WATER SPECIALISTS TECHNOLOGIES LLC

SANFORD, FL

ION SPECIFIC PRECIPITANT CONTROLLER

Designed for use with THIO-RED and TR series precipitants.

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1.0 System Overview

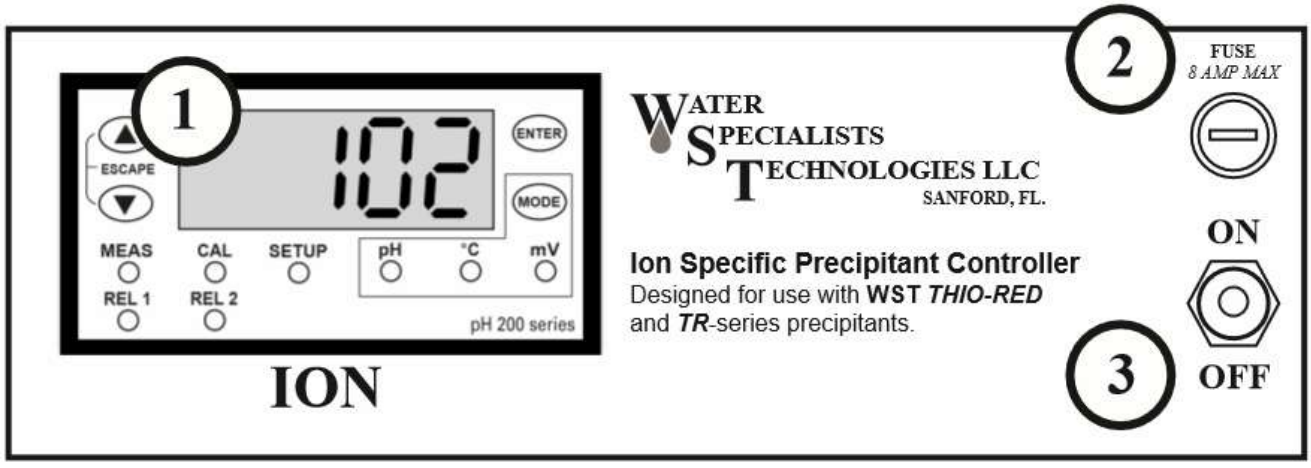
The WST Ion Specific Precipitant Control System monitors the wastewater stream and controls the addition of Thio-Red to ensure complete reaction without wasting chemistry. Electrode signals are received and monitored by the reagent controller which, as required, activates the reagent pump until predetermined set points are achieved.

The Ion Specific Precipitant Control System consists of the following items:

- Control Unit
- Reference (pH) Electrode with Cable
- Ion Selective Electrode with Cable
- Submersible Electrode Holders (2)
- Reference Adaptor Tee

1.1 CONTROL UNIT

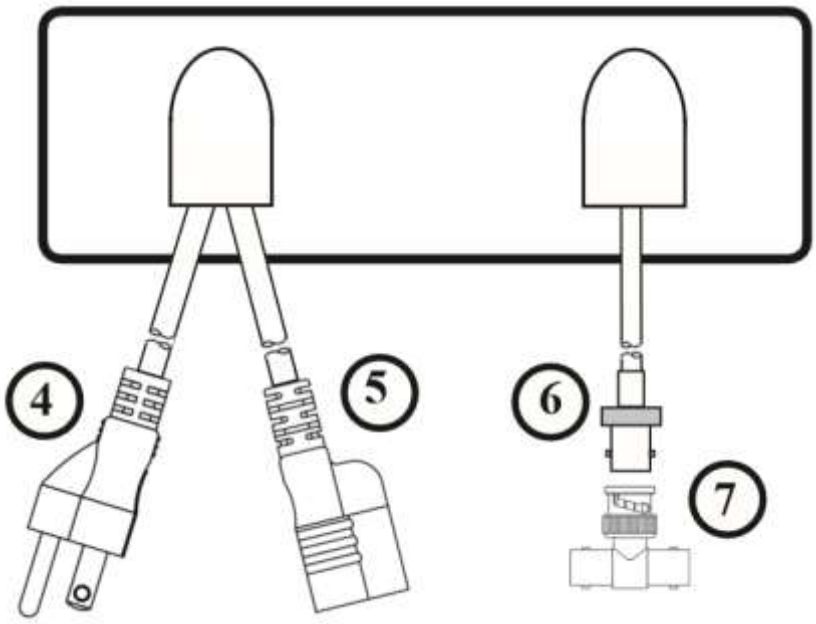
The environmental enclosure houses the controller and related components, and provides protection from the elements. The enclosure comes with mounting holes for wall, or bench-top mounting.



