WALCHEM
IWAKI America Inc.

WALCHEM LINEAR POLARIZATION RESISTANCE CORROSION SENSORS

LPR Corrosion Sensor Troubleshooting Guide

Installation requirements:

• If the electrodes aren't complete submerged with constant flow and pressure the results will be poor.

• Position the sensor such that a fresh, representative sample of the solution is available.

• Position the sensor such that air bubbles will not be trapped within the sensing area.

• Position the sensor where sediment will not accumulate within the sensing area.

• Do not use the sensor if oil is present in the sample.

• In-line mounted sensors must be situated so that the tee is always full of water and the sensors are never subjected to a drop in water level resulting in dryness. Please see the diagram further down in this guide.

• Maximum cable length 100 feet (30 m)

• Pressure 0-150 psi (0-10 bar)

• Temperature 32-158 °F (0-70 °C)

Guardrails:

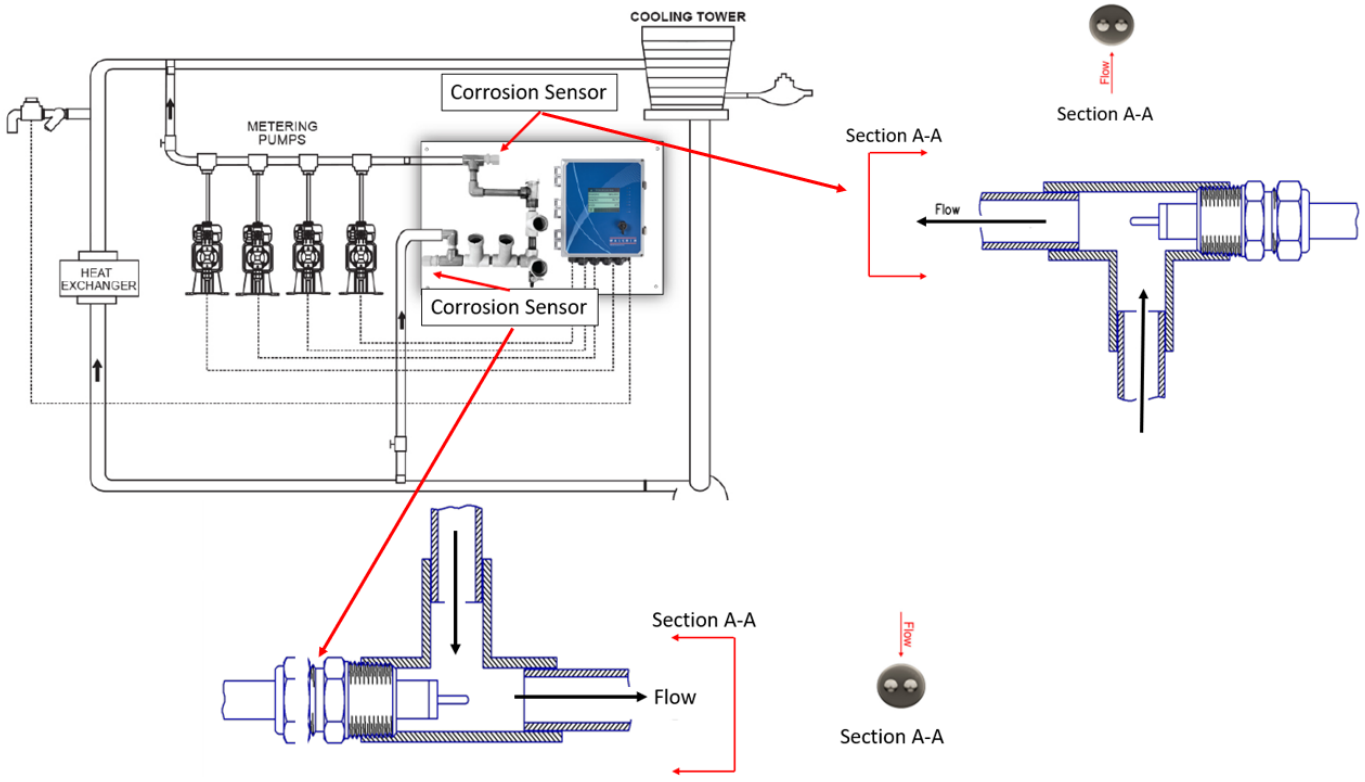
A minimum flow of 1.5 gallon per minute (5.7 liters per minute) with an ideal flow rate of 5 gpm (19 lpm) through the flow switch manifold.

