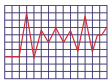


PULSE INSTRUMENTS

Disinfection Sensors Instruction Manual

pulseinstruments.net

Notice

3233 Mission Oaks Blvd Unit P, Camarillo, CA 93012 USA
(800) 462-1926

Proprietary Material

Statement of Limited Warranty

PULSE warrants equipment of its manufacture, and bearing its identification to be free from defects in workmanship and material for a period of 12 months for electronics and 12 months for mechanical parts and electrodes from date of delivery from the factory or authorized distributor under normal use and service and otherwise when such equipment is used in accordance with instructions furnished by PULSE and for the purposes disclosed in writing at the time of purchase, if any. PULSE's liability under this warranty shall be limited to replacement or repair, F.O.B. Camarillo, CA, U.S.A. of any defective equipment or part which, having been returned to PULSE, transportation charges prepaid, has been inspected and determined by PULSE to be defective. Replaceable elastomeric parts and glass components are expendable and are not covered by any warranty.

THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EITHER EXPRESS OR IMPLIED, AS TO DESCRIPTION, QUALITY, MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR USE, OR ANY OTHER MATTER

P/N 180307.AD
December 2022

Table of Contents

1.0 Introduction

The Pulse Instruments disinfection sensors consist of an amperometric sensor assembly and a flow cell. Assembly of these parts is required, so please read these instructions carefully. The sensor is capable of measuring the disinfectant in clean water or in water contaminated with debris thanks to our unique flow cell design.

Pulse Instruments controllers with amperometric chlorine sensors can be used for reporting chlorine residual measurements in accordance with EPA Method 334.0.

Sensor

The sensor assembly includes the sensor body, a replaceable membrane cap, a 100-ml bottle of electrolyte fill solution, and special abrasive paper. Make sure that all parts are included.

The oxidizer molecules diffuse through the membrane and in the acidic environment of the electrolyte fill solution, a redox reaction occurs at the electrodes in the sensor. The current generated by this reaction is converted to a robust voltage signal that is linear with the concentration of the oxidizer.

Flow Cell

The flow cell consists of a translucent flow cell body, mounting nut and o-ring, washer set and o-ring. Make sure that all parts are included.

The flow cell is required to prevent bubble formation on the membrane and to provide proper flow velocity across the face of the membrane. The sensor will not read accurately if it is not installed in the flow cell, with a flow rate between 30 and 100 liters per hour, at a steady operating pressure below the rated maximum pressure for the specific model sensor. The ¼" adapter must NOT be removed from the flow cell.

2.0 Installation

Assembling the Sensor

CAUTION: Wear gloves and safety glasses during assembly of the sensor since the electrolyte is a STRONG ACID. It is recommended to perform this operation over a sink with running water available. After using, re-cap any remaining electrolyte and store the bottle upside-down until the next use.

Standard Free Chlorine/Bromine Sensors

1. The sensor is delivered with the membrane cap loosely screwed on the electrode shaft. Pull the transparent protection cap off the membrane cap and unscrew the membrane cap. Never touch the membrane itself.

2. Fill the membrane cap to the top with the electrolyte fill solution. Never shake the electrolyte bottle, it must stay free of bubbles!

3. Clean just the tip of the working electrode with the special abrasive paper supplied. Avoid touching the electrodes! Place the special abrasive paper on top of a clean paper towel and rub the electrode tip over the abrasive paper, holding the electrode at a slight angle Repeat several times at different angles. Never touch or clean the brown electrode shaft.

4. Hold the sensor body vertically with the tip pointing down and SLOWLY screw on the membrane cap, making sure not to hold the membrane cap at the rubber band, until it is hand tight. **Be prepared for some electrolyte solution to squeeze out from the vent hole under the rubber band on the cap.**

5. Rinse your hands, the sensor, and all surfaces contaminated with electrolyte solution with running water. Check the sensor for leaks, especially at the membrane and the membrane cap threads. If any leaks are detected, tighten the membrane cap or replace it.

6. Push the cable onto the end of the sensor, aligning the pins with the holes. Turn the connector until hand tight to seal the cable connection.

