Drinking Water Industry Solutions

Safe and Reliable Liquid Analysis

ROSEMOUNT® Analytical

EMERSON™ Process Management

WE START WITH ONE IDEA: *MAKE IT SAFE*

Water is the most crucial element needed for human activity on the planet, including agricultural, industrial and domestic use. Unfortunately, water quality around the world is poor and getting worse. While over 70% of the Earth is covered in water, only about 0.01% is usable fresh water. And since water demand increases with population, the re-use of water and proper treatment methods have become a critical necessity.

With so much at stake, you need a partner that can deliver the best in knowledge and systems, and do it quickly, thoroughly and cost-effectively. The liquid analysis professionals at Emerson Process Management are ready to put their 60-plus years of experience to work for you. We'll evaluate your application and deliver an optimal, real-world, customized solution for your specific requirements, utilizing world-class Rosemount Analytical sensors and instrumentation.

Poor Water Quality: Understanding the Problem

Water treatment plants come in a wide variety of sizes, with no two plants exactly alike. But whether publicly owned or privately held, they all share the same goal — to provide a source of safe and reliable drinking water to their communities.

Water treatment varies based on the quality of the water source, size of the plant, and if ground water or surface water is used. Smaller systems are likely to use ground water, while larger systems rely on surface water sources such as rivers, lakes, and reservoirs.

As water travels through the ground, or sits in lakes and rivers, it comes in contact with organic materials, which dissolve in water. These organics in water become a food source for microorganisms. Even the most minute nutrient sources will support growth. While that's good news for microorganisms, it spells disaster for people, since these microorganisms (like Giardia lamblia or the protozoa Cryptosporidium) can be harmful or even lethal to humans.

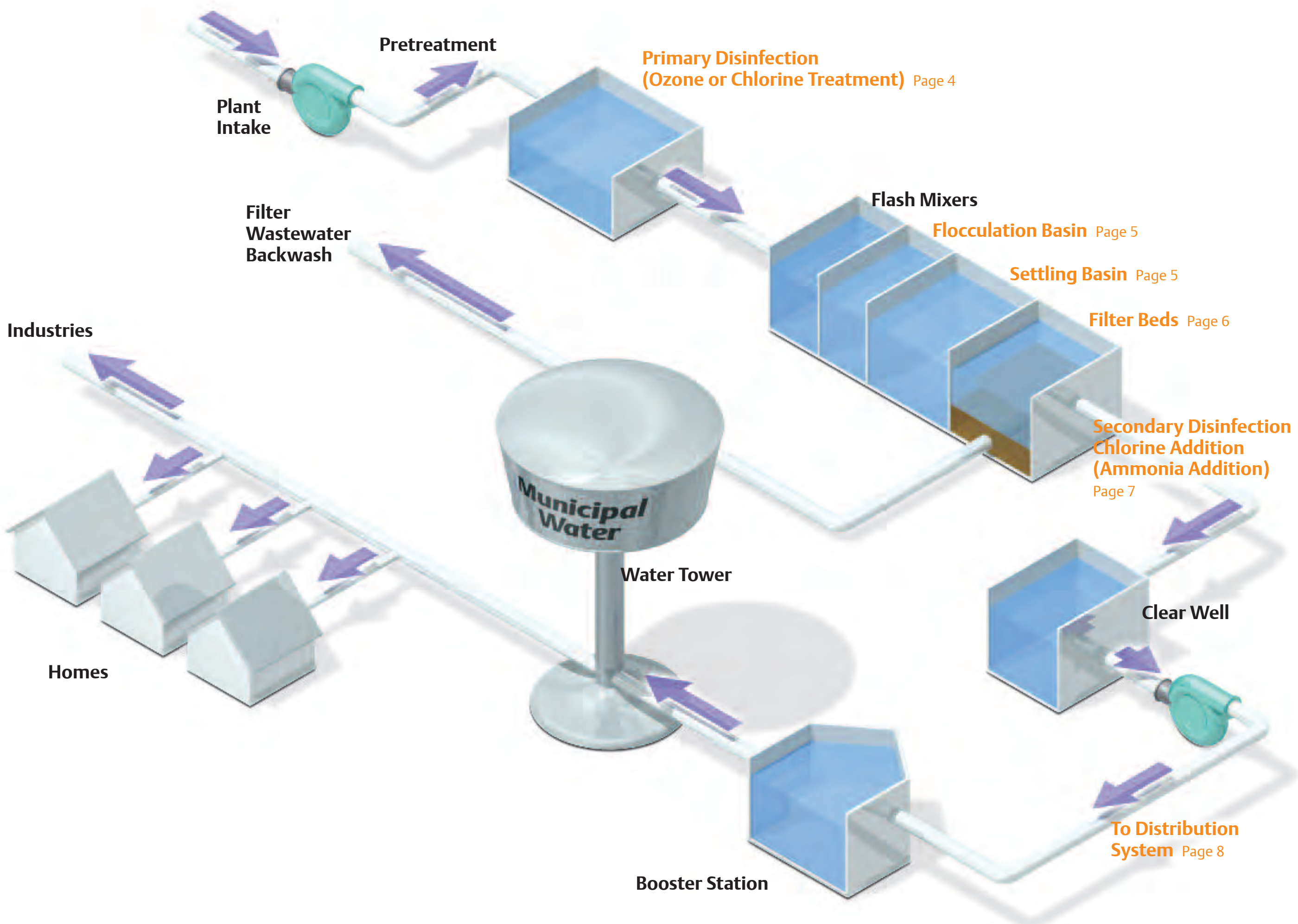
Comprehensive Solutions For *Your* Application

