



Water Quality Monitor

Q46F Fluoride

OVERVIEW

Fluoride is commonly added to drinking water to prevent tooth decay. It is typically fed as liquid hydrofluorosilicic acid using standard metering pumps. Feed control is usually flow-proportional, while monitoring of final fluoride concentration provides alarm protection against overfeed. Optimum fluoride levels of around 1 ppm are safe, but control system problems resulting in concentrations above 2 ppm are considered excessive and need to be detected as early as possible. Loss of chemical feed can also be detected quickly and reliably with on-line fluoride monitoring.

The Q46F Fluoride Monitor provides continuous measurement of free fluoride concentration in potable water. The system employs a fluoride sensitive ion selective electrode (ISE) that provides reliable measurement down to 0.1 ppm and as high as 1000 ppm. A chemistry module provides sample conditioning for the sensor and the measured fluoride concentration is displayed on a separate electronics module that also provides alarm and analog output functions.

FEATURES

- **Analog Output Options.** Two isolated 4...20 mA outputs are standard. Default setting provides analog outputs for fluoride and temperature.
- **PID Output.** Standard PID control function assignable to one analog output.
- **Digital Communications.** Available in Profibus DP, Modbus RTU, Modbus TCP/IP, Ethernet/IP or Datalogger.
- **Sensor Preamp.** Sensor preamplifier module in Auto-Chem enclosure supports monitor-to-chemistry unit separation up to 300 feet.
- **Relay Outputs.** Three SPDT relays are standard, with relay functions programmable for alarm, control or trouble indication.
- **Flexible Mounting.** NEMA 4X (IP66) enclosure is suitable for wall, pipe or panel mounting.
- **Clear Display.** Backlit large LCD display provides clear visibility in any lighting conditions. A scrolling second line on the display provides additional information and programming prompts.



APPLICATIONS

- Potable Water
- Semi-Conductor Wastewater Systems

SENSOR OPERATION

Fluoride ISE sensors measure F⁻ ion in solution the same way that a pH sensor measures hydrogen ions. A lanthanum fluoride crystal on the tip of the sensor develops a voltage that is proportional to fluoride ion activity. A reference electrode, which is part of the fluoride sensor, provides the other half of the sensing system, with the measurement made at a differential input amplifier. Since the activity of fluoride ions in solution are a function of pH and ionic strength, a small amount of buffer solution is added to the measured sample. This creates a stable condition in which the concentration of fluoride ion and the activity of fluoride ion are directly proportional.

In operation, a small amount of sample is pumped into the system and mixed with the buffer solution. The treated sample then flows to a chamber where the combination fluoride ISE and reference electrode is mounted. The fluoride ion concentration is measured in this chamber with changes in fluoride immediately reflected at the monitor. The treated sample is pumped back out of the measuring cell and into the drain side of the inlet overflow chamber.

Fluoride monitors require very little maintenance. A single gallon of buffer supports approximately 25 days of operation, and the sensor fill solution level should be inspected weekly.



AUTOMATIC CALIBRATION

Ion selective electrodes are subject to small changes in offset voltage which can be reflected as a slow measurement drift. The Q46F monitor provides an automatic calibration function that can be used to maintain long-term accuracy without the need for manual adjustments. The Auto-Cal function can be programmed for either a 1-point or a 2-point calibration. Fluoride ISE sensor slope changes relatively slowly, so a 1-point Auto-Cal is often sufficient, but a 2-point Auto-Cal provides optimum long-term accuracy.

CALIBRATION SEQUENCE

The Auto-Cal system periodically stops normal sample flow and opens the inlet for calibration standards, normally 1 and 10 ppm fluoride. After the first standard has been read, and the mV value is stored, the calibration standard valve switches to the second standard solution. After the two standards have been read, the monitor automatically adjusts the zero offset and slope in the monitor; normal measurement resumes. During the calibration cycle of about 5 minutes, the 4...20 mA output is held at the value measured just before starting the cycle. At the end of the cycle, the output holds for a short period to allow the sample to stabilize again, and then the output is released to update.