Hydrogen Peroxide Sensors

1. The sensor is delivered with the membrane cap loosely screwed on the electrode shaft. Pull the transparent protection cap off the membrane cap and unscrew the membrane cap. Never touch the membrane itself.

2. Place the membrane cap onto a clean hard surface. Fill the membrane cap up to the top with the enclosed electrolyte.

3. Place the G-Holder on a clean hard surface with the fabric facing down and wet it with electrolyte.

4. Lift the G-Holder which is moisturized with electrolyte with the supplied tweezers. Insert the G-holder, fabric side down, in the filled membrane cap. Let it down until the G-holder is held by the indentation in the middle of the membrane cap. Then remove the tweezers carefully. The G-holder stays in the membrane cap.

5. Clean just the tip of the working electrode with the special abrasive paper supplied. Avoid touching the electrodes! Place the special abrasive paper on top of a clean paper towel and rub the electrode tip over the abrasive paper, holding the electrode at a slight angle Repeat several times at different angles. Never touch or clean the brown electrode shaft.

6. Holding the electrode shaft upright, place it onto the filled membrane cap with the mounted G-holder. You may have to turn it counter-clockwise first until the thread catches. Then screw the electrode shaft (manually) slowly clockwise into the membrane cap. **Be prepared for some electrolyte solution to squeeze out from the cap.**

7. Rinse your hands, the sensor, and all surfaces contaminated with electrolyte solution with running water. Check the sensor for leaks, especially at the membrane and the membrane cap threads. If any leaks are detected, tighten the membrane cap or replace it.

8. Push the cable onto the end of the sensor, aligning the pins with the holes. Turn the connector until hand tight to seal the cable connection.

Chlorine Dioxide and Ozone Sensors

1. The sensor is delivered with the membrane cap loosely screwed on the electrode shaft. Pull the transparent protection cap off the membrane cap and unscrew the membrane cap. Never touch the membrane itself.

2. Place the membrane cap onto a clean hard surface. Fill the membrane cap up to the top with the enclosed electrolyte.

3. Clean just the tip of the working electrode with the special abrasive paper supplied. Avoid touching the electrodes! Place the special abrasive paper on top of a clean paper towel and rub the electrode tip over the abrasive paper, holding the electrode at a slight angle Repeat several times at different angles. Never touch or clean the brown electrode shaft.

4. Holding the electrode shaft upright, place it onto the filled membrane cap. You may have to turn it counter-clockwise first until the thread catches. Then screw the electrode shaft (manually) slowly clockwise into the membrane cap. **Be prepared for some electrolyte solution to squeeze out from the cap.**

5. Rinse your hands, the sensor, and all surfaces contaminated with electrolyte solution with running water. Check the sensor for leaks, especially at the membrane and the membrane cap threads. If any leaks are detected, tighten the membrane cap or replace it.

6. Push the cable onto the end of the sensor, aligning the pins with the holes. Turn the connector until hand tight to seal the cable connection.

Other Sensors

1. The sensor is delivered with the membrane cap loosely screwed on the electrode shaft. Pull the transparent protection cap off the membrane cap and unscrew the membrane cap. Never touch the membrane itself.
2. Fill the membrane cap to the top with the electrolyte fill solution. Never shake the electrolyte bottle, it must stay free of bubbles!
3. Clean just the tip of the working electrode with the special abrasive paper supplied. Avoid touching the electrodes! Place the special abrasive paper on top of a clean paper towel and rub the electrode tip over the abrasive paper, holding the electrode at a slight angle Repeat several times at different angles. Never touch or clean the brown electrode shaft.
4. Hold the sensor body vertically with the tip pointing down and SLOWLY screw on the membrane cap, making sure not to hold the membrane cap at the rubber band, until it is hand tight. **Be prepared for some electrolyte solution to squeeze out from the vent hole under the rubber band on the cap.**
5. Rinse your hands, the sensor, and all surfaces contaminated with electrolyte solution with running water. Check the sensor for leaks, especially at the membrane and the membrane cap threads. If any leaks are detected, tighten the membrane cap or replace it.
6. Push the cable onto the end of the sensor, aligning the pins with the holes. Turn the connector until hand tight to seal the cable connection.

