check solenoid location (piping).
Pump Not Bleeding With High Conductivity	No flow	Check flow switch and flow.
	Relay bad or fuse bad	Check relay and fuse.
Continued Bleeding with Conductivity Below Setpoint.	Setpoint differential not satisfied	Check settings and readings.
Chemical Pump Not Activating.	Fuse bad	Replace fuse.
	Setpoint set too high	Adjust Setpoint.
	Timer Selection/Setting	Review settings. Refer to ***Section 3.5.4 – Timer***
Drift	Sensor must be conditioned	New sensors should be conditioned for 24 hours.
	Dirty electrode	Clean sensor. Wait three days for oxidation after clean.
	Improper calibration	Review procedures.
	Chemical coating of stainless steel sensors	Do calibration without cleaning the sensor. Change to Carbon Graphite style.
	Air bubbles or turbulence	Review plumbing set-up.
	Flow Assembly improperly grounded	Check wiring. Install grounding clamp on stainless nipple near conductivity sensor.
	Calibration Technique	Follow calibration instructions closely in ***Section 3.4 – Conductivity Sensor Calibration***.

Problem	Probable Cause	Remedy
Conductivity is 0.	Air bound sensor	Review plumbing.
	Corroded sensor	Replace.
	Wiring connections loose	Check sensor connection.
	Improper calibration	Review procedures.
Conductivity Reading Does Not Change After Calibrating.	No flow by sensor	Check flow and flow switch.
	Air bound sensor (Air trapped on sensing surfaces)	Rotate sensor tee so that the sensor is below the water line (e.g. Tee points straight down).
	Defective sensor	Replace sensor or check wiring.

7. Error Codes

Error codes are displayed whenever the pump recognizes a condition that will prevent it from operating properly. Upon detection the code is displayed for approximately 2 seconds and then the pump automatically resets. This process repeats until the problem is corrected.

Code	Definition	Cause	Description	Solution
E200	Internal Processor Error	Processor/Clock Defect	The processor's clock is not generating regular interrupts.	Cycle Power. If problem does not clear, contact Technical Services.
E400	Drive Error	Fouled Sensor, Sensor Missing, Sensor Defect	This error is encountered when the pump attempts to boost its drive signal to overcome probe fouling but reaches its maximum value before the fouling is overcome.	Clean electrodes. Check all sensor connections. Cycle power. Replace Sensor.
E500	Temperature Compensation Error	Sensor Missing/Not connected. Bad Sensor connection. Sensor Defective.	The temperature sensor is generating a signal outside of the expected range.	Install sensor, check connections. Cycle power. Replace Sensor. **Note:** If the sensor is not connected, this will be the first error code generated.
E600	Zero Calibration Error	Sensor not in air or water with conductivity below 100µS/CM during calibration. or Attempting to zero calibrate a carbon graphite sensor.	This error occurs when you are attempting to perform a zero calibration but the average of the readings are not below 100µS/CM. A carbon graphite sensor will show some conductivity even when dry. This prevents an accurate zero.	Clean and dry off sensor. Check sensor connections. If using a wet sample, check sample. Cycle power. Replace sensor. Do not attempt to zero calibrate a carbon graphite sensor.
E700	Sensor Adjust Error	Fouled Sensor, Sensor Missing, Sensor Defect	This error occurs when the pump cannot adjust the probe drive signal to allow the probe feedback to fall into the designated window.	Clean electrodes. Check all sensor connections. Cycle power. Replace sensor.