The frequency of the Auto-Cal cycle is user programmable, from every 24 hours to every 999 hours. Every 1...3 days is normally sufficient to maintain good measurement accuracy. Each cycle uses about 30 cc of calibration standard, so 1 liter of standard generally provides about 33 calibrations.

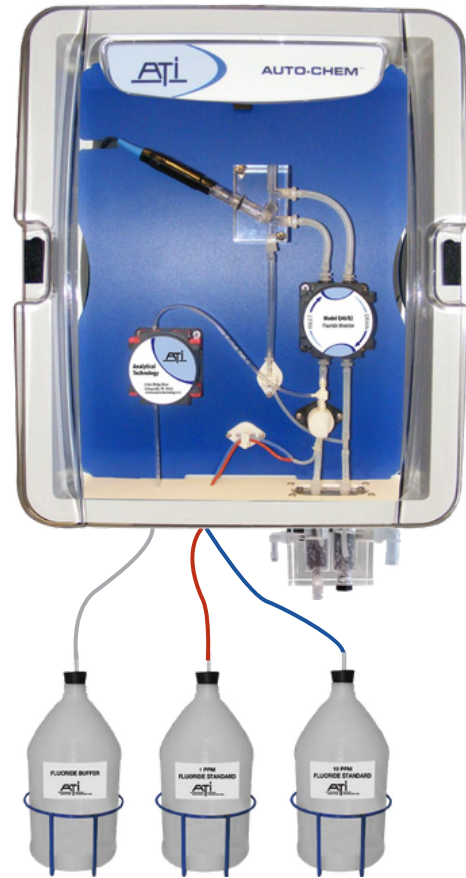


Figure 1: Auto-Chem assembly



SPECIFICATIONS

Electronic Monitor

Display Range	0...20.00, 0...200.0 or 0...2000 ppm
Accuracy	1.0% of selected range or 0.10 ppm
Repeatability	0.5% of selected range or 0.05 ppm
Non-Linearity	0.5% of selected range
Temperature Drift	0.01% of span/°C
Power	100...240V AC, 50/60 Hz, 10 VA max.
Analog Outputs Temperature	Two isolated 4...20 mA, 500 Ω load max.
Compensation Relays	Automatic 0...40° C
Display	Three SPDT, 6 A @ 250V AC, 5 A @ 24V DC
Enclosure	4-digit, 0.75 in. numeric LCD with 12-digital second line, LED backlight
Operating Temperature	NEMA 4X Polycarbonate V-0 Flammability
Weight	–4...140° F (–20...60° C)
Operating Conditions	2.5 lb (1.1 kg)
Automatic Calibration	0...50° C
	Programmable every 24...999 hours

Chemistry Module

Fluoride Sensor	Combination fluoride ISE sensor
Sensor Cable	10 ft (3.1 m) standard, 300 ft (91.4) max.
Response Time	90% in 60 seconds
Sample Pump	Internal tubing pump, 15 cc/min
Buffer Pump	Internal tubing pump, 0.1 cc/min
Measurement Chamber	Cast acrylic
Temperature Limits	2...40° C
Inlet Sample Flow Rate	5...20 gph at inlet overflow assembly
Sample Inlet	1/4 in. I.D. hose barb
Sample Drain	1/2 in. I.D. hose barb
Power	115 or 230V AC, 50/60 Hz
Weight	15 lb (6.8 kg)
Enclosure	Kydex with Acrylic Cover, V-0 Flammability

ORDERING INFORMATION

QC-A-B Fluoride Monitor

Suffix A - Power	
8	115V AC, 50/60 Hz
9	230V AC, 50/60 Hz
Suffix B - Digital Output	
1	None
2	Profibus DP
3	Modbus RTU
4	Ethernet/IP
5	Modbus TCP/IP
6	Datalogger



ACCESSORIES

09-0066	Fluoride standard, 100 mg/L, 120 mL
09-0067	Fluoride standard, 1000 mg/L, 120 mL
09-0028	Q46F fluoride buffer, one gallon bottle (powder only)
05-0108	Fluoride standards dilution kit
63-0108	Fluoride sensor (spare)
05-0068	Panel mount bracket kit for Q46F electronics



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