

# 9184sc Amperometric Free Chlorine Sensor

## Features and Benefits

### Low Minimum Detection Limit for Efficient Residual Chlorine Monitoring

The Hach 9184sc Amperometric Free Chlorine Sensor has a minimum detection limit of 5 ppb or 0.005 mg/L hypochlorous chlorine in the form of HOCl. Together with pH and temperature measurements, free chlorine concentration is calculated using dissociation curves stored in the instrument.

### Wide Measurement Range

The 9184sc free chlorine sensor is particularly useful for drinking water distribution monitoring, chlorination applications, demineralizer systems, wastewater, or cooling water processes due to its 0 to 20 ppm measurement range.

### Continuous Chlorine Measurement

Measurements are made continuously by the sensor and reported to the controller.

### Models and Options

The standard Hach 9184sc Amperometric Free Chlorine Sensor continuously measures total free chlorine (TFC) by measuring temperature and pH together with HOCl to calculate hypochlorite ions (OCl<sup>-</sup>). HOCl combined with OCl<sup>-</sup> equals total free chlorine.

Available options include:

**Acidification Unit**—Used to maintain 2% accuracy when sample pH is greater than 7.5. Alternately, it can be used intermittently or continuously for cleaning and is fully programmable.

**Intermittent Flow Unit**—This fully programmable unit saves resources while limiting excess flow to drain.

**Hypochlorous Chlorine (HOCl) Only**—This sensor does not compensate for pH and is designed for use in applications where pH does not fluctuate. This option is only available after consultation with Hach Technical support.

### Easy Setup and Maintenance

The all-inclusive 9184sc free chlorine system comes pre-assembled on a panel. Just mount the panel in the desired location, insert the sensors, and connect the controller to get started. The membrane system of the sensor means there are no reagents used for measurement. Maintenance is minimal and two years of typical maintenance items are included with the system.



*The low minimum detection limit and wide measurement range of the Hach 9184sc Amperometric Free Chlorine Sensor makes it ideal for efficient residual chlorine monitoring. Continuously measure hypochlorous (HOCl), temperature, and pH.*

### Compatible with Hach Multi-Sensor, Multi-Parameter Digital Controllers

The Hach 9184sc free chlorine sensor is used with Hach's new sc100 or sc1000 Digital Controllers. The sc100 controller accepts up to two sensors. The sc1000 accepts up to eight sensors. Multiple sc1000 controllers can be networked to accommodate many more sensors and parameters, reducing the cost per measuring point. Just connect any Hach "plug and play" digital sensor and it's ready to use without software configuration. "Plug and play" connectivity means there's no complicated wiring or set up. Network the 9184sc Amperometric Free Chlorine Sensor with any of Hach's digital sensors for measuring dissolved oxygen, turbidity, ORP, conductivity, and many other parameters.

DW = drinking water WW = wastewater municipal PW = pure water / power  
IW = industrial water E = environmental C = collections FB = food and beverage



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## Specifications\*

### Measurement Range

0 to 20 ppm (mg/L)  
as hypochlorous acid (HOCl)

### Minimum Detection Limit

5 ppb or 0.005 mg/L HOCl

### Accuracy

2% or  $\pm 10$  ppb TFC, whichever is greater at pH <7.5

2% or  $\pm 10$  ppb HOCl, whichever is greater at pH <8

### Standard Deviation

0.7%

### Response Time

90% in less than 90 seconds

### Measurement Interval

Continuous

### Minimum Flow Rate

14 L/hr (200 to 250 mL/min)  
auto-regulated by flow thru cell

### Pressure Range

0.1 to 2 bar in flow cell

### Storage Temperature

-20 to 60°C

### Operating Temperature

0 to 45°C

### Operating Humidity

0 to 90% non-condensing

### Sample Temperature

2 to 45°C

### Temperature Compensation

Automatic over sample temperature range

### Sample pH

4 to 8 (acidification unit available for pH greater than 8)

### Power Consumption

12 V, 1.5 watts (provided by controller)

### Measurement Technology

Amperometric/Membrane (electrode, membrane, electrolyte)

### Interferences

No interference from chloramines

Chlorine dioxide and ozone interfere with measurement

### Zero Calibration

Electrically (automatic) or with de-chlorinated water

### Calibration

Comparison of lab method with process sample

### pH Calibration

Single- or two-point using standards or comparison of lab method with process sample

### Calibration Interval

2 months

### Maintenance Interval

Measurement Cell: 6 months for membrane and electrolyte, typical  
pH Cell: 1 to 1.5 years, typical

### Mounting

Flat, vertical surface (panel, stand, etc.)

### Connections

Sample Line: 1/4-in. O.D.

Drain Line: 1/2-in. I.D. (supplied)

### Materials

Electrode: gold cathode/silver anode

Measuring cell: acrylic

Probe body: PVC

### Environmental Ratings

IP-66/NEMA 4X

### Certifications

UL, CSA (certified by ETL), CE

### Dimensions

270 x 250 mm (10.63 x 9.84 in.)

