Gas Phase Measurement of Total Residual Chlorine

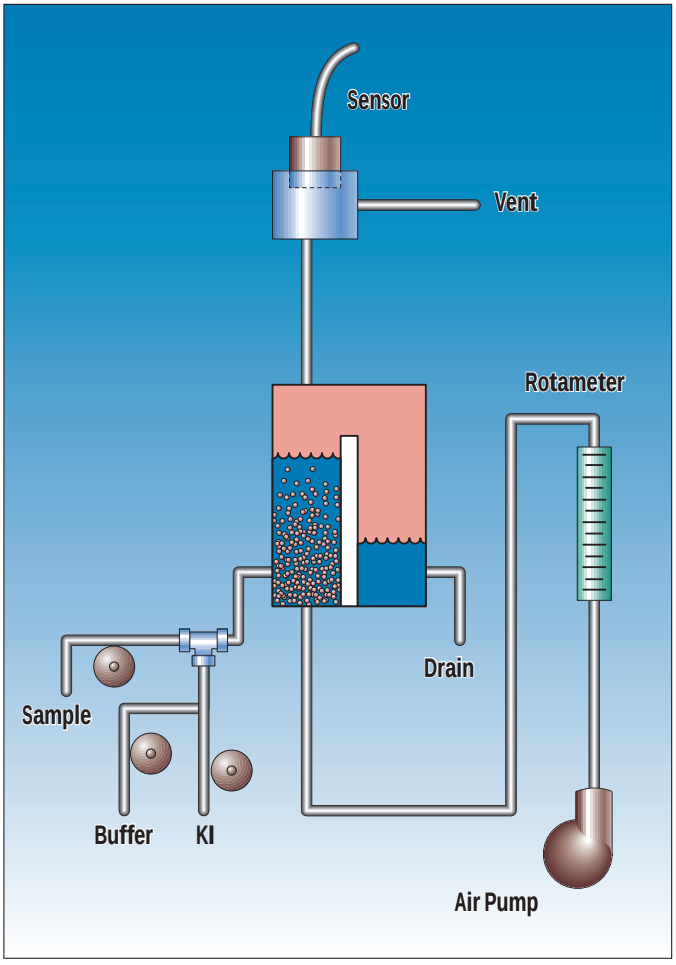
Model A15/f9

Total Residual Chlorine Monitor

Measure Any Sample Without Sensor Fouling or Contamination

Chlorination of potable water, wastewater effluent, and cooling water is widely used throughout the world to control biological activity in the water. Disinfection of potable water with chlorine ensures that tap water is safe to drink once it has passed through the distribution system. Wastewater disinfection helps to ensure that receiving streams are safe for recreational use, and cooling water chlorination reduces biofouling that can degrade heat transfer efficiency. In addition to these common uses, there are many other applications where chlorine addition helps to reduce biological contamination.

Residual chlorine is found in many chemical forms in water systems. Residuals in clean water are often predominantly free chlorine while wastewater, cooling water, and chloraminated water can contain mixtures of free chlorine, combined chlorine, and organochlorine species. Measurement of residual chlorine can be relatively difficult where a variety of chlorine forms exist, and a measurement of "Total Residual Chlorine" is often required in these applications. This total chlorine measurement is normally done by reacting the chlorine in a water sample, buffered to pH 4, with potassium iodide. All of the various chlorine compounds react with the iodide to release an equivalent amount of iodine, and the released iodine is measured using various methods.



Many on-line monitors for total residual chlorine use the iodometric method for measurement, often measuring current between two exposed electrodes to determine the iodine concentration. ATI's Model A15/79 Total Chlorine Monitor uses this same standard iodometric method, but with a unique sensing technique for measuring the released iodine. The system takes the reacted sample containing iodine and uses a membraned gas sensor rather than exposed electrodes. The gas permeable membrane allows only iodine to permeate into the sensor. Sample contaminants are eliminated from coming in contact with measuring electrodes, providing better stability. And measurement can be made either with a direct contact gas sensor, or with a special gas stripping system for highly contaminated samples.

Operation

The A15/79 monitor is an on-line automated chemistry system that provides the components necessary to perform total residual chlorine measurement. In operation, a small amount of sample is pumped into the system and mixed with pH 4 buffer, and then with potassium iodide. At pH 4, chlorine compounds in solution react as follows (equation shown for one chlorine compound only):

$$HOCl + 2KI + HCl \rightarrow 2KCl + I_2 + H_2O$$

Two types of chemistry modules are used to measure the iodine concentration released in the chemical reaction. The simplest

version provides flow of the treated sample directly into a chamber containing the iodine gas sensor. A membrane across the face of the sensor allows iodine to diffuse to the active electrode surface. Iodine is reduced to iodide, generating a current proportional to the iodine to diffuse to the active electrode surface. A second system, used for highly contaminated samples, brings the reacted sample to an air-stripping chamber where the released iodine is stripped from the sample, with the resulting air stream directed to the iodine gas sensor located in a separate chamber. This method is ideal for very low range measurement of dechlorinated wastewater, where biological growth from sulfur reducing bacteria can cause severe fouling problems in contact systems.

Total Chlorine monitors consist of three separate components: a chemistry module where buffer and potasium iodide are added for measurement, an inlet flow assembly where raw sample is delivered to the system, and an electronic readout containing the chlorine concentration display, analog output, and alarm contacts. Readout modules are available in either wall mount NEMA 4X or general purpose panel mount versions. A 20 ft. interconnecting cable is supplied to connect the monitor to the chemistry module, and this separation can be increased to a maximum of 100 ft. if required. An optional stainless steel system panel is available for mounting all components and providing a convenient shelf for reagent bottles.