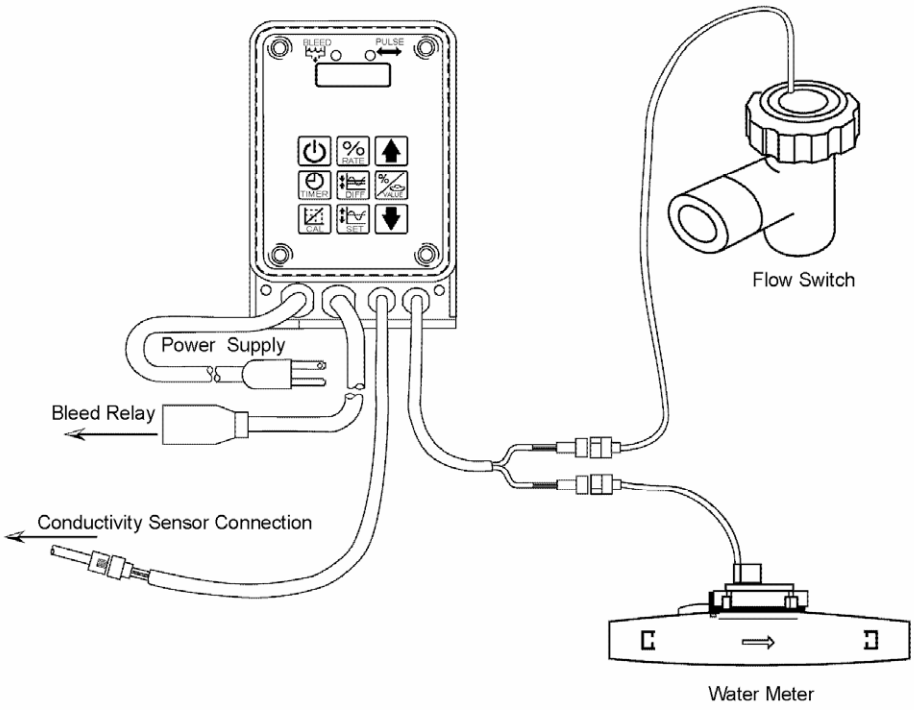
If the problem cannot be corrected, it is possible to override the error code and operate the pump manually.

❖ **Manual Pump operation procedure:**

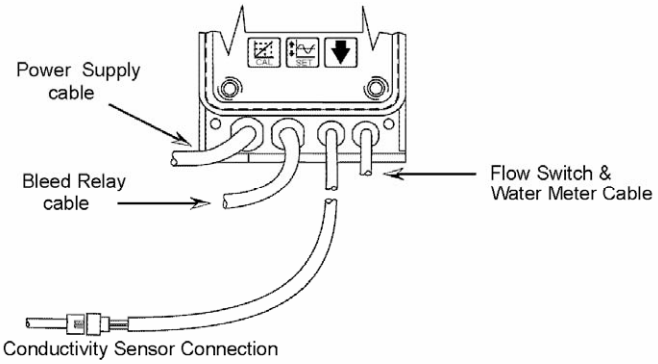
1. While the error code displays (e.g. E500) press and release the [ON/STANDBY] key.
   The pump will reset to the **Off** (Standby) mode.
2. Press and hold the [ON/STANDBY] key for 5 seconds. The pump will display the stroke rate percentage value (e.g. 100) and cycle at the set frequency. Refer to *Section 3.5.3.1 Forced-On Run* for further information.