Some smaller treatment plants using ground water systems can meet the local and national requirements without any treatment, but many other systems need additional treatment and disinfection. Governmental agencies such as the US Environmental Production Agency (USEPA) protect the public health by specifying water treatment components and appropriate disinfection levels. To meet these requirements, a variety of water treatment methods are used to remove contaminants from drinking water, and are arranged in a sequence or a treatment train.

A combination of appropriate water treatment processes is selected by the water utilities to treat the contaminants in the raw water source used. Commonly used processes include pre-treatment, coagulation, flocculation, sedimentation, filtration, and disinfection. Other treatment methods could include ion exchange, reverse osmosis, and adsorption.

For these applications and more, count on Emerson. Our full line of Rosemount Analytical sensors and measurement solutions for drink-ing water are proven solutions. When you bring your problem to Emerson, consider it solved.

DRINKING WATER TREATMENT **OVERVIEW**



Here's a typical drinking water plant. It takes water from a lake, river or well and treats it through primary disinfection, coagulation, sedimentation, filtration and secondary disinfection to purify it into safe drinking water.

Harmful organisms are killed by a combination of ozone, chlorine and ammonia addition. The disinfection process is monitored and controlled by continuous measurement of ozone and/or chlorine. Particles are removed and filtered out, and require continuous turbidity measurement for reporting purposes and indicate filter performance. Particle Counters are gaining more acceptance since they provide a quantitative measurement of drinking water clarity and are being used to anticipate filter breakthrough.

CONTENTS

PRETREATMENT

To better define the dynamics of the raw water source being used by a treatment plant, a number of liquid analytical measurements are made prior to entering the treatment process. Influent monitoring measurements could include pH, conductivity, temperature, turbidity, dissolved oxygen, and Total Organic Carbon (TOC). Some plants also keep a permanent record of each of these measurements for future reference or for detecting seasonal changes in the source water.

Before water is clarified, it passes through coarse filters to remove sticks, leaves, fish, and other large objects, preventing them from entering the water treatment plant. Pretreatment also includes primary disinfection using either chlorine or ozone to treat algae growth and for oxidation of chemicals and microorganisms.

Caustic soda is one of the basic building blocks of chemistry and as such it finds diversified applications. One use is in water treatment. Municipal water treatment facilities use caustic soda for pH adjustment, ion exchange regeneration, and on-site generation of sodium hypochlorite. Caustic soda, especially when used for pH control, neutralization of waste acids, and similar applications, competes with other alkalies, particularly sodium carbonate (soda ash). The common factors for selecting caustic soda are its stronger basicity and easier storage and handling.

For water treatment, this is one of the first steps to water treatment and is prior to the filter bed at the mixing tank. Measuring whether caustic soda is in the stream, which indicates whether the feed pumps are working, can be achieved with toroidal conductivity. Toroidal conductivity sensors are long lasting in this application and indicate by the drop in conductivity, that the pump is not feeding caustic into the water stream. The Model 228 toroidal conductivity sensor in a loop with the Model 1056 analyzer work to indicate the feed pump is working or not.

Model 228 Toroidal Conductivity Sensor

PRIMARY DISINFECTION

Since water is a universal solvent, it comes in contact with several different pathogens (bacteria, viruses, and parasitic protozoa), some of which are well know and potentially lethal. Both surface water and groundwater sources can be contaminated by these pathogens, and inactivation is accomplished through chemical disinfection and mechanical filtration treatment.

Chlorine was used first used in the USA in 1908 as a chemical disinfectant of drinking water.

