FX-300 Inline Reagentless Ammonium Analyzer

The Foxcroft FX-300-NH4 uses ion selective electrode technology to monitor and control in real time free Ammonium (NH4+) in drinking water chloramine production, boosting and select locations in the wastewater treatment process.

The FX-300 is designed to be a simpler, lower cost alternative to sample conditioning analyzers where the application allows, producing online measurements that can provide you a more detailed status of your process and reduce grab sampling frequency.

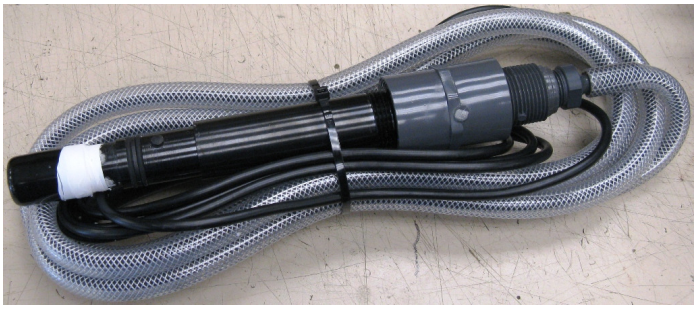
The modular design allows you to select either a single channel monitor or a multi-parameter instrument to include pH, temperature, ORP, conductivity or other ion measurements all in one package.

FX-300 Features / Benefits

- Unique membrane technology results in a heavy duty combination sensor that directly measures ammonium ion NH4+in water without converting ammonium to NH3 gas. pH compensation is available to calculate the gaseous form of ammonia NH3 present in samples above pH 7. In the majority of drinking water applications pH compensation is unnecessary since the typical pH and temperature results in 100% of ammonium being in the measureable form of NH4+.
- 1-point grab sample offset calibration with a separate instrument is required and quickly standardizes the instrument WITHOUT removing the sensor from service with your interference compensated grab or lab analysis used for reporting.
- The flexibility to configure the FX-300 as a simple transmitter, or as an analyzer *for any combination of available measurements and functions* to suit your application and budget.
- Minimize maintenance and ownership costs due to rugged ISE sensors that require no reagents, electrolyte, sample preparation or sensor rebuilding.
- These industrial grade sensors can be submerged in a basin, inline mounted in a pipe tee, or mounted in an optional low flow panel.

Unique Membrane Technology

Engineered from the ground up and extensively field tested, unique proprietary membrane and reference technology provides significantly improved sensor life and selectivity of ammonia over potassium when compared to traditional ion selective electrode (ISE) membranes.

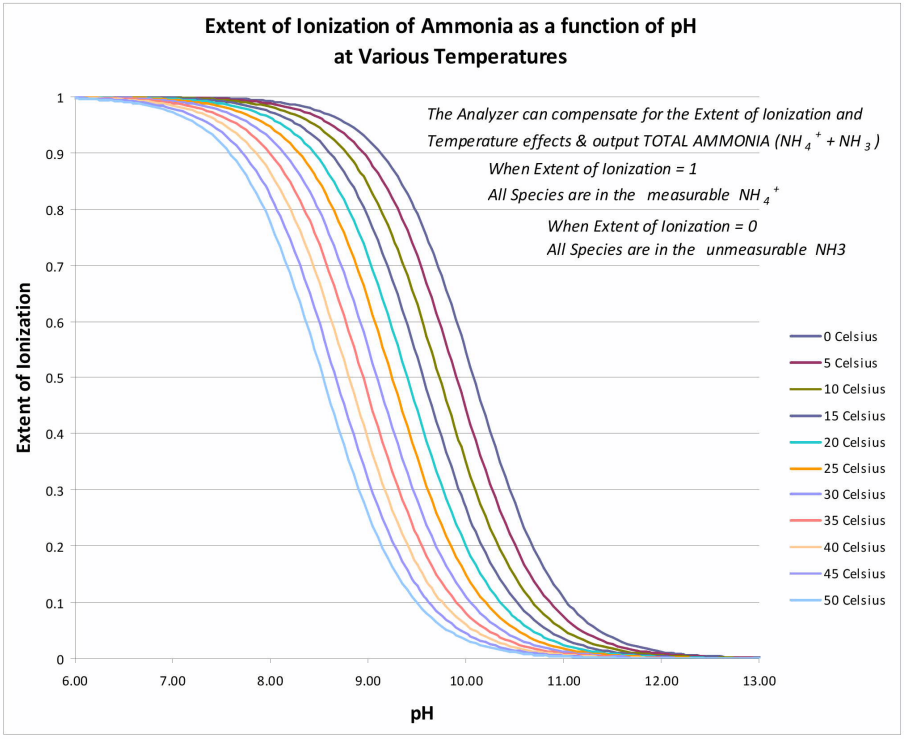


Applications

Free ammonium NH4 ion activity in potable water through wastewater and industrial processes. Total unbound ammonia (NH3) using optional pH sensor and compensation module.