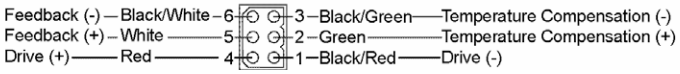
8. Wiring & Connection Drawings

Typical Connections

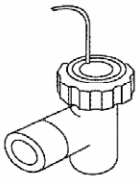


Conductivity Sensor Connection

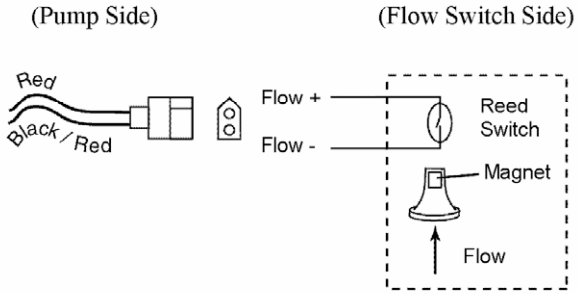


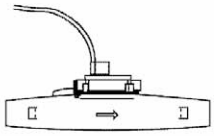


Flow Switch & Water Meter Input Wiring

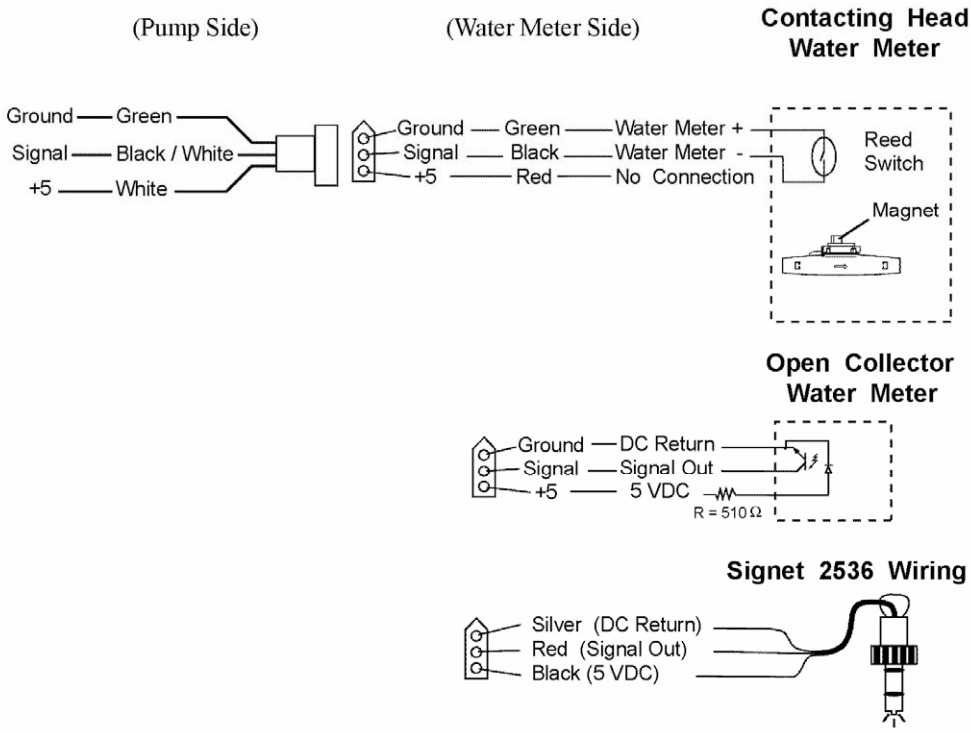


Flow Switch
(Option)

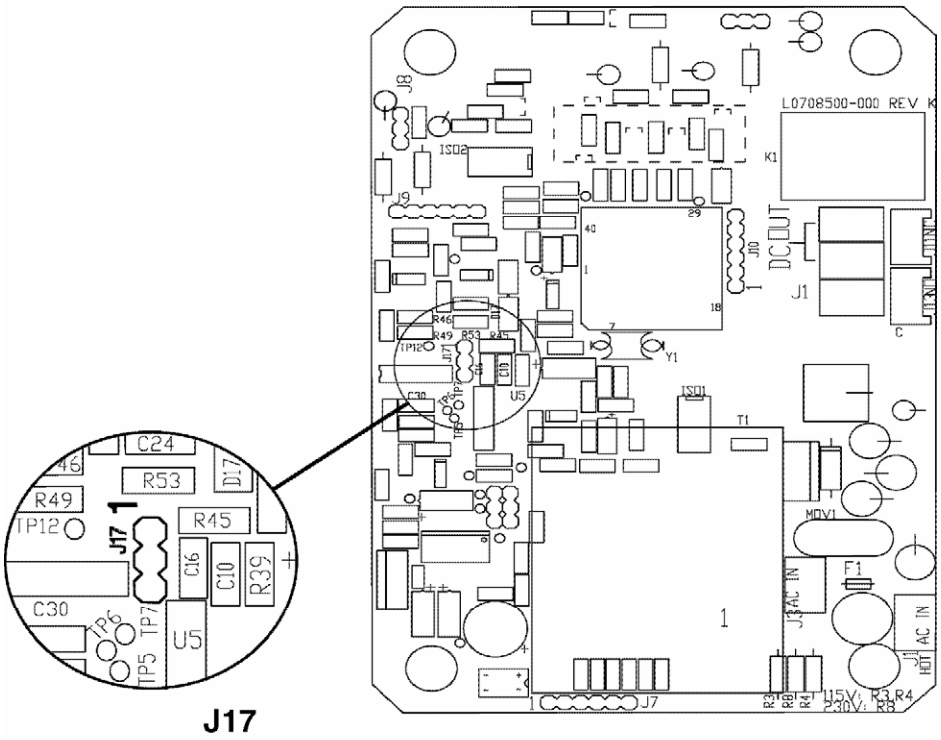




Water Meter
(Accessory)



Cell Constant Selection



1 Carbon Graphite Sensor Setting
(Cell Constant = 0.5)

1 Stainless Steel Sensor Setting
(Cell Constant = 0.3)