1. **ION Controller** – Monitors the signal from the ION and reference (pH) electrodes and activates the reagent pump as required.

2. **FUSE** – Accepts standard "MDL" ¼ in x 1 ¼ in fuse. A 4 amp fuse is supplied but should be replaced with a fuse sized to match the reagent pump. **8 amp max**

3. **On/Off Switch –** Switches power on/off off for the controller and reagent pump.



4. **Power Plug -** 8 foot power cord fits into a standard 115 VAC electrical outlet.
5. **Power Receptacle - "**Pigtail" outlet for powering the reagent pump.
6. **Coaxial cable -** 25 ft. coaxial cable with female BNC connector.
7. **Reference Adaptor Tee –** Both ION and reference electrodes connect to the tee. See section 2.2.2.

2.0 Installation

2.1 Mounting

The unit should be mounted in close proximity to the Thio-Red supply, reaction tank and electrical supply. When mounted as show in Figure 1 the control enclosure is rated for outdoor use, but a cool, dry, well-ventilated location is preferred. See separate mounting template sheet for mounting hole dimensions.

- The distance between the Control unit and the electrode cannot be more that 40 feet. If more distance is required then a preamplifier must be used.
- Do not mount the Control unit directly over the reaction tank. Chemical fumes may damage the unit.
- Electrical requirements: 115V 60Hz. An eight foot standard electrical cord is supplied. Please follow local building codes if this distance must be extended.

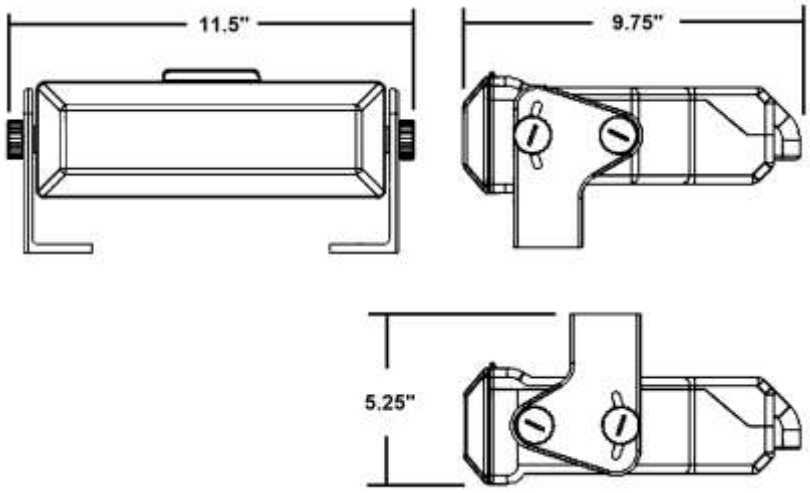


Figure 1 Unit Dimensions

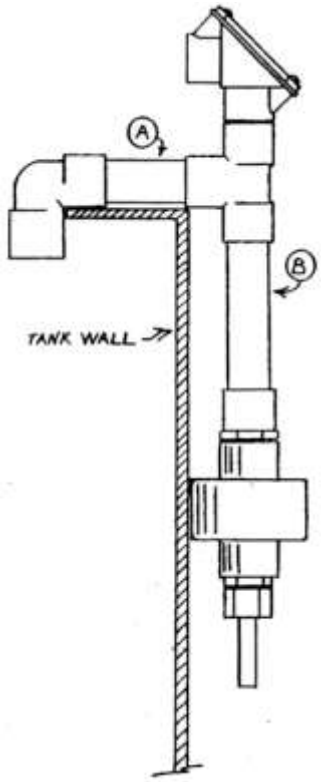
2.2 ELECTRODE INSTALLATION

The reference and Ion specific electrodes share a common reference. Therefore, they must be installed in close proximity of each other - preferably within 12 inches.

When the electrodes are installed in a tank, they must be placed in an area where the wastewater and reagent are well mixed. The electrodes are to be mounted so only the electrode body is in the solution and the connector above fluid levels.