Flow Cell Placement

Instructions for mounting the sensor into the process can vary greatly with the circumstances that are encountered in your application. Here are some general guidelines to assist you. Refer also to the typical installation drawings.

The sensor should be mounted such that the measuring surfaces will always stay wet. If the membrane dries out, it will respond slowly to changing disinfectant values for 24 hours, and if dried out repeatedly, will fail prematurely. **If the sensor is left dry for longer than 24 hours, the membrane cap must be replaced!**

The flow cell should be placed on the discharge side of a circulation pump or downhill from a gravity feed. Flow into the cell must come from the

bottom side that has the ¾" x ¼" NPT reducing bushing installed. **The reducing bushing provides the flow velocity required for accurate readings and must not be removed!**

A "U" trap should be installed so that if the flow stops, the sensor is still immersed in the water. The outlet of the flow cell must be plumbed to open atmosphere unless the system pressure is at or below the maximum rated pressure of the sensor. If the flow through the line cannot be stopped to allow for cleaning and calibration of the sensor, then it should be placed in a by-pass line with isolation valves to allow for sensor removal. Install the sensor vertically, with the measuring surface pointing down, at least 5 degrees above horizontal. (Refer to Installation drawings)

Flow rate regulation must be done upstream from the sensor, because any flow restriction downstream can increase the pressure above the maximum rated pressure of the sensor and damage the membrane cap!

The sensor should be installed in an area where there is good solution movement and where it will respond rapidly to chemical additions. The placement of the sensor relative to the placement of chemical replenishment, along with the quality of the mixing, and the replenishment chemical flow rate are critical to accurate process control.

To avoid biological growth on the membrane, which can block measurement, never leave the sensor in water without oxidant for longer than 24 hours.

Installing Sensor into Flow Cell

1. Assemble the flow cell as shown below from the top down. The reducer should already be installed in the flow cell body.

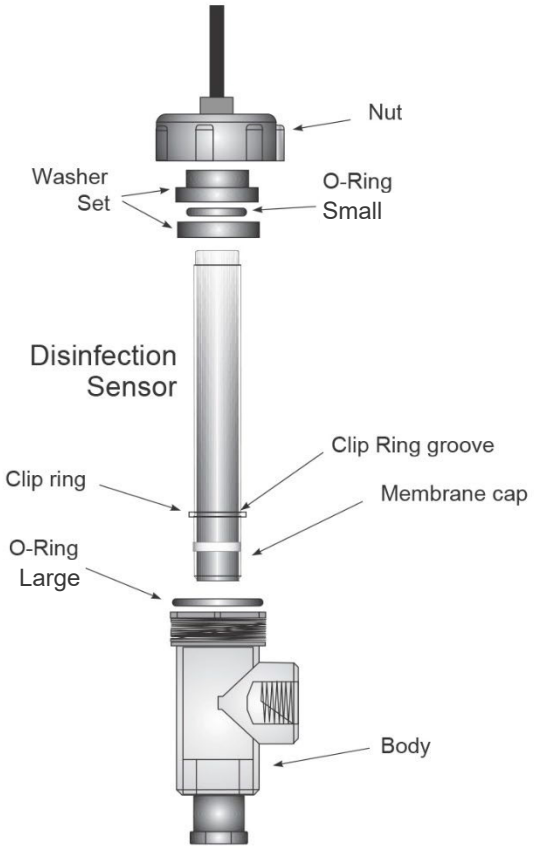
2. Slide the bottom washer (concave side up) over the cable end of the sensor, followed by the small O-ring, followed by the top washer (concave side down), followed by the nut.

