

# Water Quality Monitor

## Q46N Dissolved Ammonia

### OVERVIEW

On-line monitoring of Ammonia in water is of increasing importance due to the increased emphasis on nutrient reduction in lakes, streams and estuaries. Unfortunately, simple direct measuring sensors have not proven sufficiently reliable, and rather complicated systems have been developed to address the measurement problem. These systems can be used but require substantial maintenance and are expensive to purchase.

The Q46N Dissolved Ammonia system is designed for the continuous measurement of free ammonia, total ammonia and monochloramine in potable water. It is intended for monitoring chloraminated water to minimize the amount of excess ammonia in the system. The full scale operating range of the system is 0...5.00 ppm. The display is capable of values as high as 20.00 ppm, but the instrument should not be used for monitoring water with total ammonia concentration higher than 5 ppm. The analog output signal may be spanned for smaller ranges, with 0...1 ppm being a common range. Q46N chemistry modules are designed to operate on sample temperatures from 5...40° C. Because water is flowing through the chemistry module at a low rate, this unit cannot be exposed to temperatures below 0° C.

The Q46N Free Ammonia System uses a unique chemistry that converts ammonia in solution to a stable monochloramine compound equivalent in concentration to the original ammonia level. Two separate sensors are used in the system—one to measure chloramine concentration prior to chemical injection, and another to measure chloramine levels after all ammonia has been converted. Free ammonia is calculated by subtracting the chloramine ammonia value from the total ammonia value.

Sample and drain connections are made to an inlet overflow assembly located under the chemistry module enclosure. An adapter for 1/4 in. I.D. tubing is supplied for the inlet and a 1/2 in. I.D. hose barb is provided for the drain connection.

The Q46N ammonia system consists of two separate parts—a wall-mounted electronic unit and an Auto-Chem chemistry system. AC power is required for both the monitor and chemistry system. Power may be brought to each unit separately or may be connected to the chemistry module with a power cable connecting the monitor to the chemistry unit. A 10 foot length of 9-conductor shielded cable connects the sensors in the chemistry module to the monitor.

Three separate reagents are required for operation. Reagent filter assemblies are included for each and must be used to ensure that no obstructions occur in the reagent tubing. Four feet of pickup tubing is supplied for each reagent. Reagent pickup assemblies, sensor membranes and electrolyte, spare parts and a copy of the manual are packed inside the chemistry.



### APPLICATIONS

- Chlorinated Potable Water
- Wastewater Effluent
- Potable Water Intake
- Ammonia Chillers
- Aquariums
- Fish Farms

### FEATURES

- Fast response time for real time ammonia measurement
- Auto-Chem chemical module uses inexpensive reagents
- Displays free ammonia, monochloramine and total ammonia for chloramination systems
- Automatic response verification for ammonia breakthrough applications
- Digital communications options include Profibus DP, Modbus RTU, Modbus TCP/IP, Ethernet/IP or Datalogger

## THEORY OF OPERATION

Ammonia measurement is accomplished by adding three reagents, using a multichannel peristaltic pump. First, a stabilizer chemical is injected to stop calcium precipitation in the tubing. Next, a solution containing free chlorine is injected which results in the conversion of ammonia to monochloramine.



The third reagent added quenches the above reaction by removing the excess free chlorine. This ensures that free ammonia in the sample stream is converted to monochloramine and dichloramine formation does not occur.

Once chloramine formation is complete, the sample is temperature stabilized and pumped to a flow cell containing a special amperometric membraned sensor. This sensor measures the monochloramine formed in the chemical system and produces a highly linear output that is amplified and displayed in the monitor.

## CHLORAMINATION SYSTEM MONITORING

Chloramination in potable water treatment has become common, especially in utilities with large distribution systems. The use of chloramines to reduce disinfection by-products and to provide disinfectant protection throughout a large pipe network has proven useful but does present potential water quality problems if not controlled properly.