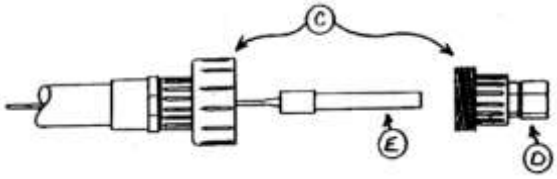
2.2.1 SUBMERIBLE ELECTRODE HOLDER

Two (2) submersible electrode holders are supplied with this system. One for holding the Ion Specific electrode and one for the reference (pH) electrode. To assemble the holders, use the ¾ inch Schedule 80 PVC pipe supplied, or longer lengths if required, to install the holder on the sidewall of the tank.



To assemble the electrode holder:

1. Cut PVC pipe (A) and (B) to fit.
2. Join pipe to fitting using PVC solvent glue



To install the electrode into the holder see the diagram above:

1. Disassemble Union (C)
2. Loosen gland nut (D) and insert the electrode (E) through the gland fitting.
3. Hand tighten the gland nut and thread the electrode cable through the piping.
4. Reassemble the union (C), checking that the O-ring is in place.

Figure 2 Submersible Electrode Holders

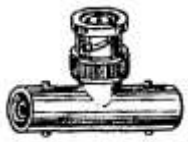
When the electrodes are to be installed in a piping manifold, gland-type holders (available from WST) are required to secure them. Care must be taken not to damage the electrodes when inserting them and tightening the gland.

The distance between the controller and electrodes should not exceed 40 feet.

2.2.2 ELECTRODE CONNECTIONS

Connect the BNC connectors on the electrode cables to the appropriate connections on the Reference Adaptor Tee. Confirm that the reference (pH) Electrode cable is connected to the hollow jack and the ION Specific Electrode cable is connected to the normal jack.

Connection to Coaxial Cable →



Connect Normal side to Ion Electrode → ← Connect Hollow side to pH/reference electrode

2.3 Thio-Red Precipitant Pump

The precipitant pump is powered by a standard receptacle "pigtail" found at the back of the control enclosure. This receptacle is switched on or off as necessary to activate the pump. Note: The fuse found on the front panel may need to be resized to fit the needs of your pump. (8 amp max.)

3.0 Operation

3.1 ION CONTROLLER CALIBRATION

This controller requires no field calibration. The ION controller displays the milivolt (mV) value received from the electrode.

3.2 CONTROLLER SET POINTS

The controller set points are application specific and must be verified often to ensure accurate process control. Setpoints will vary based on the concentration of metals to be treated, presence of oxidizers or reducers in the solution, etc. Initially jar testing should be used determine the best settings for your installation. As a guide we suggest you start with the values listed below. Adjustment should be made if underdosing or overdosing is encountered.

The Ion control unit is configured to lower the mV value of the solution. The Ion controller's Set Point 2 (P2.1) determines at what value the precipitant pump will activate and the hysteresis value (P2.3) determines when the precipitant pump will deactivate. Example, if the Ion controller's set point value was set at -150 and the hysteresis was set at 100, the precipitant pump would turn on for any reading of -150 or higher (more positive). The pump will continue to pump until the reading dropped down to -250 or less. The precipitant pump would turn back on when the reading rose above -150 again.

P1.0 Internal Relay One (Not Used)

P1.1 Set Point: 1000

P1.2 High/Low: High

P1.2 Hysteresis: 100

P2.0 Internal Relay Two (Precipitant Pump)

P2.1 Set Point: -150

P2.2 High/Low: High

P2.2 Hysteresis: 100

P3.0 Configuration

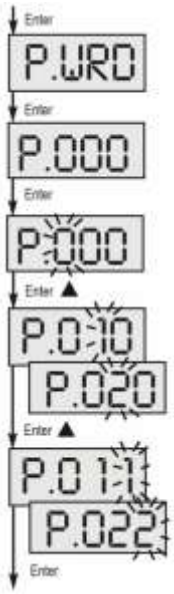
P3.1 Units: ORP

P3.2 Input Mode: Asymmetrical

P3.3 Temp. Comp: MTC

3.3 CONTROLLER ACCESS

See the separate controller manual a detailed walkthrough of changing the controller set points. For convenience a brief overview is supplied below.



To access the setup functions, you need to enter a password code. You cannot change setup parameters unless you first enter the password.

- Setup program password = 022.