Municipal wastewater range: 1 ppm to 999 ppm depending on other solution constituents
Municipal drinking water range: 0.5 ppm to 999 ppm

- Drinking water chloramine production
- Chloramine boosting
- Monitoring of drinking water distribution systems
- Primary or tertiary wastewater treatment
- Industrial air scrubbers - ammonium solution concentration measurement.

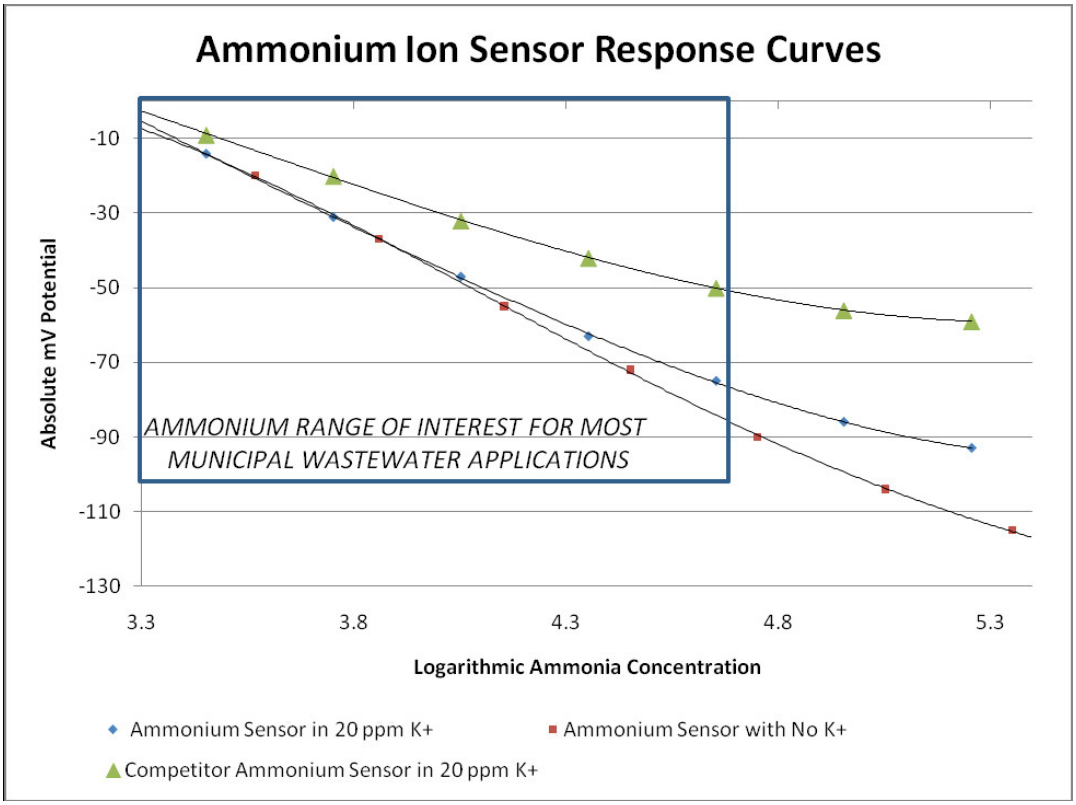


Ion Compensation For ISE Electrodes Is Not a Valid Solution

Measuring ammonium ions using traditional older ISE membrane technology has been problematic due to interfering potassium ions that are present in concentrations typically found in processes outside of the laboratory. Often the "solution" has been to measure the interfering ion with a second electrode and "compensate" for the effect of the error on the primary measurement.

However, there is no widely accepted scientific consensus that an ion selective sensor can be compensated for interferences with a second ISE sensor in continuous field applications. Interference is a degenerative process, exposure to levels outside the range of the sensor gradually degrades the sensor to the point it becomes unresponsive. Online process streams can have varying analyte and interfering ion levels, temperature, and sample background. Such continuous change in the sensor characteristics and sample, combined with potential uncertainty of a second "compensation" electrode, is a complex process to measure properly even in lab conditions. This just can't be corrected in the field with a simple mathematical factor.

Sensors used with the FX-300 do not require such compensation, and are capable of measuring ammonium in the presence of 20 to 30 ppm potassium ion while maintaining linearity and stability.



Conversion Table for Logarithmic Ammonia

pNH4	to	ppm Ammonia
3.3		9.041 ppm
3.8		2.859 ppm
4.3		0.904 ppm
4.8		0.286 ppm
5.3		0.090 ppm