3. Place the large O-ring in the top o-ring groove of the flow cell body.

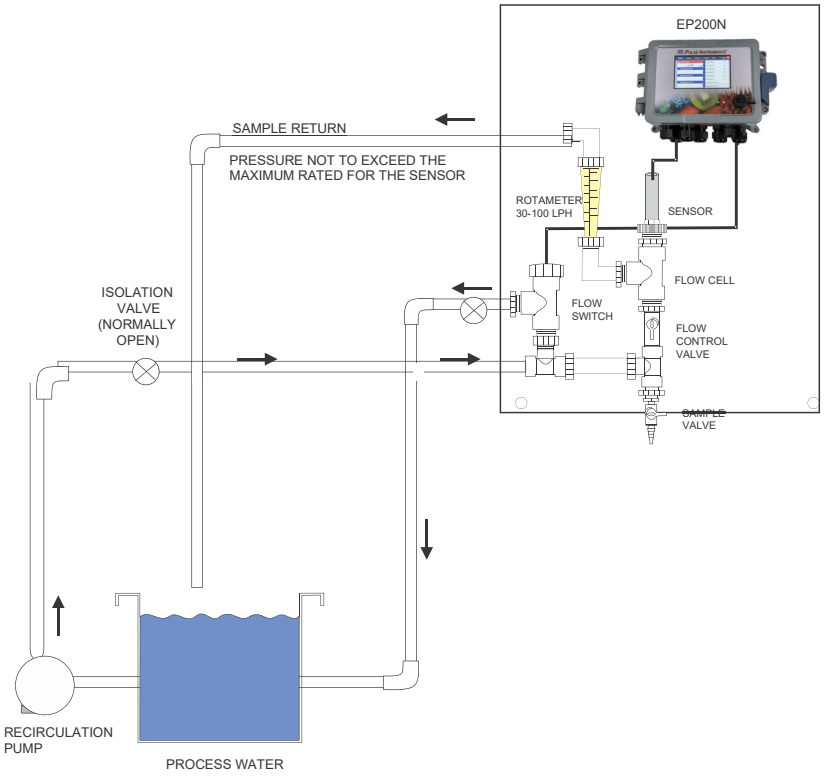
4. Place the sensor body into the flow cell body, and tighten the nut until it is hand-tight. Before tightening completely, pull the sensor up until the clip ring is up against the bottom washer.

5. Many models are 3-electrode sensors, and the steel electrode around the sensor body must be immersed in the sample.

Sensor Parts Exploded View



Typical Installation



3.0 Operation

This section describes how to prepare the sensor for use.

Conditioning

The sensor requires conditioning to acclimate the electrodes prior to generating stable readings. Conditioning consists of installing the sensor in the flow cell, ensuring that the sensor remains wet at all times with water containing the disinfectant to be measured, and supplying power to the sensor.

The following conditioning times are recommended:
New Sensor: 1 – 24 hours (see specifications in section 6.0)

Calibration

The frequency of calibration is a function of many factors. These factors include:

1. The accuracy required by the application.
2. The value of the off-specification product versus the cost of calibration.
3. The coating or abrasive nature of the application.
4. The stability of the sensor and controller as a system.

The frequency of calibration is really determined by experience. At a new installation, calibration might initially be checked every day by comparing the controller reading to a DPD test or other manual analysis and logging the results. If the reading drifts off significantly in one direction you should consider calibrating. Resist the temptation to calibrate to correct for small errors that may be a result of normal variations in the test methods.

A calibration MUST be performed on initial installation, or after cleaning or replacing the membrane or electrolyte. A sensor installed in clean water can hold its calibration for several months.

DO NOT attempt to perform a calibration until the following conditions have been met:

1. The sensor has been conditioned as described above.
2. The sensor has equilibrated to the temperature of the water (for the zero calibration) or the sample (for the 1 point process calibration).

Zero Calibration

1. Remove the sensor from the flow cell and place it in a beaker of clean, oxidizer-free water.
2. Allow the sensor 15 minutes to equilibrate to the water temperature.
3. Go to the Zero Calibration menu of the controller. Refer to the controller instructions.
4. Stir the water with the sensor until the mV reading is stable for at least 5 minutes.
5. When the reading is stable, continue to the final steps of the calibration.
6. Return the sensor to the flow cell and check for leaks.