Ozone (O_3) is also a powerful disinfectant first used in water treatment in Europe in 1886. Ozone consists of three oxygen atoms and degrades back to oxygen forming a free oxygen radical, which survives less than 30 minutes. The rate of degradation depends on the water chemistry, pH and temp-erature. Since ozone is unstable, it is generated on site.

Ozone is a very powerful oxidant and it disinfects in less time than is required with chlorine. Ozone

Chemical	Oxidation Potential (volts)
Ozone	2.08
Hydrogen Peroxide	1.78
Hypochlorous Acid	1.48
Chlorine Gas	1.36
Hypobromous Acid	1.33
Chlorine Dioxide	0.95
Hypochlorite	0.81

Relative Oxidation Power of Various Chemicals

attacks the chemical bonds of pathogens in the water, reducing the concentration of organic material, iron, manganese, sulfur, and reducing or eliminating odor and taste problems. Chlorine is a slow oxidizer, has limited effect on bacteria, and Cryptosporidium and Giardia are extremely resistant to chlorine disinfection. Ozone treatment is gaining popularity as a fast and effective treatment technology for disinfection in the primary disinfection stage.

Ozonated air is bubbled up through the water in contact chambers. By the time the water reaches the end of the contact chambers, primary disinfection is complete and the ozone has converted back to oxygen. For proper ozone disinfection to occur, suitable contact time and the proper ozone dosage are required.

The Ozone sensor Model 499AOZ is used to monitor ozone dosage and residuals in the contact chamber.

After pretreatment and primary disinfection, the clarification of raw water is usually a multiple step process for reducing turbidity and suspended solids.

Coagulation and Focculation

Smaller particles combine or coagulate into larger fluffy particles called floc and settle out of the raw water source as sediment. The coagulation process is promoted by the addition of chemical coagulant such as alum, iron salts or synthetic organic polymers. After chemical addition, the water flows through a mixing channel where the water and chemicals are flash mixed.

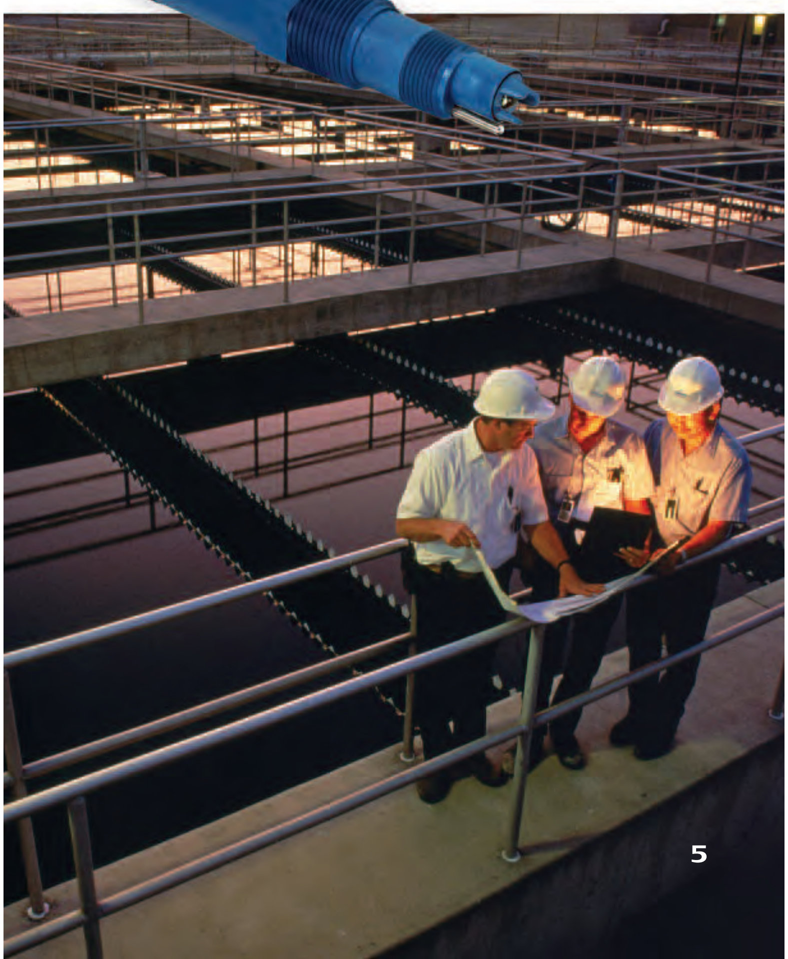
The floc is mechanically stirred to attract suspended solids and microorganisms. The pH measurement plays an important role in the coagulation process. Keeping the pH at the proper levels improves the coagulation process, lowers the turbidity and also improves TOC removal as the pH is lowered.