Sample is connected to the inlet overflow assembly using 1/4" I.D. flexible tubing. Recommended sample flowrate is 3-30 gallons per hour (.2-2 LPM.). While the monitor uses only a small fraction of this sample, higher flow keeps sample delivery times to a minimum. Excess sample simply overflows into a drain chamber. A 1/2" I.D. hose barb is provided for connection of drain tubing.

Contact Chemistry Module

Air-Stripping Chemistry Module

NEMA 4X Monitor

Features

Gas Phase Sensing: Measurement is made without contact between sample and electrodes, eliminating the potential for sensor fouling.

Standard Method: Total chlorine is measured using EPA recommended method of reaction of sample with buffer and potassium iodide, and measurement of iodine released in the reaction.

Alphanumeric LCD: Provides residual chlorine display, alarm status indication, and all configuration information.

Two Control Relays: Relays are programmable for setpoint, deadband, and time delay. Relays offer pulse frequency and pulse width modulation control modes in addition to simple on/off control for direct chemical feed pump modulation.

Isolated Output: Programmable 4-20 mA output span from 0-0.2 PPM to 0-20.00 PPM full scale. Output may also be inverted if required.

Model A15/79 Residual Chlorine Specifications

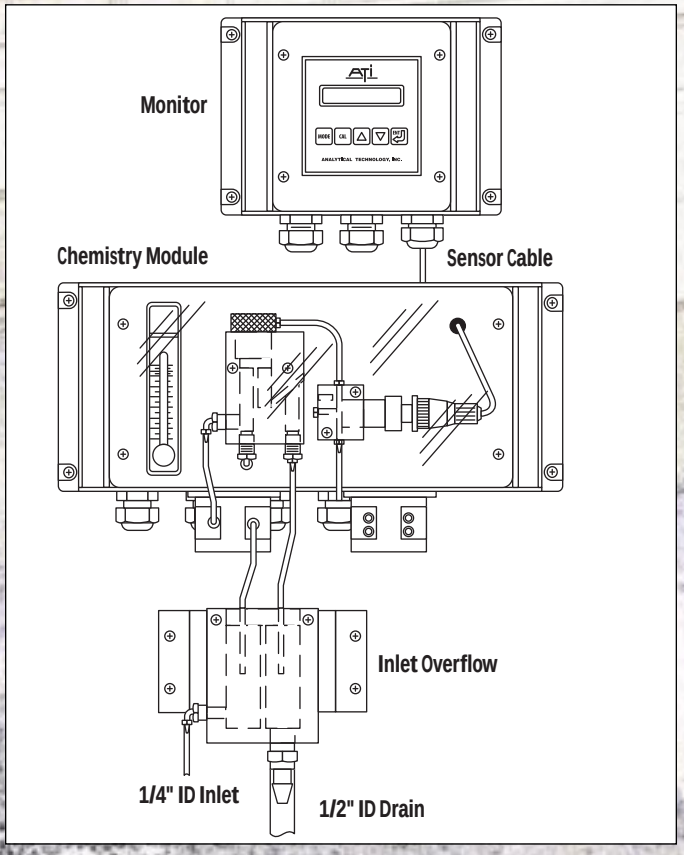
Electronic Monitor

Range:	0-2.000 or 0-20.00 PPM
Accuracy:	± 0.02 PPM
Repeatability:	± 0.01 PPM
Linearity:	0.1% of F.S.
Zero Drift:	< 0.01 PPM per month
Display:	16 character alphanumeric backlit LCD
Control Relays:	Two SPDT relays, 5A @ 220 VAC resistive. Programmable deadband and time delay.
Control Mode:	On/Off, pulse width modulation, pulse frequency modulation
Alarm Relay:	Independent SPDT relay, 5A @ 220 VAC resistive.
Analog Output:	Isolated 4-20 mA, 600 ohm maximum load. Programmable output span. Output may be inverted.
Operating Conditions:	0-50° C., 0-95% R.H. non-condensing.
Power:	110/220 VAC ±10%, 50/60 Hz.
Enclosure:	Panel mount standard, NEMA 4X (IP-65) wall mount optional.

Chemistry Module

Sensor:	Membraned I_2 Gas Sensor
Sensor Cable:	25 feet standard, 100 feet maximum
Response Time:	95% in 3 Minutes
Sample Pump:	Internal Tubing Pump, 5 cc./min.
Buffer/KI Pump:	Internal Tubing Pump, 0.06 cc/min.
Air Supply:	Diaphragm air pump with precision flow control
Air Stripping Chamber:	Cast Acrylic
Temperature Limits:	0-50° C.
Sample Flow Rate:	3-30 GPH (.2-2 LPM) at sample inlet overflow assembly
Sample Inlet:	1/4" I.D. Hose Barb
Sample Drain:	1/4" I.D. Hose Barb
Power:	120 VAC, 60 Hz. standard, 220 VAC, 50 Hz. Optional

Typical Installation



Ordering Information: Model A15/79 - C - D - E Total Chlorine Monitor

Suffix C - Enclosure
- 1 - Panel Mount
- 2 - NEMA 4X Wall Mount

Suffix D - Sensing System
- 1 - Contacting Gas Sensor System
- 2 - Air Stripping Sensor System

Suffix E - Power
- 1 - 120 VAC, 60 Hz
- 2 - 220 VAC, 50 Hz

Options:

00-1261	Stainless steel system mounting plate
31-0037	Sensor interconnect cable (max. 100 ft.)

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