### Shipping Weight

6.5 kg (14.3 lbs.)

### Accessories

#### Acidification Unit

Use for pH adjustment to force sample pH to between 5.5 and 6.5.

Cleaning: can be set to inject cleaning solution through the measurement cell for cleaning.

Always on or programmable via controller relays.

Equipped with power switch.

NEMA 4X/IP66 compliant.

Connects in series with analyzer.

Complete system requires one input to the controller.

#### Intermittent Flow Unit

Use to minimize the amount of water by eliminating continuous sample flow.

Programmable via controller relays.

Use to comply with the proposed Ground Water Rule which will specify when corrective action (including disinfection) is required to protect consumers who receive water from ground water systems from bacteria and viruses. The GWR specifies continuous or interval monitoring of disinfection levels.

NEMA 4X/IP66 compliant.

Connects in series with analyzer.

Complete system requires one input to the controller.

\*Specifications subject to change without notice.

## Principle of Operation

### Chlorine Species\*

- **Active Chlorine (HOCl)** or hypochlorous acid is a powerful disinfectant – up to 100 times more efficient than hypochlorite.
- **Total Free Chlorine (TFC)** is composed of dissolved chlorine (at low pH values), hypochlorous acid gas, and hypochlorite ion (ClO<sup>-</sup>) coexisting in the sample. Their relative proportion depends on pH and temperature (see figure).

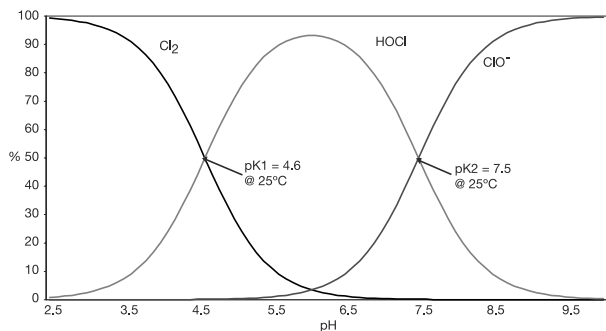
The combination of HOCl, temperature, and pH measurements are used to calculate ClO<sup>-</sup> concentration to determine TFC. An acidification unit can be used to force the pH of the sample to between 5.5 and 6.5.

HOCl is reduced at the gold working electrode (cathode).



\*Total Combined Chlorine (TCC) is the result of adding total free chlorine and chloramines (mono-, di-, and tri-chloramines). The 9184sc sensor does not measure TCC.

Dissociation Curve



The silver reference electrode (anode) is oxidized into Ag<sup>+</sup> ions that precipitate with the chloride ions.



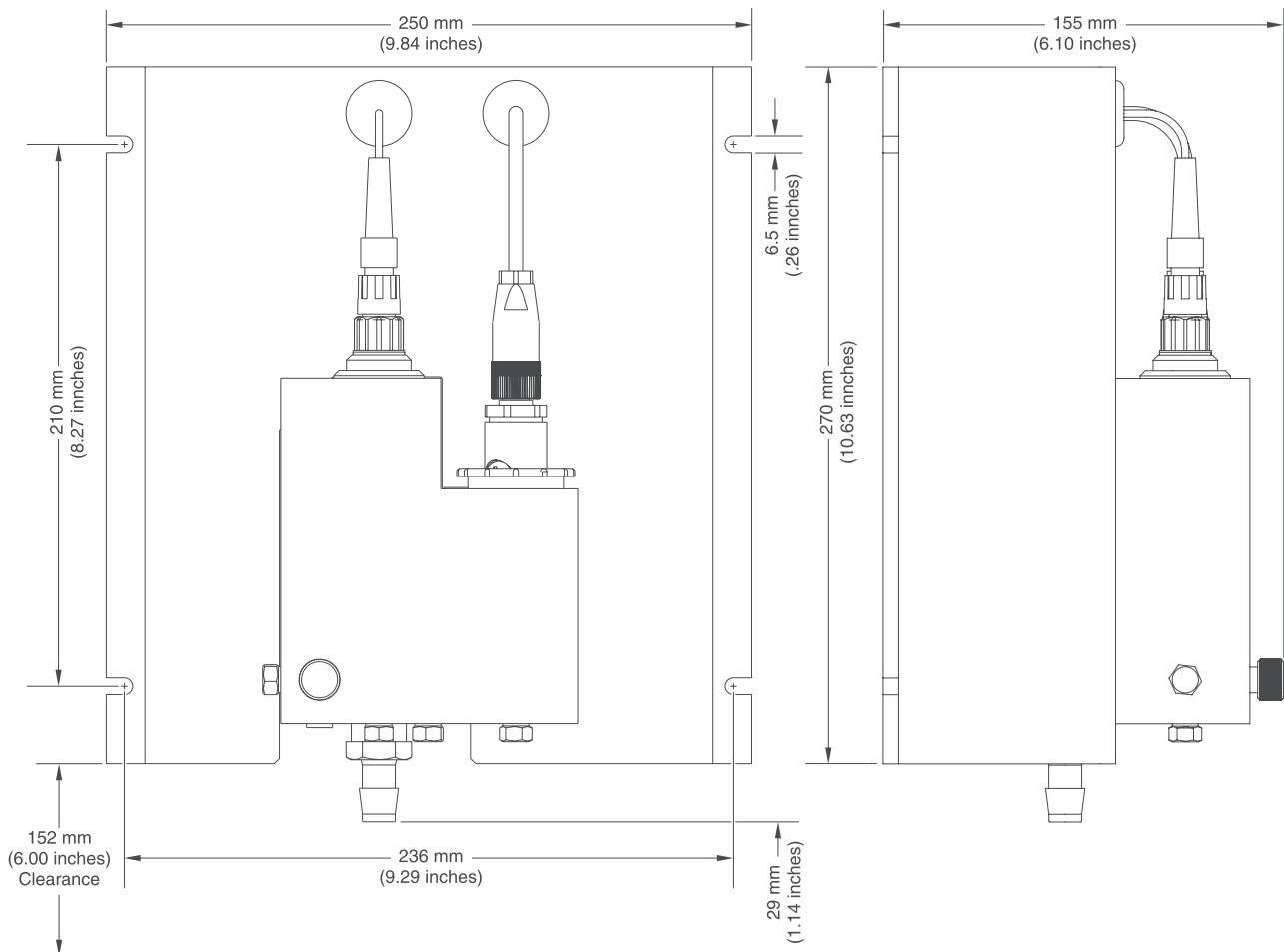
The HOCl reduction at the cathode generates a current directly proportional to HOCl concentration.