One Point Process Calibration

1. Ensure that the sensor is conditioned and equilibrated to the temperature of the sample.
2. Ensure that the sample flow rate is between 30 and 100 liters/hour.
3. Perform a DPD test or other manual analysis on the sample water.
4. Go to the One Point Process Calibration menu of the controller. Refer to the controller instructions.
5. When the reading is stable, continue to the final steps of the calibration.

NOTE: Disinfectant concentration can change rapidly in the sample! Minimize the time between performing the DPD test or manual analysis and finishing the calibration!

4.0 Troubleshooting

The disinfectant reading is much lower than the manual analysis

Possible Causes	Corrective Actions
Insufficient conditioning	Wait for the appropriate amount of time before attempting a calibration.
Insufficient sample flow	Increase flow rate to between 30 and 100 liter per hour.
Air bubbles on membrane	Dislodge bubbles. Adjust flow rate higher if necessary.
Counter electrode dry	Ensure counter electrode is in water
Dirty membrane	Clean membrane
Loose membrane cap	Tighten membrane cap.
Faulty membrane	Replace membrane cap.
High Pressure	Reduce pressure to below rated maximum for the sensor and refill cap with electrolyte
No electrolyte fill solution in membrane cap	Fill membrane cap with electrolyte. Replace membrane cap if it will not hold solution.
Faulty sensor	Replace sensor
Faulty analysis equipment or reagents	Consult test equipment instructions

The disinfectant reading is much higher than the manual analysis

Possible Causes	Corrective Actions
Insufficient conditioning	Wait for the appropriate amount of time before attempting a calibration.
Faulty membrane	Replace membrane cap.
Faulty sensor	Replace sensor
Faulty analysis equipment or reagents	Consult test equipment instructions
Sample contaminated with interfering molecule (refer to Sensitivity specification in Section 6)	Remove source of contamination

Sensor Error

This error message appears if the signal from the sensor is outside the range of –1400 to 1400 mVDC (EP500) or -2560 to 60 mV (EP200, EP1000)

Possible Causes	Corrective Actions
Faulty wiring	Check wiring
Faulty sensor	Replace sensor
Faulty controller sensor input (EP500)	Go to the Sensor Input menu and perform a self test. If this passes, then the problem is with the sensor or its wiring. If it fails, then disconnect the sensor from the circuit board and try the self test again. If it still fails, replace the circuit board.
Faulty controller sensor input (EP200, EP1000)	The controller will report Sensor Fault in the alarm menu. Replace the circuit board.

Disinfectant Reading is Unstable

Possible Causes	Corrective Actions
Air bubbles on membrane	Dislodge bubbles. Adjust flow rate higher if necessary.
Air bubbles in electrolyte	Refill membrane cap with electrolyte.
Fluctuating flow rate	Provide stable flow rate
Fluctuating pressure	Provide stable pressure in the recommended range for the sensor
Faulty membrane	Replace membrane cap.
Faulty wiring	Check wiring

Faulty controller sensor input (EP500)	Go to the Sensor Input menu and perform a self test. If this passes, then the problem is with the sensor or its wiring. If it fails, then disconnect the sensor from the circuit board and try the self test again. If it still fails, replace the circuit board.
Faulty controller sensor input (EP200, EP1000)	The controller will report Sensor Fault in the alarm menu. Replace the circuit board.

Calibration Failure

For EP500

The controller will display a calibration failure if the offset calculated in the Zero Calibration is outside of the range –20 to 40 mV or the slope (mV/ppm) calculated in the One Point Process Calibration is outside of the range of the nominal mV per 0.1 to 2.0 ppm.

For EP200, EP1000:

The calibration will fail if the adjustment to the gain is outside of 0.2 to 10.0, or if the calculated offset is outside of -40 to 40 mV.

To calculate the nominal slope for your sensor, divide the high end of the nominal range by -2000. For example, for a 0-20 ppm sensor, the nominal slope is -2000/20 = -100 mV/ppm.