A carefully controlled chloramination system will result in the conversion of all free chlorine to monochloramine with only a slight excess of ammonia. This excess ammonia, called "free ammonia", should be kept as low as possible to avoid the formation of nitrites and nitrates in the distribution system.

Minimizing the free ammonia concentration requires the accurate measurement of free chlorine to pace the ammonia addition, and also requires an accurate measurement of residual free ammonia. A special version of the Q46N ammonia monitor provides the capability of monitoring free ammonia by continuously measuring both total ammonia and monochloramine concentrations. Free ammonia concentration is then derived from these values.

Two sensors integrated into the Auto-Chem chemistry system provide the required measurements. A sensor located in the inlet assembly measures monochloramine concentration in the chloraminated water. After addition of reagents, a second sensor measures the total ammonia concentration. The electronic monitor subtracts the monochloramine ammonia from the ammonia and the free ammonia value.

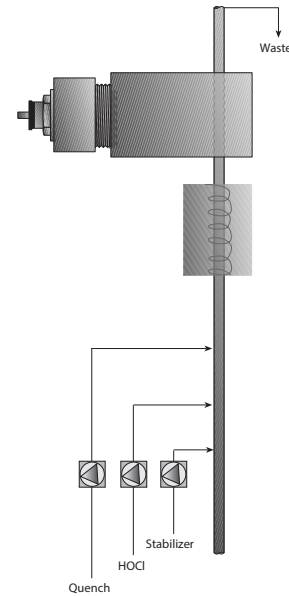


Figure 1: Permanganate measurement

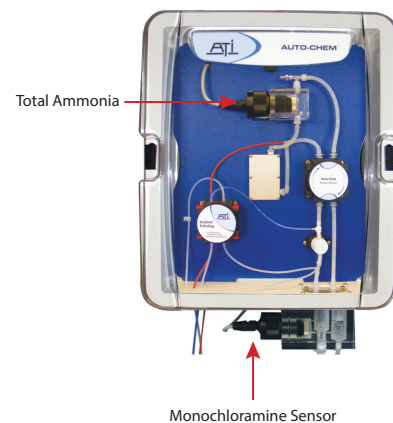


Figure 2: Chloramination system monitoring

## SPECIFICATIONS

### Electronic Monitor

|                              |                                                                                                                                                      |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Measurement</b>           | Total Ammonia (as $\text{NH}_3$ or $\text{NH}_3\text{-N}$ )<br>Free Ammonia, Monochloramine (as $\text{NH}_2\text{Cl}$ or $\text{NH}_2\text{Cl-N}$ ) |
| <b>Display Range</b>         | 0...5.00 ppm for Total Ammonia<br>0...10.00 ppm for Monochloramine (Free Ammonia Systems Only)                                                       |
| <b>Response Time</b>         | 90% in 180 seconds                                                                                                                                   |
| <b>Accuracy</b>              | $\pm 0.05$ ppm or 2% of full scale                                                                                                                   |
| <b>Sensitivity</b>           | $\pm 0.01$ ppm                                                                                                                                       |
| <b>Zero Stability</b>        | $\pm 0.01$ ppm/month                                                                                                                                 |
| <b>Electronic Linearity</b>  | $\pm 0.5\%$                                                                                                                                          |
| <b>Span Drift</b>            | Generally less than 5% per month (application dependent)                                                                                             |
| <b>Analog Outputs</b>        | Two isolated 4...20 mA, 575 $\Omega$ load max. (TNH3 systems)<br>Three isolated 4...20 mA, 575 $\Omega$ load max. (FNH3 systems)                     |
| <b>Power</b>                 | 100...240V AC $\pm 10\%$ VAC, 50/60 Hz, 5VA max.                                                                                                     |
| <b>Relays</b>                | Three SPDT, 6A @250V AC, 5A @ 24V DC                                                                                                                 |
| <b>Display</b>               | 4-digit, 0.75 in. numeric LCD with 12-digital second line, LED backlight                                                                             |
| <b>Enclosure</b>             | NEMA 4X (IP66) Polycarbonate, V-0 flammability                                                                                                       |
| <b>Operating Temperature</b> | Electronics: $-40\ldots 140^\circ\text{F}$ ( $-40\ldots 60^\circ\text{C}$ )                                                                          |
| <b>Auto Verification</b>     | Programmable from 1...999 hours (Total $\text{NH}_3$ only)                                                                                           |
| <b>Digital Output</b>        | Profibus DP, Modbus RTU, Modbus TCP/IP, Ethernet/IP, Datalogger                                                                                      |