If the raw water source has an unusually high hardness, chemicals are added such as lime and soda ash to reduce the levels of calcium and magnesium. Lime softening can produce water from 60 to 120 ppm hardness, but will result in a higher pH. Therefore, the treated water is buffered to reduce the pH to make it acceptable for further processing.

Sedimentation

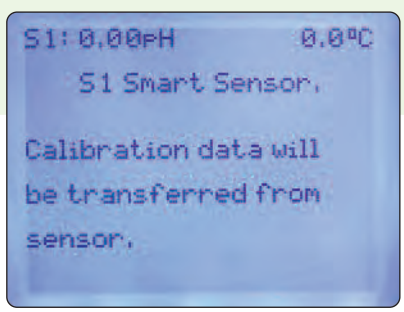
Floc settles to the bottom to form a sludge in sedimentation basins. The combined weight of the dirt and chemical agent become heavy enough to sink to the bottom, and the settling or sedimentation occurs naturally as larger particles settle out. Sludge is removed by mechanical scrapers and disposed of properly. Water is skimmed from the surface of the settling basins and flows into settled water channels.

A Model 3900 pH sensor is used to monitor and control the addition of chemicals for pH adjustment. Available with SMART capabilities.



Rosemount Analytical Smart technology – The SMART solution for pH measurement

SMART pH measurement loops which include SMART pH sensors and SMART-enabled instruments have the advantage of not requiring calibration of pH sensors in the field. All SMART sensors automatically download critical calibration data and performance parameters to the instrument upon calibration in the lab. Simply reconnect the pre-calibrated sensor to a SMART-enabled field instrument and the pH loop is automatically calibrated.



Sensor data transferred to analyzer

Lime is used by many municipalities to improve water quality, especially for water softening and arsenic removal. In terms of annual tonnage, lime ranks first among chemicals used in the treatment of potable and industrial water supplies. Lime has multiple applications:

pH Adjustment/Coagulation - Hydrated lime is widely used to adjust the pH of water to prepare it for further treatment. Lime is also used to combat "red water" by neutralizing the acid water, thereby reducing corrosion of pipes and mains from acid waters. The corrosive waters contain excessive amounts of carbon dioxide. Lime precipitates the CO_2 to form calcium carbonate, which provides a protective coating on the inside of water mains.

Lime is used in conjunction with alum or iron salts for coagulating suspended solids incident to the removal of turbidity from "raw" water. It serves to maintain the proper pH for most satisfactory coagulation conditions. In some water treatment plants, alum sludge is treated with lime to facilitate sludge thickening on pressure filters.

Effect on Pathogen Growth - By raising the pH of water to 10.5-11 through the addition of lime and retaining the water in contact with lime for 24-72 hours, lime controls the environment required for the growth of bacteria and certain viruses. This application of lime is utilized where "phenolic water" exists, because chlorine treatment tends to produce an unpalatable water due to the phenol present. This process, called "excess alkalinity treatment," also removes most heavy metals.

To accurately measure pH, the Rosemount Analytical pH sensor, Model 3900 can be used for continuous online measurement of pH. This general purpose sensor is designed for enhanced performance and increased life with minimal glass cracking provided by field proven ACCU-Glass pH glass formulation. It also fits a large variety of installations with both ¾” and 1” mounting threads.

A Model 3900 pH sensor – available with SMART capabilities.

The sedimentation process removes particles 25 microns and larger, but the process is not 100% efficient, and filtration is required. The turbidity is between 1 and 10 NTU as it enters the filtration stage.

The Clarity II On-Line Turbidimeter is used to monitor and report the turbidity of the filter effluent.

Item	EPA 180.1	ISO 7027
Light Source	Tungsten Lamp	LED or Tungsten Lamp
Wavelength	400-600 nm	860 ± 30 nm
Characteristics	Long Warm-Up Time	Low Stray Light
	More Sensitive to Smaller Particles	Less Sensitive to Smaller Particles
	Color Interferences	Low Color Interferences

Comparison of USEPA 180.1 and ISO 7027

Water flows through sand filters and percolates down through a combination of sand, gravel, anthracite coal, and a mixture of support gravel fine sand. Larger particles become trapped first and smaller particles such as clay, iron, manganese, microorganisms, organic matter, precipitates from other treatment processes, and silt are also removed resulting in crystal clear water.

The filtration stage also removes residual matter resulting from the oxidation of organic chemicals and microorganisms in the primary disinfection stage. Finally, microorganisms resistant to chlorine or ozone disinfection in the pretreatment stage are effectively removed during filtration.