Possible Causes	Corrective Actions
Insufficient conditioning	Wait for the appropriate amount of time before attempting a calibration.
Insufficient sample flow	Increase flow rate to between 30 and 100 liters per hour
Air bubbles on membrane	Dislodge bubbles. Adjust flow rate higher if necessary.
Dirty membrane	Clean membrane
Faulty membrane	Replace membrane cap.
High Pressure	Reduce pressure to below the maximum rated pressure for the sensor and refill cap with electrolyte
No electrolyte fill solution in membrane cap	Fill membrane cap with electrolyte. Replace membrane cap if it will not hold solution.
Faulty sensor	Replace sensor
Faulty analysis equipment or reagents	Consult test equipment instructions
Sample contaminated with interfering molecule (refer to Sensitivity specification in section 6.0)	Remove source of contamination
Faulty wiring	Check wiring
Faulty controller sensor input (EP500)	Go to the Sensor Input menu and perform a self test. If this passes, then the problem is with the sensor or its wiring. If it fails, then disconnect the sensor from the circuit board and try the self test again. If it still fails, replace the circuit board.
Faulty controller sensor input (EP200, EP1000)	The controller will report Sensor Fault in the alarm menu. Replace the circuit board.

5.0 Maintenance

The sections below describe how to clean and replace the membrane cap and electrolyte solution, and also how to store the sensor when not in use.

See section 4.0 Troubleshooting for assistance in determining when maintenance may be required.

Cleaning the Membrane

Instructions for cleaning the membrane vary depending upon the type of contamination. Follow the directions for replacing the membrane shown below, replacing step 3 with one of these cleaning methods:

For general deposits:
Rinse in clear cold water.

For calcium scale:
Soak in dilute (1% by volume) hydrochloric acid, then rinse in clear cold water.

For oils:
Rinse in isopropyl alcohol.
DO NOT use cleaners or detergents containing surfactants on the standard free chlorine/bromine sensor membrane, as these will reduce the life of the membrane.

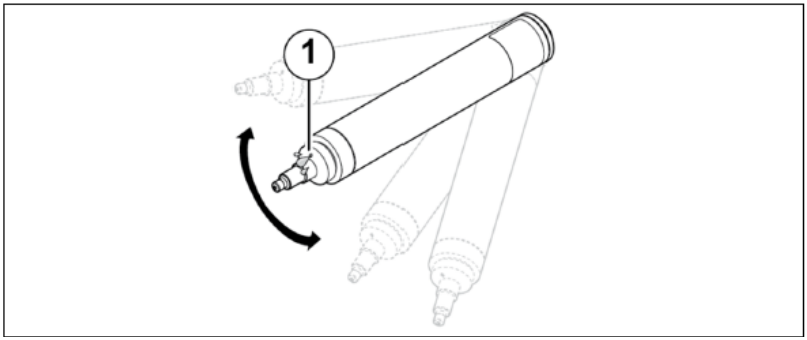
If the sensor still cannot be calibrated after cleaning, replace the membrane cap as described below.

Replacing the Membrane

CAUTION: Wear gloves and safety glasses during assembly of the sensor since the electrolyte is a STRONG ACID. It is recommended to perform this operation over a sink with running water available. After using, re-cap any remaining electrolyte until the next use.

1. **Always move the gray band to uncover the vent hole before removing the membrane cap, or else the membrane will be destroyed!** Hold the sensor vertically with the membrane facing down and carefully unscrew the membrane cap.
2. **For Chlorine Dioxide, shake the sensor body several times.**

➥ This empties the pressure compensation opening [1].



3. Rinse the electrolyte fill solution off the cap and electrodes with cold water.
4. Discard the old membrane cap.
5. Unpack the new membrane cap, taking care not to touch the membrane or get it dirty.
6. Fill the membrane cap to the top with the electrolyte fill solution.
7. Hold the sensor body vertically with the tip pointing down and SLOWLY screw on the membrane cap until it is hand tight. **Be prepared for some electrolyte solution to squeeze out from the cap.**
8. Rinse your hands, the sensor, and all surfaces contaminated with electrolyte solution with running water.
9. Check the sensor for leaks, especially at the membrane and the membrane cap threads. If any leaks are detected, tighten the membrane cap or replace it. Move the rubber band back into the groove.