To enter the password:

1. Press ENTER twice. The display reads "P.000". The first "0" is flashing.
2. Press ENTER again to leave the first digit "0" and to scroll to the next number.
3. Press the ▲ and ▼ keys to change the second digit to 2. Press ENTER.
4. Press the ▲ and ▼ keys to change the third digit to 2. Press ENTER. If you enter an incorrect digit, press MODE to back up.
5. Press ENTER again. You are now in Setup mode.

Press the ▲ or ▼ keys to display the various sub-menus. When a sub-menu item is displayed, press the ENTER key to enter that sub-menu. Press ▲/▼ together (ESCAPE) to leave Setup mode.

For example to change the setpoint values of internal relay two (P2).

1. Press the ▲ key once. The screen will scroll P2.0 and SP2. Press ENTER.
2. The screen will scroll P2.1, SP2, and then show the current set point value.
3. Press the ▲ and ▼ keys to adjust the first relay set point. You can adjust it in 001 increments from –999 to 1000 mV. Recommended starting value -150. Press ENTER.
4. The screen will scroll P2.2, SP2, and HIGH.
5. Press the ▲ and ▼ keys to toggle between LOW and HIGH. Note: this value should be HIGH. Press ENTER to confirm.
6. The screen will scroll P2.3, HYS2 and the current hysteresis value.
7. Press the ▲ and ▼ keys to adjust the hysteresis value. Recommended starting value 100. Press ENTER to confirm and return to general Setup mode.
8. Press ▲/▼ together to exit Setup mode and return to measurement mode.

4.0 Maintenance

4.1 ELECTRODES

To ensure accurate process control the Ion specific and reference (pH) electrodes must be properly installed and cleaned daily.

Daily cleaning should be done by rinsing both electrodes with tap water and gently wiping them with a clean soft tissue. Periodically a more thorough cleaning is required as described below.

The life of the electrodes will be increased if they are kept wet at all times. If the system is to remain idle for more than one day, remove the electrodes from their holders and immerse both electrodes in a beaker of tap water. DO NOT use deionized water. Deionized water will reduce the life of the reference electrode.

4.1.1 PERIODIC CLEANING PROCEDURE

ION SPECIFIC ELECTRODE

The metal surface at the tip of the Ion electrode should appear clean and shiny. If the metal tip appears dull use the following procedure to clean the electrode.

To Renew The Electrode:

Materials required: alumina abrasive and a polishing cloth.

A. First polish the face with alumina on a wetted polishing cloth by moistening the cloth with water and placing a small amount (approx. 0.1 gram) of alumina powder on the surface of the polishing cloth. The cloth retains just enough of the moisture to form a polishing paste of the correct consistency.

B. Grasping the electrode as you would a pen, press firmly down flush onto the polishing cloth and move the electrode over the surface of the cloth in a circular motion, making 5 or 6 rapid circles. Then rotate the electrode 180° with your thumb and index finger and repeat. The entire surface of the metal face should now be polished.

C. Rinse with water and blot dry with a soft wipe.

REFERENCE (PH) ELECTRODE

REFERENCE (pH) ELECTRODES MUST REMAIN WET AT ALL TIMES, DEHYDRATION WILL CAUSE INACCURACY AND SHORTENED LIFE.

If a reference (pH) electrode is unresponsive or was allowed to dehydrate, soaking it in a pH 4 buffer solution for 12-36 hours may return it to life. If normal function is still not restored, replace the electrode. Normal electrode life is 6-12 months. At least one spare electrode should be kept in stock at all times.

4.1.2 CHECKING ELECTRODE RESPONSE

The following procedure can be used to check if the electrodes are working correctly:

1. After cleaning the electrodes place both electrodes in a glass of tap water. The display on the controller/indicator should indicate a slightly positive (+) reading.

2. Add precipitant to the water drop-by-drop and stir. The display should slowly drop in value as the metals and oxidizers in the water are consumed then quickly drop to a large negative (-) value. If not -- proceed with the periodic cleaning procedure described above.

3. After cleaning, repeat the response check procedures (1 and 2 above).

If the electrodes fail to respond, proceed with the following check list:

- Check all electrode cables and connections. Insure that the electrodes are attached correctly to the adaptor tee (see section 2.2.2).

- Replace the reference (pH) electrode only and repeat the above procedure (1 and 2).

- Replace the Ion specific electrode only and repeat the above procedure (1 and 2).

- Replace both electrodes.

4.1.2 DRIFT

The electrodes furnished with this system must be kept clean to insure proper operation and satisfactory performance. In particular -- a dirty or defective pH/reference electrode will cause failure in the system.