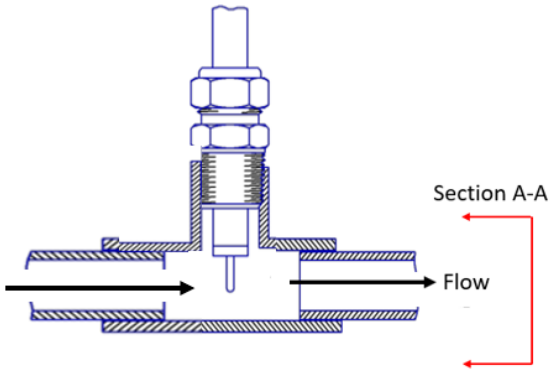
The sensor should be mounted horizontally. The sensor should ideally be installed in the side branch of a 1" or ¾" tee, with the flow entering the tee through one branch and flowing away from the base of the sensor, towards the tips of the electrodes. The sensor is marked with a notch so that the electrodes can be aligned such that they each see equal flow.

The most important considerations are that the entire electrode sees the same flow conditions, and that the two electrodes see the same conditions as each other. It is valid to insert electrodes into a pipe and they are completely perpendicular to the flow. You can mount them this way, however, it is difficult to line electrodes up correctly and to insert the sensor at the same depth each time. If the water level does not get to the base of the electrode, false high imbalance readings can occur. Please see our recommended installation below.

The most important thing is to be consistent in flow velocity, direction, and electrode orientation so that both electrodes see identical environments.

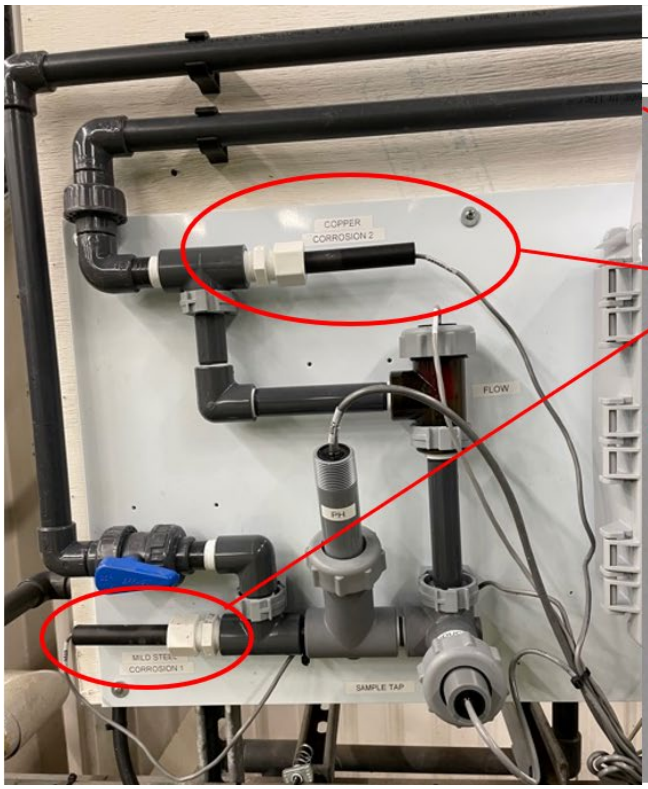
Installation Diagram



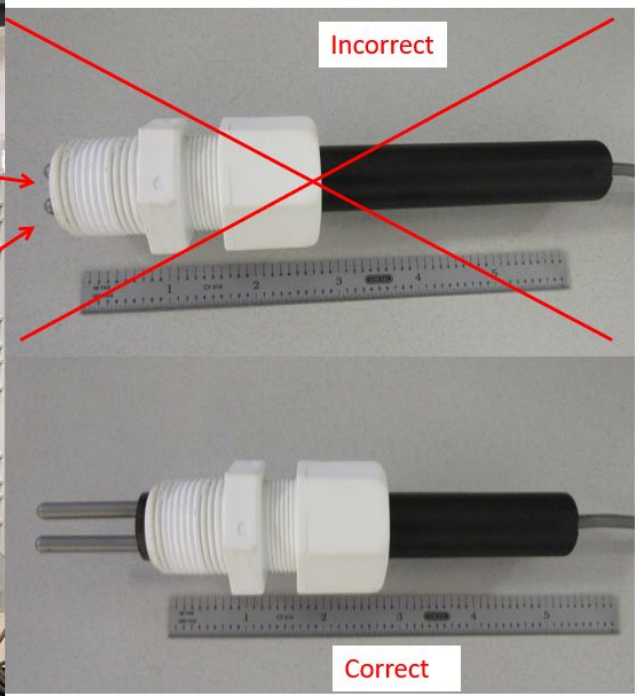


Sensor Installed Perpendicular to Flow

Section A-A



Make sure the sensor is inserted into the tee the proper depth.



Photos:

Photos of the manifold/plumbing with the corrosion sensors installed can be very helpful. Photos of the electrodes are also helpful to see if they are coated or pitted.

Program the Controller:

Go into the Inputs Menu, then enter the Corrosion Sensor Input Menu.

Stabilization time: The sensor takes some time for the electrodes to acclimate to the sample water. It reads high for some amount of time. How long it takes to get a good reading from the sensor depends upon the application, possibly 2-3 days. The time will be shorter if the electrodes are pretreated in water with inhibitor in it. At the first installation at a site, set to 0, then set it to the actual time required for when the electrodes get changed again.