### Chemistry Module

|                               |                                                                              |
|-------------------------------|------------------------------------------------------------------------------|
| <b>Ammonia Sensor</b>         | Amperometric Membraned Sensor                                                |
| <b>Interconnect Cable</b>     | 10 ft (3 m) standard, 100 ft (30.5 m) max.                                   |
| <b>Sample Pump</b>            | Peristaltic pump, 13 cc/min                                                  |
| <b>Reagent Pump</b>           | Peristaltic pump, 0.1 cc/min                                                 |
| <b>Reagent Use</b>            | 25 days per gallon (3.8 L)                                                   |
| <b>Inlet Sample Flow Rate</b> | 1...10 gph (60...600 cc/min.) at inlet overflow assembly                     |
| <b>Sample Inlet</b>           | 1/4 in. I.D. hose barb                                                       |
| <b>Sample Drain</b>           | 1/2 in. I.D. hose barb                                                       |
| <b>Power</b>                  | 120 or 240V AC, 50/60 Hz, 60 VA max.                                         |
| <b>Operating Temperature</b>  | $36\ldots 113^\circ\text{F}$ ( $2\ldots 45^\circ\text{C}$ )                  |
| <b>Size</b>                   | 15.2 H $\times$ 13.2 W $\times$ 7.1 in. D (386 $\times$ 335 $\times$ 180 mm) |
| <b>Weight</b>                 | 17 lb (7.7 kg)                                                               |

## ORDERING INFORMATION

### QD-A-B-C Dissolved Ammonia Monitor

| Suffix A - Power          |                                                 |
|---------------------------|-------------------------------------------------|
| 8                         | 115V AC, 50/60 Hz                               |
| 9                         | 230V AC, 50/60 Hz                               |
| Suffix B - Parameter      |                                                 |
| TN                        | Total Ammonia only                              |
| FN                        | Total Ammonia, Total Monochlorine, Free Ammonia |
| Suffix C - Digital Output |                                                 |
| 1                         | None                                            |
| 2                         | Profibus DP                                     |
| 3                         | Modbus RTU                                      |
| 4                         | Ethernet/IP                                     |
| 5                         | Modbus TCP/IP                                   |
| 6                         | Datalogger                                      |

## ACCESSORIES

|                |                                                               |
|----------------|---------------------------------------------------------------|
| <b>07-0100</b> | Universal junction box, NEMA 4X                               |
| <b>31-0027</b> | 9-c sensor interconnect cable, max. 100 ft                    |
| <b>05-0094</b> | Panel mount bracket kit                                       |
| <b>47-0005</b> | 2 in. U-bolt, 304 SS                                          |
| <b>09-0074</b> | Ammonia reagent A buffer, 1 pkg.                              |
| <b>09-0075</b> | Ammonia reagent C stabilizer, 1 pkg.                          |
| <b>51-0066</b> | Hydrogen peroxide, 27%, 500 cc bottle (drop shipped, US only) |

### NOTES:

- Each system is supplied complete with monitor, chemistry module, reagent bottle brackets, reagent pickup tubing assemblies and spare parts kit. A 20 foot cable is provided for connection of the sensor inside the chemistry module to the Q46N monitor.
- Free ammonia systems (Suffix B2) have three 4...20 mA outputs.

