

Features

For Acid Etching and Fluoride Removal Control Systems

Reagentless operation

Concentration Range: 1 to 10⁻⁶ Molar, 19,000 to 0.019 ppm

Lowest Limit of Detection 5X10⁻⁸ Molar, .001 ppm

pH Range: 0 to 9.5 pH (continuous), up to 10pH intermittently.

Standard system measures free Fluoride, pH and pH compensated total unbound fluoride ions .

Available with analog or smart digital, auto calibrating pH sensors.

Modular electronics permit multiple sensors and additional functions.

Valve retractable sensor holders are available for insertion depths into process tanks up to 41”.

Universal AC input, 24VDC power.

Sensors are customizable per application.

Made in America



FX-300-F-AS Acid Service Free Fluoride Analyzer



The heart of any fluoride removal or etching control system is the fluoride and pH sensors used to monitor the process.

Typical fluoride ion selective electrodes (ISE) and pH sensors designed for potable water simply cannot survive the extremely corrosive solutions used in semiconductor etching, solar panel manufacturing and processes such as stainless steel and beverage can pickling baths.

Hydrofluoric Acid (HF) dissolves standard pH glass and the acidic fluoride mixture attacks the fluoride measuring element. High volumes of etching solution deplete the salts from the pH sensor's reference system, causing drifting and constant recalibration. Etching processes leave a crust of insoluble calcium fluoride and fluorosilicate on the sensor's junction and pH elements, reducing sensitivity and increasing response time. This can only be removed with abrasive cleaning with hydrochloric acid.

The proprietary combination Fluoride ISE and high HF resistant pH sensors used with the **Model FX-300-F-AS** *reagentless* fluoride ion analyzer are specifically engineered to survive these conditions and required cleaning regimen, featuring:

- Custom solid state acid/fluoride resistant double or triple reference junction, rugged enough to withstand aggressive cleaning.
- Special sealing of the fluoride sensing element to survive 0-6pH solutions.
- Radel body for chemical resistance.
- A true high level HF resistant pH element (not just thicker glass) with acid-fluoride resistant solid state reference junction provides more accuracy than antimony or ISFET pH elements.

The analyzer measures free fluoride ion activity from 0-10PPM up to thousands of PPM and determines pH compensated total unbound free fluoride ion activity in solutions below 6pH using a pH sensor and pH compensation module.

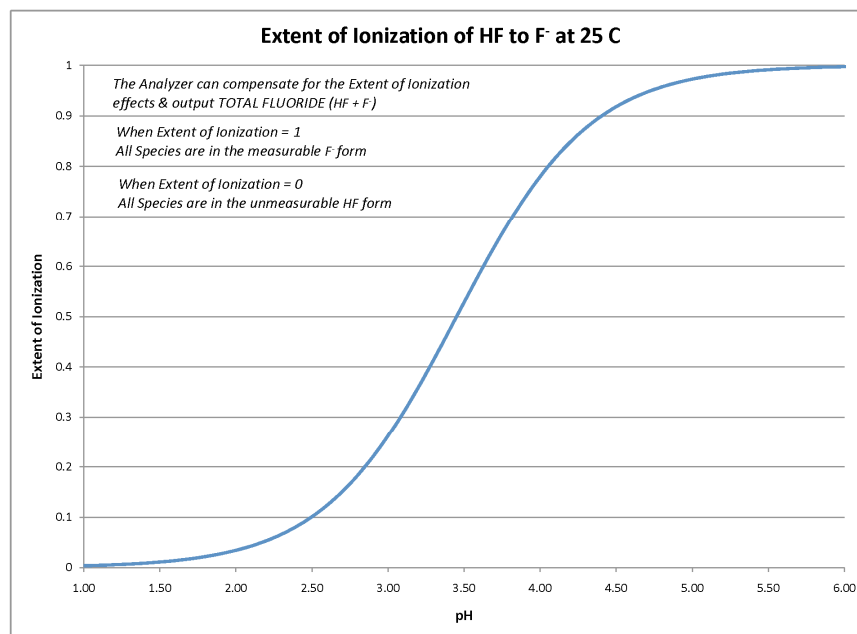
FX-300-F-AS Free Fluoride Analyzer for Acid Etching and Fluoride Removal Control Systems

Product Summary

The FX-300-F-AS is a modular system and is equipped based on the functions required. The base configuration includes a 7" wide IP65 wall mount enclosure holding (3) 35mm Din rail mounted transmitter modules: free fluoride, pH and pH compensated total free fluoride. A 10" wide enclosure holds up to (5) modules, which includes the base configuration and additional functions such as alarm relay/control, temperature output, data logging, or an additional pH or fluoride sensor. The enclosures can also be stacked if more sample points are needed.