## Engineering Specifications

1. The sensor shall continuously measure hypochlorous acid (HOCl) and temperature in water to determine free chlorine concentration. When combined with pH measurements the sensor shall also determine total free chlorine concentration.
2. The measurement technology shall be amperometric/membrane which includes electrode, membrane, and electrolyte).
3. The measuring range shall be from 0 to 20.0 mg/L HOCl.
4. The minimum detection limit shall be 5 ppb or 0.005 mg/L HOCl.
5. The accuracy shall be less than 2% or  $\pm 10$  ppb of the measured value, whichever is greater.
6. The response time shall be approximately 90 seconds.
7. The analyzer shall automatically compensate for sample temperature that shall be between 2 and 45°C.
8. The flow rate of sample shall be 200 to 250 mL/minute.
9. The calibration method for the analyzer shall be comparison with lab method.
10. The transmitter enclosure shall be rated at NEMA4x/IP66.
11. The electrodes shall be constructed of a gold cathode and silver anode.
12. The analyzer shall be model 9184sc Amperometric Free Chlorine Sensor manufactured by Hach Company.

## Dimensions

The sensor should be installed in an accessible location. It can be mounted on a flat, vertical surface (such as a panel, stand, etc.). It should allow for access for any checking or maintenance. Sample flow should meet the specifications above.



## Ordering Information

- 6043000** 9184sc Free Chlorine HOCl only Analyzer  
Includes 9184sc HOCl sensor, sc100 digital controller, and sc100 mounting panel (Only available after consultation with Hach.)
- 6043001** Same as above with RS485 MODBUS®
- 6043002** Same as above with RS232 MODBUS®
- 6043200** 9184sc Free Chlorine TFC Analyzer  
Includes 9184sc TFC sensor with pH, sc100 digital controller, and sc100 mounting panel
- 6043201** Same as above with RS485 MODBUS®
- 6043202** Same as above with RS232 MODBUS®

### Sensor Only

- LXV430.99.00001** 9184sc Free Chlorine HOCl only Sensor  
(Only available after consultation with Hach.)
- LXV432.99.00001** 9184sc Free Chlorine TFC Sensor

### Optional Accessories

- LZY051** 9180sc Acidification Unit
- LZY052** 9180sc Intermittent Flow Unit
- 5743200** Instrument Stand
- 5448800** 125V Power Cord with Strain Relief
- 5448900** 230V Power Cord with Strain Relief

### Digital Extension Cables

Standard cable length is 0.4 m (1.25 ft.)

- 6122400** 1 m (3.2 ft.)
- 5796000** 7.6 m (25 ft.)
- 5796100** 15.2 m (50 ft.)
- 5796200** 30.5 m (100 ft.)

### Digital Termination Box

Required when the length of cable between the digital sensor and sc100 or sc1000 controller is between 100 and 1000 m (328 and 3280 ft.).

- 5867000** Digital Termination Box

### Replacement Parts

- 368416,00000** pH Electrode
- 09184=A=1001** 9184sc Electrode
- 09184=A=3500** 9184sc Pre-mounted Membranes, qty. 4
- 09184=A=3600** 9184sc Electrolyte

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*Keep it pure.*

*Make it simple.*

*Be right.*

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