Sensor Storage

The sensor may be stored for up to one month in the flow cell assuming that the membrane is always kept submerged in water.

For long term storage, up to 3 years, follow this procedure:
CAUTION: Wear gloves and safety glasses during assembly of the sensor since the electrolyte is a STRONG ACID. It is recommended to perform this operation over a sink with running water available. After using, re-cap any remaining electrolyte until the next use.

1. Hold the sensor vertically with the membrane facing down and carefully unscrew the membrane cap. Always move the gray band to uncover the vent hole before removing the cap!

2. Rinse the electrolyte fill solution off the cap and electrodes with cold water.

3. Allow the parts to air dry.

4. Loosely screw the membrane cap back on and store the sensor in a clean dry place. The electrode tip must not touch the membrane.

5. The old membrane cap used to protect the sensor during storage must be discarded and replaced when the sensor is put back into service.

6.0 Specifications

Calibration	Weekly
Change electrolyte	3-6 months
Change membrane cap	1 year

Electrical

Power requirements	±5 VDC, 5 mA maximum
Signal	0 to -2000 mVDC
Maximum cable length	100 feet (30.5 meters)
Extension cable	2 twisted pair, 22 AWG, shielded, 35 pF/ft

Mechanical

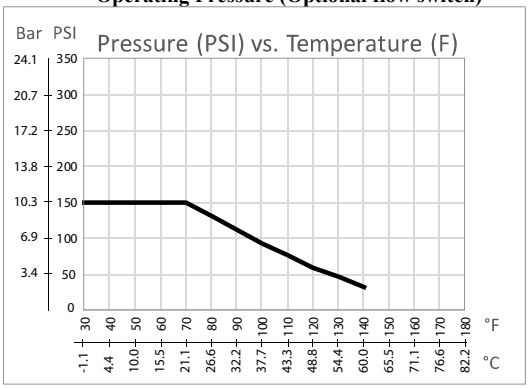
Operating Temperature	Free Chlorine/Bromine Free Chlorine/Bromine (Extended pH Range) Total Chlorine Stabilized Bromine 2000 ppm Cl_2/Br_2	0 to 45°C (32 to 113°F)
	Chlorine Dioxide	0 to 50°C (32 to 122 °F)
	Chlorite	0 to 40° C (32 to 104 F)
	Peracetic Acid	0 to 45°C (32 to 113 °F)
	Ozone	0 to 50°C (32 to 122 °F)
	Hydrogen Peroxide	0 to 45°C (32 to 113 °F)

Operating Pressure (Sensor)	0 to 3 atmosphere (0 to 44 psi) – Total and High pH Chlorine 0 to 6 atmosphere (0 to 90 psi) – Stabilized Bromine 0 to 1 atmosphere (0 to 14.7 psi) – All other sensors
Operating Pressure (Optional flow switch)	0 to 10.3 atmosphere (0-150 PSI) *see graph on next page*
Storage	Sensor: Frost-protected, dry and without electrolyte no limit at 5 to 40°C Membrane cap: Used membrane caps cannot be stored! Electrolyte: in original bottle protected from sunlight at 5 to 35°C, 1 year or until specified expiration date
Flow cell inlet	¼" NPTF
Flow cell outlet	¾" NPTF

Wetted materials of construction

Sensor	Free Chlorine/Bromine	PVC, Polycarbonate, Silicone rubber
	Free Chlorine/Bromine (Extended pH Range) Total Chlorine Stabilized Bromine 2000 ppm Cl_2/Br_2 Chlorine Dioxide Chlorite Peracetic Acid Ozone Hydrogen Peroxide	PVC, Polycarbonate, Silicone rubber, SS, PEEK
Flow cell body	Isoplast	
O-Ring	FKM	

Operating Pressure (Optional flow switch)