Periodically, the filter must be back washed to remove the fine suspended matter and accumulated sediment that collects in the filter media. As an indication of filter performance and the need to backwash filters, the effluent from the filter beds is continuously monitored with a turbidimeter. Turbidity is the clarity of the sample, and the cloudy appearance is caused by tiny particles in the water. The Clarity II On-line Turbidimeter can be used to monitor and report the turbidity of the filter effluent. Turbidity measurements also help monitor and improve plant efficiency.

High turbidity levels are an indication that the filter is not operating properly, and back washing is necessary.

Government rules and regulations apply to public water systems, and water treatment plants are required to achieve a minimal reduction of harmful microorganisms and viruses. Filtration systems are presumed to achieve the minimal percent reduction of harmful Cryptosporidium, Giardia and viruses by meeting certain turbidity limits in combination with adequate disinfection. The adequacy of the filtration process and the removal of these microorganisms are determined by measuring the turbidity of the combined filter effluent water to meet governmental criteria. This criteria includes the turbidity monitoring frequency, the maximum turbidity limit, and the approved turbidity measuring methods.

Two approved measuring methods have been accepted for making turbidity measurements for compliance monitoring purposes, the USEPA Method 180.1 and the ISO Method 7027. USEPA method is used in the United States and some other countries. The ISO method is used outside of the United States, such as in Canada, Europe, Latin America and Asia. A comparison of the two methods is shown in the table above.

Keeping water systems safe is a national priority. To monitor online multiple parameters, Emerson has a configurable system, the Water Quality System, model WQS, to meet your particular system and regulatory requirements. The system assists in meeting the requirements of the Surface Water Treatment Rule.

Water Quality Monitoring reviewed by EPA

In compliance with the regulations requiring post residual disinfection, plants use chlorination as secondary disinfection in the final treatment step. Ozone does not provide germicidal or a long-lasting disinfection residual to inhibit or prevent re-growth of pathogens in the water distribution system.

Model TCL Total Chlorine Sample Conditioning System

The Monochloramine Measuring System Model MCL directly measures monochloramine without chemical reagents to condition the sample.

Today, chlorine is added as chlorine gas (Cl_2), sodium hypochlorite ($NaOCl$), or chlorine dioxide (ClO_2) as the secondary disinfection agent. Secondary disinfection prevents the re-growth of certain pathogens that may enter the treatment plant or be introduced by back-flow contamination.

When chlorine is added to water, free chlorine forms a mixture of hypochlorous acid (HOCl) and hypochlorite ion (OCl^-). The relative amount of each is dependent on the pH, and the total of HOCl and OCl^- is defined as free chlorine.

For disinfecting water, hypochlorous acid is not only more reactive than hypochlorite ion, but is also a stronger disinfectant and oxidizer. Hypochlorous acid is 80 to 100 times more effective than hypochlorite ion.

To accurately measure free chlorine concentrations, the Rosemount Analytical three electrode chlorine sensor Model 498CL can be used for continuous measurement of free chlorine. Neither a pH sensor, sample conditioning, nor reagent is required.

Chlorine diffuses through a semi-permeable membrane and develops a current proportional to the chlorine concentration inside the sensor.

Chlorination by-products were discovered in drinking water in 1974, and can form when chlorine reacts with bromide and natural organic materials present in the water source. These by-products have a potential health effect on humans. Fears that these by-products could be potential human carcinogens has led the USEPA to establish maximum levels for these disinfection by-products.

Alternates to chlorine disinfection exist, such as chloramines. This process involves adding chlorine and ammonia compounds to the water that, when properly controlled, form chloramines.

Compared to chlorine, chloramines produce fewer disinfection byproducts and exist as mono-chloramine, dichloramine or trichloramine. The ratios of these three depend on the pH, physical properties of the water source, chlorine contact time, and the ratio of chlorine to ammonia. Monochloramine is the most desirable of the three forms, since it contributes little or no taste or odor, and is considered to be the most effective at disinfecting water.

Plant operators using chloramination for disinfection need to accurately determine monochlora-mine levels in the water treatment systems. Rosemount Analytical offers a complete Monochloramine Measuring System Model MCL capable of directly measuring monochloramine. No chemical reagents are needed to condition the sample.

For Total Chlorine measurement, we have the Model TCL Total Chlorine Measuring System. The TCL uses household vinegar and potassium iodide as reagent.