Electrode Alarm: This is a reminder to change the electrodes. The amount of time they last depends upon the corrosion conditions for the installed process. Some customers want to change them on a regular schedule no matter what, typically 90 days.

Cal Required Alarm: This is a reminder to calibrate the input. A calibration is typically unnecessary, and a setting of 0 disables this reminder. It is possible to shift the reading to match a coupon if desired.

Smoothing Factor: The smoothing factor slows down the response of the input to changes. Since the corrosion reading typically changes slowly this is normally set to 0.

Alloy Multiplier: Set this to the correct value from the chart for the electrode material installed.

Alloy Multipliers

These values are based on using standard corrosion electrodes with 5 cm2 surface area.

Material	Multiplier	UNS Code
Carbon Steel	1.00	K03005
Copper 110 ETP	2.00	C11000
Admiralty Brass	1.67	C44300
Aluminum 1100	0.94	A91100
Aluminum 2024	0.88	A92024
Phosphorized Admiralty Brass	1.68	C44500
Aluminum Silicon Bronze	1.48	C64200

Aluminum Brass	1.62	C68700
Copper/Nickel 90/10	1.80	C70610
Copper/Nickel 70/30	1.50	C71500
AISI 4130 Alloy Steel	1.00	G41300
Lead	2.57	L50045
Monel 400 Nickel	1.13	N04400
Monel K500 Nickel	1.04	N05500
Hastelloy C22	0.85	N06022
Inconel 600 Nickel	0.95	N06600
Incoloy Alloy 20	0.98	N08020
Incoloy Alloy 800	0.89	N08800
Incoloy Alloy 825	0.88	N08825
Hastelloy C276	0.86	N10276
Titanium Grade 2	0.75	R50400
304 Stainless Steel	0.89	S30400
316 Stainless Steel	0.90	S31600
2205 Duplex Stainless Steel	0.89	S31803
2507 Super Duplex Stainless Steel	0.88	S32750
Zinc	1.29	Z17001

Cycle Time: The longest time will give the most accurate results. The shortest time will give the fastest reaction time to an upset. Since conditions in a cooling tower don't change quickly, 20 minutes is a typical choice.

Range: The range is just used to set the decimal places for the display and sets the point at which a high range alarm occurs. Set this to a value slightly higher than the expected corrosion rate.

Guidance on Replacing Electrodes and How to Condition Them:

The electrodes will need to be replaced periodically when they too heavily corroded, pitted or coated. When in doubt, it is better to replace electrodes than to try to clean. The expected life of the electrodes is dependent upon conditions in the process.

After replacing the electrodes, press "Replace Corrosion Electrode" to reset the timers for the Electrode Alarm (the reminder to change electrodes) and the Stabilization Time (locks out control during the initial period of high readings while the electrodes acclimate to the process). Adjust the settings of these timers based on your experiences with the past set of electrodes if necessary.

Automatic Circuit Tests

The controller automatically checks the circuit and wiring for any problems and will display an alarm message if the test fails.

To see the results of past test, download the System Log (Config Menu/File Utilities/Export System Log). Below is an example of the messages for a controller with two corrosion sensors installed:

06-Mar-2018 11:21:28 - IO_2_DRIVER_TGT - INFORMATION - Sensor (S21) Corrosion Circuit Self-Test completed: Success ! (34.2°C)

06-Mar-2018 11:21:28 - IO_2_DRIVER_TGT - INFORMATION - Results: ADC offset = 4.08142e06, gain = 1.00, dac_40mv_count = 50027, Rs = 101.445, Rp = 169.477

06-Mar-2018 11:34:11 - IO_2_DRIVER_TGT - INFORMATION - Sensor (S23) Corrosion Circuit Self-Test completed: Success ! (34.2°C)

06-Mar-2018 11:34:11 - IO_2_DRIVER_TGT - INFORMATION - Results: ADC offset = 4.08126e06, gain = 1.00, dac_40mv_count = 50005, Rs = 111.219, Rp = 152.079

The Corrosion board can detect if the electrode holder is wired correctly or not.

In the System Log **Rs** and **Rp** numbers are displayed for each test.

Rs is the solution resistance and **Rp** is the polarization resistance. The **Rp** is the basis for the LPR measurement. High resistance means low conductivity and low resistance means high conductivity.

If there are 2 corrosion sensors installed in the same manifold/system piping, then when comparing the **Rs** values, they should be nearly the same. This means the corrosion board is measuring the solution conductivity the same for each sensor. This indicates both corrosion measurements are working properly.

Very high **Rp** numbers indicates very low levels of corrosion.

Datalogs:

To help troubleshooting, download some datalogs to see if they reveal anything. Go to the Config menu/File Utilities and download the 1 day, 10 second logging interval log, and then download the 1 week, 2 minute logging interval log.

The conductivity readings should be close to the inverse of the Rs numbers in the system log.

Low ORP and high pH normally correlate to low corrosion.

High imbalance tends to indicate that there are high levels of pitting corrosion occurring in this water.