

pH-Independent Free Chlorine Sensor

- MEASURE FREE CHLORINE without sample treatment and without an auxiliary pH sensor
- SENSOR RESPONSE IS PRACTICALLY INDEPENDENT of pH between pH 6.5 and 10
- AUTOMATIC CORRECTION for changes in membrane permeability caused by temperature
- EASILY REPLACED MEMBRANE; no special tools required
- VARIOPOL CONNECTOR OPTION allows the sensor to be replaced without running new cable



APPLICATIONS AND FEATURES

The Model 498CL-01 sensor is intended for the continuous determination of free chlorine (hypochlorous acid plus hypochlorite ion) in water. The primary application is measuring chlorine in drinking water. The sensor can also be used to monitor dechlorination. The sensor requires no acid pre-treatment, nor is an auxiliary pH sensor required for pH correction. Between pH 6.5 and 10 the chlorine reading decreases less than 4% per unit increase in pH. Below pH 6.5 the change is less than 1%. The linear range of the sensor is 0 to 20 ppm. For determination of higher levels of chlorine, consult the factory.

The 498CL-01 is a three electrode, membrane-covered amperometric sensor. The sensor consists of a hydrophilic membrane stretched over a gold mesh cathode. A silver/silver chloride reference electrode and a copper auxiliary electrode complete the circuit. The fill solution is saturated succinic acid. During operation, an electrochemical reaction, driven by the polarizing voltage, consumes free chlorine at the cathode surface. The auxiliary electrode provides the electrons for the cathode reaction, and a current proportional to the reaction rate flows between the electrodes. Because the concentration of chlorine at the cathode is zero, free chlorine in the sample continuously diffuses through the membrane to be destroyed at the cathode. Thus, the current is proportional to the diffusion rate, which is proportional to the concentration of free chlorine in the sample.

Unlike free chlorine sensors from other manufacturers, the 498CL-01 requires neither sample pretreatment nor pH correction. All amperometric free chlorine sensors generate a raw signal that depends primarily on the concentration of hypochlorous acid. Because the fraction of free chlorine present as hypochlorous acid is a function of pH, readings will be in error if the sample pH changes from the value it had during calibration. To correct for pH changes, some manufacturers treat the sample with acid to convert hypochlorite to hypochlorous acid. Others continuously measure pH and use the result to correct the raw chlorine signal. The 498CL-01 is different. It uses a highly buffered acidic fill solution for internal pH adjustment. The fill solution converts all the free chlorine entering the sensor as well as much of the free chlorine at the outside surface of the membrane into hypochlorous acid. Thus, the sensor response is practically independent of pH.

Because the rate of diffusion of free chlorine through the membrane depends on membrane permeability, the sensor response must be corrected for changes in permeability caused by temperature. A Pt 100 RTD in the sensor measures the temperature, and the analyzer automatically performs the correction.

Stable dilute chlorine standard are generally not available, so the sensor must be calibrated against the results of a laboratory test run on a grab sample of the

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process liquid. Portable test kits are available from other manufacturers.

Maintenance is fast and easy. Replacing the membrane requires no special tools or fixtures. Replacing the succinic acid slurry is also simple. Maintenance takes at most a few minutes.

The sensor cannot be pressurized. Sample must drain to open atmosphere. A low flow cell is available, and its use is highly recommended.

The 498CL-01 sensor is available with a Variopol (VP) watertight connector. Wire the interconnecting cable to the analyzer and run the cable to the sensor. The sensor plugs into the cable receptacle. To replace the sensor, simply disconnect the Variopol fitting and plug in a new sensor.

SPECIFICATIONS — SENSOR

Linear Range: 0-20 ppm (mg/L) as Cl₂. For higher ranges consult the factory.

Wetted Materials: PVC, polyethersulfone, polyester, Viton¹, silicone, copper

Cathode: Gold mesh

Accuracy: Accuracy depends on the accuracy of the chemical test used to calibrate the sensor.