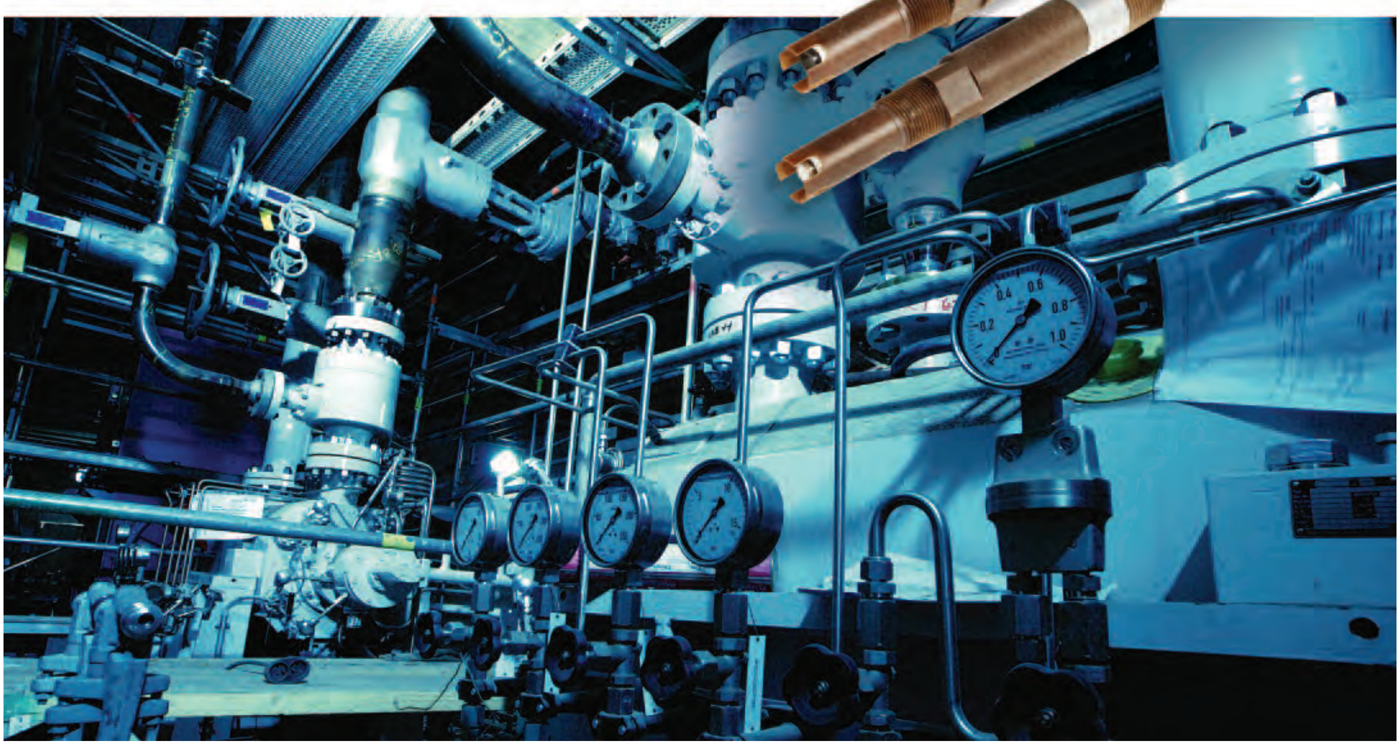
The U.S. specifies the optimal level of fluoride to range from 0.7 to 1.2 mg/L (milligrams per liter, equivalent to parts per million), depending on the average maximum daily air temperature; the optimal level is lower in warmer climates, where people drink more water, and is higher in cooler climates.

The Centers for Disease Control and Prevention have developed recommendations for water fluoridation that specify requirements for personnel, reporting, training, inspection, monitoring, surveillance, and actions in case of overfeed, along with technical requirements for each major compound used.

Water districts that monitor the levels of fluoride in the drinking water supply can be required to monitor multiple measurement points. Grab samples with resulting temperature fluctuations could give erratic results and require a time burden on the maintenance staff and result in reduced plant efficiency. An inline fluoride ion selective sensor, specially engineered to water applications, with a rugged fluoride mono-crystal ion sensing element, and a virtually maintenance-free solid state reference system is recommended.