The controller uses the pH/reference electrode as a foundation or reference to compare to the signal from the Ion electrode. If the reference is weak or missing the controller's reading will drift or even go off scale. Some drift is normal, but if the reading continually drifts in one direction, inspect and clean the electrodes. If drifting persists replacement of the pH/reference electrode is required.

5.0 GENERAL INFORMATION

The purpose of this manual is to provide information and procedures for installing, operating, maintaining, and servicing the ION SPECIFIC PRECIPITANT CONTROL SYSTEM. Personnel concerned with these functions should study this manual carefully to ensure that correct procedures are followed and safety precautions are observed.

General Safety
The system contains a high voltage electrical system, chemical reagents, and potential hazardous wastes. Personnel who operate, maintain, or service this system must exercise caution while performing these functions. Careful study of this manual will alert the operator(s) to conditions and/or procedures which require special attention.

Safety Equipment
Due to potential exposure to reagents, process chemicals, and other potentially harmful substances, system operators should make safety gloves, aprons, eye protection, and breathing protection part of their standard equipment.

When exposure to hazardous substances is a potential risk, worker safety can be greatly enhanced by the installation of (1) an Emergency Instant Action Safety Shower, (2) Emergency Eye Wash Station, (3) Fire extinguisher, (4) complete First Aid Kit and (5) H2S Gas Monitor/Alarm.

Ventilation/Exhaust
For safety reasons and to prevent exposure of personnel to potentially harmful chemical fumes, all operations involving the storage or use of chemicals must be performed in a well ventilated area. This includes the location of tanks for holding untreated wastewaters, chemical storage tanks and drums, and the location of equipment for treating wastewaters.
IN ADDITION, FOR INDOOR OPERATIONS, A VACUUM EXHAUST SYSTEM IS REQUIRED TO ENSURE THE REMOVAL OF ANY HARMFUL CHEMICAL FUMES THAT MAY BE GENERATED BY CHEMICAL REACTIONS.

Process Chemicals
All wastewater influents, reagents, and effluents are potentially corrosive and reactive. Handle drums, pumps, supply lines, and discharge lines carefully. Always wear safety gloves, aprons, and eye protection. Minimize exposed skin by wearing long sleeves, and trousers long enough to cover shoe tops. Remain alert to both liquid and gaseous chemical hazards. Do not store reagents near acids or other process chemicals. In the event of light contact, flush exposed skin with clean water, and continue until certain of thorough removal. If contact is severe, continue until emergency assistance arrives.

Hydrogen Sulfide Gas
When sulfide-based reagents are utilized, hydrogen sulfide gas (H2S) can be generated if the reagent is accidentally combined with an acid or strongly acidic solution. Limited concentrations of hydrogen sulfide gas can damage sensitized materials, and sufficient concentrations are toxic to humans. The gas has a characteristic "rotten egg" odor, but may not be detectable by odor, since prolonged or high exposure can disable the sense of smell. The Time Weighted Average (TWA) for exposure with no adverse effects is 10 ppm for a normal, 40-hour week of 8-hour days. Current OSHA limits are 20 ppm (50 ppm maximum for
10 minutes. An H2S monitor/alarm, installed near the treatment area, will sense the presence of H2S gas and alert the operator.

Electrical Safety
In addition to the basic principles of safe maintenance and service -- consult local building and electrical codes. Know the location of main breakers and other emergency disconnects. Ensure that replacement parts and wiring are new, and of proper capacity. If the condition of a repaired part or harness is in doubt, replace it. Confirm mainframe grounding of components and earth grounding of the mainframe. Work with power OFF. Keep in mind that this system combines electronic, electromechanical, and fluid systems which MUST be kept segregated.

Cardio-Pulmonary Resuscitation (CPR)
Chemical processing equipment operators and technicians are exposed to potential inhalation and shock hazards. Site personnel can contribute to the safety of fellow workers by learning to perform CPR.

WARRANTY AND REPAIR SERVICE

WST warrants Reagent Control Systems for a period of six (6) months from date of installation against all defects in material and workmanship. This warranty does not apply to the electrodes and abuse or misuse of the system. If repair or adjustments are required, please obtain return authorization from the factory and return the system freight prepaid. Systems within warranty will be repaired at no charge. Make sure that the system is properly packaged and insured against possible damage in shipment.