Linearity between 0 and 20 ppm: 1% (per IEC 60746)

Linearity between 0 and 2 ppm: ±0.05 ppm following calibration at about 2 ppm

Sensitivity to pH: Between pH 6.5 and 10 sensor signal changes < 4% per unit change in pH. Below pH 6.5 the change is < 1% per unit change in pH.

Sample Conductivity: >10 uS/cm

Interferences: Monochloramine, dichloramine, and permanganate

Response Time: < 2 minutes to 90% of final value following step change at 1.2 gal/hr (75 mL/min) and 25°C

Sample Flow: 1.2 gal/hr (75 mL/min). Changing flow from 0.5 to 2.5 gph (30 to 160 mL/min) increases the sensor signal by about 30%. Increasing flow increases pH dependence.

Pressure: Sample must drain to open atmosphere. No back pressure allowed.

Temperature: 32 to 122°F (0 to 50°C)

Process Connection: Sensor must be used in flow cell PN 24091-01

Electrolyte Life: 3 months (approx)

Cable Length (standard integral cable): 25 ft (7.6 m)

Cable Length (maximum): 300 ft (91 m)

Weight/Shipping Weight: Sensor with integral cable: 2 lb/1.0 kg (3 lb/1.5 kg)

Sensor with VP connector: 1 lb/0.5 kg (2 lb/1.0 kg)

Note: Weights and shipping weights are rounded up to the nearest 1 lb or 0.5 kg.

¹ Viton is a registered trademark of EI duPont de Nemours.

FLOW CELL SPECIFICATIONS

Part Number: 24091-01 (low flow cell with bubble sweeping nozzle)