Water fluoridation is the controlled addition of fluoride to a public water supply to reduce tooth decay. Fluoridated water has fluoride at a level that is effective for preventing cavities; this can occur naturally or by adding fluoride. Fluoridation does not affect the appearance, taste, or smell of drinking water. It is normally accomplished by adding one of three compounds to the water: sodium fluoride, fluorosilicic acid, or sodium fluorosilicate. These compounds were chosen for their solubility, safety, availability, and low cost. The U.S. specifies the optimal level of fluoride to range from 0.7 to 1.2 mg/L (milligrams per liter, equivalent to parts per million), depending on the average maximum daily air temperature; the optimal level is lower in warmer climates, where people drink more water, and is higher in cooler

Ion Selective Electrodes (ISE's) for fluoride and ammonia determination.



climates. Fluoride ISE measuring systems are complete systems that measure fluoride ion activity and are available in single or dual panels.

Many water systems already have ammonia in their water or add ammonia during their treatment process. Excess free ammonia in water distribution systems promotes biological growth and nitrification. If the system experiences isolated areas of water quality degradation that affect the aesthetic quality of the water, which may generate customer complaints due to taste, odor, and particles in the water, or if the system has areas where it's difficult to keep acceptable chlorine levels, this might be a direct result of biological growth and nitrification.

The term "free ammonia" is used when naturally occurring ammonia is present in water and/or when chloramines are used to disinfect water. During chloramination, chlorine and ammonia are added to water to form monochloramine. The portion of ammonia that has not combined with chlorine is called free ammonia, and exists as either NH_4+ or NH_3 depending on the pH and temperature of the water. At typical water pH of 7.0 to 7.8 and temperature of 12 to 24 degrees Celsius, more than 96 percent of ammonia is in the ionized form of ammonium (NH4+). As the pH and temperature increase, the amount of NH_3 increases and the amount of NH_4+ decreases.

The only accurate way to determine if treated water contains ammonia is to perform an ammonia analysis. If ammonia is detected, additional sampling on the distribution system for free ammonia should be explored. Ground water may have ammonia levels ranging between 0.2 to 2.0 mg/L. Municipal drinking water plants carefully control their level of free ammonia (often also described as total nitrogen of NH_3-N) and chloramine (also called monochloramine or MCL) used to ensure that the water remains suitable for human consumption. There are panels available in single or dual measuring systems.

Drinking Water Panels for fluoride, ammonia, and monochloramine allow for fast, easy determinations with virtually no operating costs.

The prevention of contamination in the distribution system, thereby reducing the risk of water borne diseases, requires regular monitoring for disinfectant levels, microbial levels, and corrosion products. Although water may be safe upon leaving the treatment plant, it is important to monitor for contamination by growth of microorganisms, pressure problems, and water main breaks. Monitoring can also indicate formation of biofilms, malfunctioning piping and valves or other threats to the system.

Because pathogens can enter the distribution system through cracks and joints in pipes, water systems are also required to provide continuous disinfection of the drinking water entering the distribution system, and maintain a detectable residual level within the distribution system.

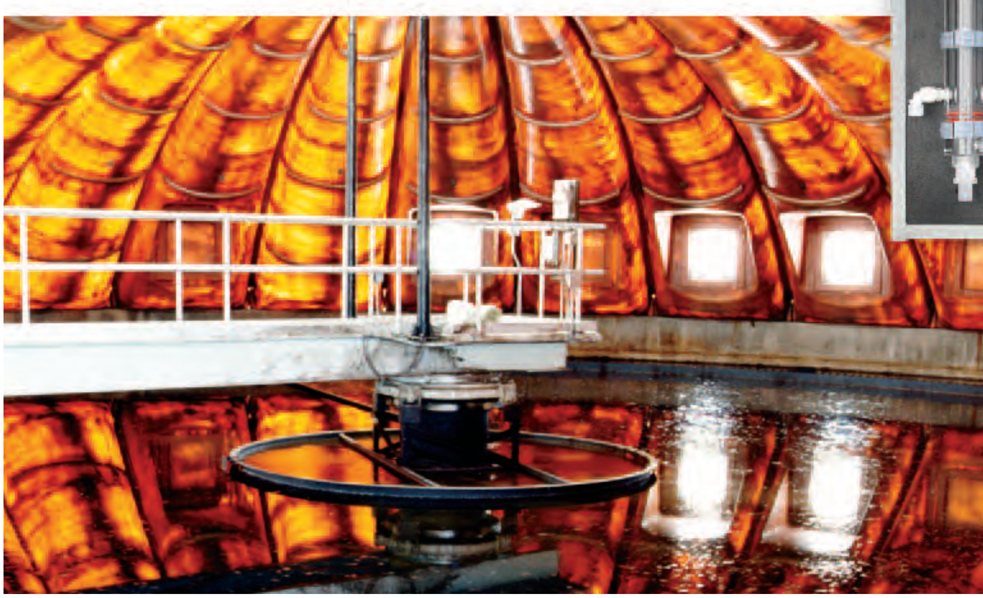
Regular monitoring includes microbial monitoring to meet public health standards. Chlorine residuals in the distribution system also need to be checked. The pH is monitored to confirm that the proper applications of corrosion control chemicals are being applied at the treatment plant.