Each transmitter includes a 3-digit display, scalable 0/4-20mA output, RS-485 Modbus output is optional. The FX-300-TOT pH compensation module also includes RS-485 Modbus output as standard.

In solutions below 6pH a pH sensor is required to provide input to the FX-300-TOT pH compensation module, which computes the extent of HF ionization given a certain pH, temperature and ionized free fluoride ion activity. The extent of ionization defines the percentage of fluoride that is converted into the form which the ion selective sensor can detect, which is the free ionized species. When ionization is zero, none of the fluoride can be measured by the sensor, when ionization is one all fluoride is in the measurable form, and pH compensation is not required. The "Total ISE" computed by the FX-300-TOT module is the value computed as if all 100% of the fluoride were in the measurable form.



The Fluoride sensor can only be mounted by submersion into a tank; or, by immersion through the wall of a tank using stainless steel hot tap fittings. Sensor cables are water proofed with flexible tubing, fittings and sealant that are compatible with the process medium.

For cable lengths over 20-feet, digital cable extensions with NEMA 6P Snap connector fittings are available. With one end permanently connected to the analyzer, sensor replacement is not only simplified, the cost is reduced since only a fraction of the cable is replaced with the sensor.

FX-300-F-AS Free Fluoride Analyzer

Product Summary, continued

The fluoride ion sensor is supplied only with integral analog electronics in two styles: without integral signal preamplifier for cable length 20 feet or less: or with integral preamplifier for cable lengths over 20 feet up to 330 feet.

The pH sensor can be supplied with onboard analog electronics or smart digital electronics. Smart pH sensors feature auto calibration, remote calibration with values and configuration automatically uploaded to the transmitter, storage of the last five calibrations, and more features for efficient sensor installation and management.

NOTE: The analyzer requires a one-point offset calibration using the grab sample analysis from a separate photometer or laboratory instrument. An application data form must be submitted to determine if the system is suitable for your process.

Instrument Technical Data

Display:	3-digit, 5/16" high red LED display of PPM and temperature in °C, visible in sunlight
Transmitter Operating Range:	0-10, 0-100, 0-999 ppm, ±1000mV. Optional: Kilo-PPM: 0-10,000, 0-100,000 or 0-999,000 ppm. Includes both 4-20mA & RS-485 Modbus output
Power Supply:	Operating power 24VDC +/- 10%, by included CSA/UL/CE approved universal 115/230 VAC input power supply, consumption 60mA max. Customer supplied 3-wire 24VDC power supply if it is not shared with other devices.
Power Entry:	6 Amp fused power entry module, IEC #320-C14 socket, with 2-meter IEC power cord with IEC #C13 & NEMA 5-15P connectors
Galvanic Isolation:	Between all inputs, power & analog outputs (3000V rating)
Signal Output:	Selectable 0-20mA or 4-20 mA DC, 500 Ω max, must always be connected to isolated inputs. Scalable to 20% of full scale range with arbitrary set points for 4mA & 20mA; RS-485 Modbus digital output optionally at time of order
Accuracy:	±0.2% under ideal conditions, excluding sensor
Temperature Compensation	Automatic or manual using PT1000 or optional PT100 temperature element
Temperature Range:	0-150 °C
Instrument Mounting & Dimensions:	Wall Mount IP65/NEMA 4X polycarbonate enclosure, 180mm (7") H x 110mm (4.3")D x 182mm (7.16") or 254mm (10")wide.