Free Chlorine/Bromine

Range	Resolution
0-2 mg/l	0.001 mg/l
0-20 mg/l	0.01 mg/l
0-200 mg/l	0.1 mg/l

Sensitivity	HOCl (100%) HOBr (100%) Ozone ClO_2 (900%) Not for use with isocyanuric acid or stabilized bromine
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	6.8 – 8.0 (pH must be stable within ± 0.10)
Conductivity Range	Up to 4% NaCl, 10 µS/cm minimum
Response time	30 sec
Conditioning time	60 min

Free Chlorine/Bromine- Extended pH Range

Range	Resolution
0-2 mg/l	0.001 mg/l
0-20 mg/l	0.01 mg/l

Sensitivity	HOCl (100%) HOBr (100%) Ozone ClO_2 (100%) HOCl with isocyanuric acid Not for use with stabilized bromine
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	4.0 – 12.0
Conductivity Range	10 µS/cm minimum
Response time	2 min
Conditioning time	120 min

Stabilized Bromine

Range	Resolution
0-2 mg/l	0.001 mg/l
0-20 mg/l	0.01 mg/l

Sensitivity	Stabilized Bromine (100%) Ozone ClO_2 Cl_2
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	6.5 – 9.5
Conductivity Range	10 µS/cm minimum
Response time	2 min
Conditioning time	120 min

2000 PPM Chlorine/Bromine

Range	Resolution
0-2000 mg/l	1 mg/l

Sensitivity	HOCl (100%) HOBr (100%) Ozone ClO_2 Peracetic Acid
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	5.0 –8.0
Conductivity Range	10 µS/cm minimum
Response time	8 min
Conditioning time	11 hours

Free Chlorine/Bromine- High Range High pH

Range	Resolution
0-200 mg/l	0.1 mg/l

Sensitivity	HOCl (100%) HOBr (100%) Ozone (80%) ClO_2 (75%) Not for use with stabilized bromine
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	4.0 – 9.0
Conductivity Range	10 µS/cm – 50 mS/cm
Response time	2 min
Conditioning time	120 min

Total Chlorine

Range	Resolution
0-2 mg/l	0.001 mg/l
0-20 mg/l	0.01 mg/l

Sensitivity	ClO_2 (100%) Ozone (130%)
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	4.0 – 12.0
Conductivity Range	10 µS/cm minimum
Response time	2 min
Conditioning time	120 min

Chlorine Dioxide (CD10.1 Type)

Range	Resolution
0-2 mg/l	0.001 mg/l
0-20 mg/l	0.01 mg/l

Sensitivity	Free Chlorine (10%) Ozone (2500%)
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	1.0 – 12.0
Conductivity Range	10 µS/cm minimum
Response time	1 min
Conditioning time	60 min

Chlorite

Range	Resolution
0-2 mg/l	0.001 mg/l

Sensitivity	Chlorite. Mn2+, Nitrite, Fe2+. No interference to ClO_2, Cl_2 or ClO_3^-
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	6.0 - 9.0
Conductivity Range	10 µS/cm minimum
Response time	1 minute
Conditioning time	120 min

Peracetic Acid

Range	Resolution
0-200 mg/l	0.1 mg/l
0-2,000 mg/l	1 mg/l
0-20,000 mg/l	10 mg/l

Sensitivity	Ozone (250%) ClO_2 (100%) H_2O_2 (0.5%)

Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	1.0 – 6.0
Conductivity Range	10 µS/cm minimum
Response time	3 min
Conditioning time	60 min

Ozone (OZ10.1)

Range	**Resolution**
0-20 mg/l	0.01 mg/l
0-2 mg/l	0.001 mg/l

Sensitivity	
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	4.0 – 9.0
Conductivity Range	10 µS/cm minimum
Response time	8 min
Conditioning time	60 min

Hydrogen Peroxide

Range	**Resolution**
0-200 mg/l	0.1 mg/l
0-2,000 mg/l	1 mg/l
0-20,000 mg/l	10 mg/l

Sensitivity	Chlorine (none may be present) PAA (none may be present) Ozone (none may be present)
Sample Flow rate	30 to 100 liters/hour (0.13 to 0.44 gal/min)
pH Range	2.0-11.0
Conductivity Range	10 µS/cm minimum
Response time	5-10 min
Conditioning time	180 min