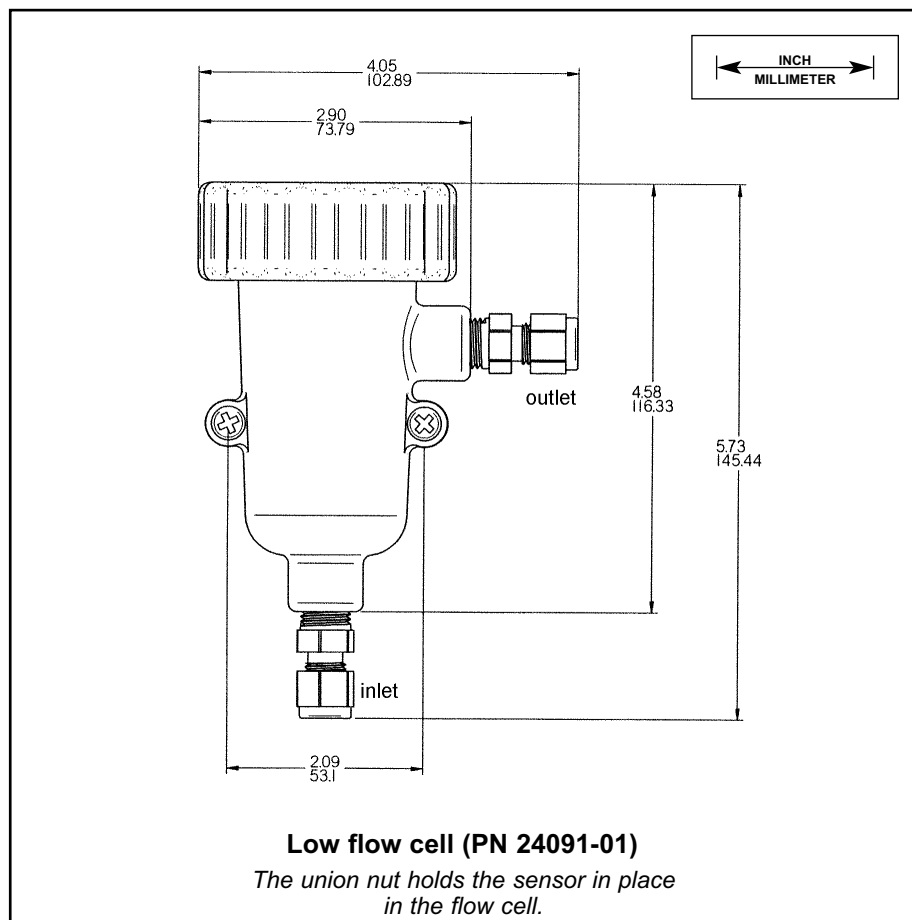
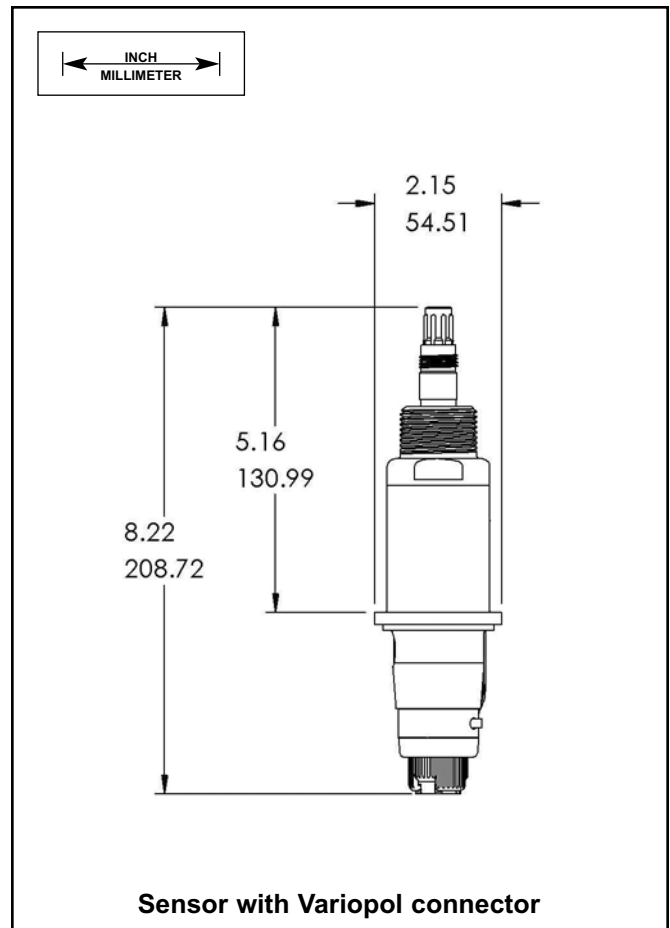
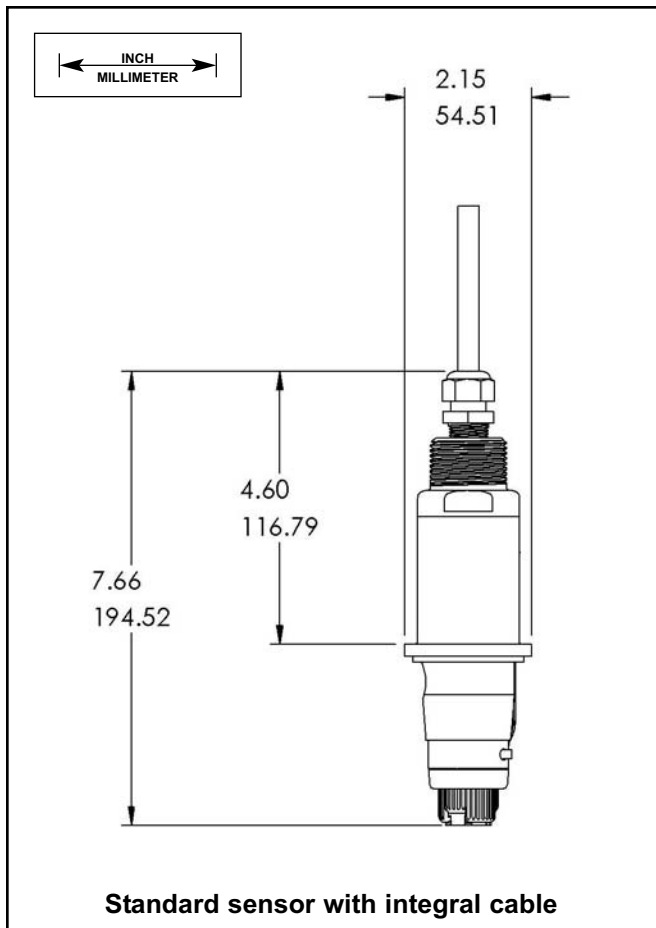
Wetted Materials: polycarbonate, polyester, 316 stainless steel, silicone