FX-300-F-AS Free Fluoride Analyzer

Fluoride Sensor Technical Data

Basic Part Number & Description	SFL-8U-UL-G-10 Combination Fluoride (F ⁻) Industrial Ion Selective (ISE) Sensor with 1" front & 1.25" MNPT rear threads for immersion & waterproofing seal for submersible installations
Recommended Applications	<p>Measurement of free fluoride ion activity for etching solutions at low pH and/or elevated temperatures including acid fluoride etching of aluminum for beverage cans, titanium for aerospace parts & for silicon wafer fabrication.</p> <p>Hydrofluoric (HF) wastewater treatment systems where strong acid cleaning is required to remove calcium fluoride (CaF₂), fluorosilicate or any other similar fouling build-up on sensor in environmental remediation and reduction applications.</p>
Operating Temperature Range:	+5 to +70 °C Continuous
Operating Pressure Range	1 to 20 psig (6.9 to 138kPa)
Sensor Body Material	RADEL®R-5000 NT (Poly-Phenyl-Sulfone, PPSU)
Junction Support Matrix Material	High-Density Polyethylene(HDPE)
Linear Measurement Range	0.019 to 19,000 ppm (1X10 ⁻⁶ to 1.0 Molar)
Lowest Limit of Detection	5X10 ⁻⁸ Molar, 0.001 ppm
Interfering Ion(s)	OH ⁻ when pH is above 12.0
Suitable pH range	0 to 10 pH (continuous)
Cases where pH Compensation is necessary to compute total fluoride species	When pH is below 5.5 then the sum of the measured unbound fluoride ions and dissolved hydrogen fluoride (HF) gas form must be computed as a function of realtime continuously measured pH to ensure proper field calibration & measurement
Measuring Element	Fluoride ion sensitive crystal with PEEK sealing cap
ISE Sensing Element Dimensions	0.315" (8mm) diameter for active fluoride ion sensing region, 0.625" (15.9mm) overall diameter including PEEK sealing cap
Tip Guard	4-Tab style tip guard standard, optional with no guard
Reference System Type	Double Junction Standard, Triple Junction optional
Reference Half Cell	Ag/AgCl, Saturated KCl
Primary Junction	Porous Ceramic, Sat. KCl in crosslinked polymer, Interfaced to Secondary Junction
Secondary Junction	Solid-State Non-Porous Cross-Linked Polymer embedded in HDPE Support Matrix holds excess KCl assuring saturation at all temps for stability & long sensor life
Integrated Components	Pt1000 Temperature Compensation Element Analog Preamplifier (Optional for noisy areas and/or long cable runs)
Cable, analog sensors without integral preamplifier	20-ft standard, sealed, terminated with tinned leads
Cable, analog sensors with integral preamplifier	20-ft standard, 330-ft max, sealed, terminated with tinned leads or quick disconnect NEMA 6P Snap connector
Mounting Style	Submersible, Immersion using 1"MNPT front threads & 1-1/4" MNPT rear threads. <i>Inline mount prohibited.</i>
Storage & Shelf Life	One (1) year from date of dispatch from factory when stored at indoor ambient room temperature with proper orientation & protector cap

FX-300-F-AS Free Fluoride Analyzer

Typical pH Sensor Technical Data

Basic Part Number & Description	SPH-HHF-68-UL-G-10 Acid Fluoride & HF Resistant combination pH Sensor, 3/4" front & 1" MNPT rear threads for immersion & waterproofing seal for submersible installations
Recommended Applications	Wastewater treatment of acid fluoride etching solutions, Fluoride wastewater containing high HF levels with low pH, applications requiring strong acid cleaning to remove precipitate buildup
Operating Temperature Range:	-5 to +70°C in strong HF & fluoride at low pH
Operating Pressure Range	1 to 150 psig (6.9 to 1035kPa)
Sensor Body Material	RADEL®R-5000 NT (Poly-Phenyl-Sulfone, PPSU)
Junction Support Matrix Material	KYNAR® (Poly-Vinylidene-Fluoride, PVDF)
pH Measurement Range	0 to 11pH with high HF resistance option
Measuring Glass Type	HF resistant hemispherical, with ten times the fluoride resistance of standard general pH glass.
pH Glass Dimensions:	0.354" Dia. (9.0mm)
Initial Impedance:	< 1,500 MΩ @ 25°C with High HF Option
Sodium Ion Error	Less than 0.15 pH in sodium (Na+) solutions at pH 14.00 (without "HF" option)
Acidic Error:	Less than 0.05 pH in hydrochloric acid (HCl) solutions at 0.00 pH (for standard version)
Tip Guard	4-Tab style tip guard standard, optional with no guard
Reference System Type	Double Junction Standard, Triple Junction optional
Reference Half Cell	Ag/AgCl, Saturated KCl
Primary Junction	Porous Ceramic, Sat. KCl in crosslinked polymer, Interfaced to Secondary Junction
Secondary Junction	Solid-State Non-Porous Cross-Linked Polymer embedded in HDPE Support Matrix holds excess KCl assuring saturation at all temps for stability & long sensor life
Integrated Components	Pt1000 Temperature Compensation Element Analog Preamplifier (Optional for noisy areas and/or long cable runs), integral smart digital circuitry optional
Cable, analog sensors without integral preamplifier	20-ft standard, sealed, terminated with tinned leads
Cable, analog sensors with integral preamplifier	20-ft standard, 330-ft max, sealed, terminated with tinned leads or quick disconnect NEMA 6P Snap connector
Mounting Style	Submersible, Immersion using 3/4"MNPT front threads & 1" MNPT rear threads.
Storage & Shelf Life	One (1) year from date of dispatch from factory when stored at indoor ambient room temperature with proper orientation & protector cap