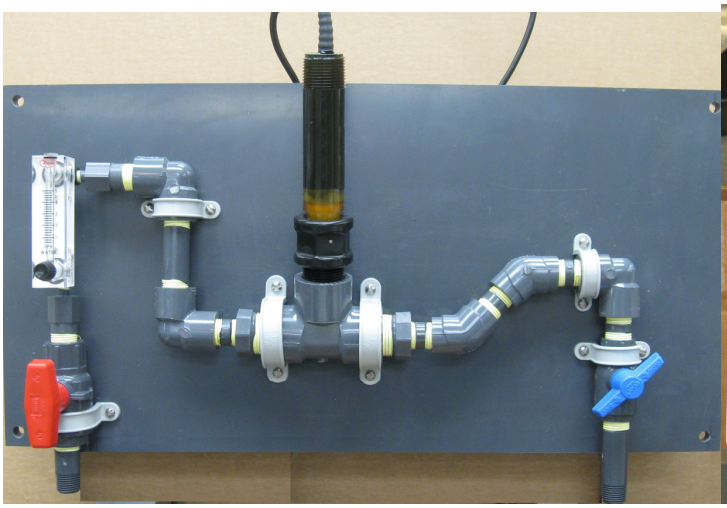
As shown in the graph, the FX-300-NH4 sensor performs nearly identically to the ideal response (as shown with the no potassium ions present plot with red squares) in the presence of 20 ppm potassium even at low levels of ammonium. For the primary range of interest (as shown in blue square bracketed area) the deviation from ideal response for the FX-300-NH4 sensor even in the presence of 20 ppm potassium is altogether negligible whereas the deviation from the competitor sensor in this same area is quite prominent, with poor linearity and large deviations from the ideal response.

Description & Options:

Standard system includes the universal power supply, the measurement transmitter(s) in a 9” x 11” NEMA 4X windowed enclosure that can be wall or pipe mounted. Options include: a pH compensation module, a temperature transmission module and alarm relays with control module. Control functions are selectable between on/off, time proportional control, and proportional frequency (variable pulse) control.

The ISE modules in the FX-300 include the parameter and temperature measurement, integral temperature compensation, 3-digit LED display of ppm or temperature, and configurable 0/4-20mA output of ppm. Sensors are supplied as standard with a 10-ft cable with tinned lead ends, and feature industrial grade construction with the best reference lifetime in process industry through a solid state nonporous cross linked conductive polymer reference system.

Sensors can be mounted on a pre-plumbed flow panel, inline in a pipe tee, immersion mounted in a tank, or submerged in a basin. A variety of waterproofing options are available to suit almost any application.



Inline Sensor Mounting Panel

Ammonium NH4 with pH compensated total NH3

Description & Options:

Measurement / Transmitter Modules: Modules are available to measure pH, ORP, mV, Temperature, Conductivity, Ammonium NH_4^+, Nitrate NO_3^-, Nitrite NO_2^-, Fluoride F^-, Calcium CA^{+2} (used as a proxy for water hardness), Potassium K^+, Perchlorate CLO_4^-, Chloride CL^-, Cyanide CN^-, Sulfide S^-, Silver Ag^+ and Sodium Na^+among other ion selective parameters.

Each module includes a 3-digit display, LED mode indicators, and a single scalable 0 / 4-20mA output. All analog outputs have built-in trim calibration support, including both offset and span adjustments. Calibration of temperature element is available for all measurement modules.

Preamplifier Support: Unlike many low cost systems, the FX-300 series supports optional external sensor preamplifiers for operation in noisy environments. It also eliminates the need to open the analyzer enclosure for sensor service, thus preventing accidental damage to the analyzer. Sensors with integral or external preamplifiers can be located up to a maximum 300 feet away. Available only at time of order.

FX-REL Option: Alarm and relay controller module with two independent configurable limits. One module required for each measurement module. Providing (2) each 250VAC / 5 amp dry contact relays, each can be set to minimum or maximum limits, and control functions that are fully configurable for control mode and variables for each control algorithm. Control modes include: 1) Alarm functions only; 2) On/Off control with a user-configurable dead band; 3) Time proportional control; 4) Proportional frequency control (variable pulse controller). Alarms include configurable startup timer and reaction timer to avoid alarming if limits are exceeded for a short time. Hold function to disable alarms during calibration and maintenance.

Data Logging Option: Removable single or dual channel USB data logger, Windows compatible software to configure, graph, or export data to other applications, or with the FX-300-DAT data logging module for up to 63 Modbus digital inputs, 16 MB onboard flash memory, Windows software.

FX-TP Option: Temperature output module. Transmits a 0/4-20mA output of the spliced PT100/PT1000 temperature element or raw input from an external temperature sensing element.

FX-TOT Option: Computes pH compensated total unbound free ammonium measurement using the free ion activity, pH and temperature as inputs; and sends the computed value by 4-20mA output. The inputs can also be sent by included RS485 Modbus digital output along with the computed total unbound ion value.

Modbus Option: Available by ordering the measurement module to include RS485 Modbus (only on initial order), or by adding the separate FX-TOT module anytime. Modbus outputs from the FX-300-TOT module can consist of the ISE measurement, pH, and temperature, or the ISE measurement, pH, and a third input which can be conductivity, or a second pH/ORP or ISE measurement that does not require pH compensation.

Power: Universal 115/230 VAC input 24VDC power supply suitable to power up to (8) measurement / function modules. Optional 3-wire 24VDC (not 2-wire loop power) using a power supply dedicated only to the FX-300 modules.