Process Connections: ¼-inch OD tubing compression fitting or ¼-inch FNPT

Maximum Inlet Pressure: 65 psig (549 kPa abs)

RECOMMENDED ANALYZERS

The 498CL-01 sensor can be used only with the 1055-24, 1055-24-32, and 54eA analyzers. It cannot be used with the 1054BCL, 5081-A, and Xmt-A.



ORDERING INFORMATION

The **498CL-01 sensor** is intended for the determination of free chlorine in water. The sensor must be mounted in a sidestream sample, with the waste draining to atmosphere. Low flow cell PN 24091-01 is recommended. The sensor is available with either integral cable or a VP 6.0 quick disconnect fitting. Three replacement membrane assemblies, three O-rings, and enough reagent to replace the fill slurry three times is provided with each sensor.

MODEL 498CL-01 pH-INDEPENDENT FREE CHLORINE SENSOR	
CODE	Optional selection
VP	Sensor with Variopol 6.0 fitting (interconnecting cable must be ordered separately)
498CL-01	-VP EXAMPLE

FOR FIRST TIME VARIOPOL INSTALLATIONS

PART #	DESCRIPTION
24150-01	Variopol 6.0 interconnecting cable, 10 ft (3 m)
24150-02	Variopol 6.0 interconnecting cable, 50 ft (15 m)

ACCESSORIES

PART #	DESCRIPTION
24091-01	Cell, low flow, 1/4 inch inlet and outlet, with bubble shedding nozzle

SPARE PARTS

33970-00	Fill Plug
33968-00	Membrane retainer cap
23501-10	pH-independent free chlorine membrane assembly, includes one membrane assembly and O-ring
23502-10	pH-independent free chlorine membrane assembly, includes three membrane assemblies and O-rings
24146-00	pH-independent free chlorine sensor electrolyte kit, includes three bottles of saturated succinic acid solution and three bottles of succinic acid crystals

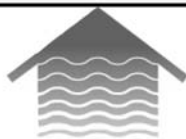
MODEL 498CL-01 ENGINEERING SPECIFICATION

1. The sensor shall be suitable for the determination of free chlorine in water without the use of sample conditioning reagents or an auxiliary pH sensor. Sensors that use sample conditioning or require an auxiliary pH sensor are not acceptable.
2. The sensor shall be a three-electrode membrane-covered sensor with a silver/silver chloride reference, gold mesh cathode, and external copper auxiliary electrode. The fill solution shall be saturated succinic acid.
3. The sensor shall contain a Pt 100 RTD to measure temperature used for correcting the raw signal for changes in membrane permeability.
4. The change in chlorine signal shall be less than 4% per unit change in pH between pH 6.5 and 10.
5. The linearity of the sensor shall be 1% between 0 and 20 ppm (IEC 60746).
6. The recommended sample flow shall be about 1.2 gph (75 mL/min).
7. The response time to a step change in free chlorine concentration shall be <2 minutes to 90% of final value at 1.2 gph (75 mL/min).
8. Sensor maintenance shall require no special tools or fixtures.
9. The life of the fill solution shall be approximately three months.
10. The sensor shall be available with either integral cable or VP 6.0 quick disconnect fitting. Sensors without a quick disconnect fitting are not acceptable.
11. A flow cell designed for use with the sensor shall be available.
12. The sensor shall be Rosemount Analytical Model 498CL-01 or 498CL-01-VP or approved equivalent.



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