A minimum of 0.2 mg/L of chlorine residual is advisable at the last tap on the distribution system, and prompt investigation is required to correct a low or no residual reading.

Water quality within the distribution system can be monitored on a continuous basis, and several large water utilities have installed automatic sampling systems throughout their district.

A continuous on-line chlorine measurement is especially important in ensuring adequate disinfection levels throughout the distribution system; it can be accomplished by using one of three measurement systems available from Rosemount: free chlorine, monochloramine or total chlorine. The monitoring data can be transmitted back to the plant and automatically stored for future reference, historical trends, and detection of seasonal fluctuations.

Additional functionality can be obtained if the FCL is ordered with the Model 56 analyzer. This instrument includes the data logging feature and stores up to 30 days of data. Logging of events, like calibrations, power outages and faults & warnings can be accomplished easily on the Model 56. Data logging is valuable for reviewing data when troubleshooting sensor and process out of range readings. The data can be downloaded onto a flash drive using a USB port in the front panel.



Free Chlorine Measuring System, Model FCL, is suitable for compliance monitoring when calibrated against a grab sample that has been analyzed using a laboratory test acceptable to EPA. Refer to EPA Method 334.0 for more details.

Desalination refers to the water treatment process of removing salts from water. Of all the earth's water, 94% is salt water and less than 1% is accessible fresh surface water.

With the improvements in desalination technologies over the past 50 years, and the growing demand for fresh water, there are more than 16,000 desalination plants worldwide. This compares to only 5 plants in 1960. Cities and major industries have developed with the availability of fresh water produced from seawater.

Thermal techniques, such as multi-stage flash desalination (MSF) distillation, and membrane technologies, such as reverse osmosis (RO), are the two major competing techniques used in the desalination of seawater, and both make seawater drinkable.

About half the world's desalting plants produce fresh water using heat to distill water from sea water. Hybrid plants combine a steam power plant and a desalination plant. The latent heat of condensation from the power plant is reused to increase the temperature of the incoming sea-water. The main benefit of this dual-purpose plant is the reduction of fuel used.

Multi-Stage Flash Distillation is one of the most commonly used types. Typically, the salt water is heated in the brine vessel for the separation of water and salt. The heated water is sent to another vessel where it boils rapidly and flashes to create steam. The steam is then captured and immediately cooled to convert it back into a liquid that has been desalinated and is ready for use. Desalination plants can have anywhere from four to 40 different stages of flashing. Scaling is one of the biggest problems in multi-stage distillation applications. Maintaining a pH balance of 5.7 or less is crucial to minimize scaling. This can be achieved by using a Rosemount Analytical pH/ORP sensor model 399 with the 1056 dual channel analyzer.

Scaling also causes a problem when the feed solution becomes saturated with calcium sulfate. It is important to maintain a concentration level below the saturation point. Using the Rosemount Analytical toroidal conductivity sensor model 228 along with a 1056 two channel analyzer, will insure that no excessive build up of dissolved solids takes place and minimizes fouling in the evaporator.

Contacting Conductivity ENDURANCE™ Sensors are used to monitor the reverse osmosis treatment process and are available in a variety of mounting options.

Seawater Reverse Osmosis (SWRO) using membrane technology is another way of accomplishing desalination. RO is a technique in which water is forced through semi-permeable membranes, and requires pretreatment consisting of coagulation and filtration.

The passage of dissolved salts and microscopic particles is blocked, and relatively ion-free water (called-permeate), passes through the membrane. Contacting conductivity sensors placed in the feed-water and permeate let operators monitor the overall water quality and efficiency of the RO treatment.

Newer aromatic polyamide composite membranes are more resistant to chemical attack at extreme pH values than cellulose acetate membranes. However, both types benefit from careful pH control to prevent precipitation of sparingly soluble salts and to extend membrane life. A general purpose sensor such as Model 399 can complete this measurement.

EMERSON PROCESS MANAGEMENT: THE PROVEN SOURCE

Emerson Process Management is the proven supplier of Rosemount Analytical on-line electrochemical sensors and instrumentation with over 60 years experience in drinking water treatment, waste treatment and process control. In recognition of our dedication to customer service, product excellence, and quality we have received the #1 Readers Choice Award from Control Magazine for the sixteenth consecutive year.

With a fixed amount of fresh water available for consumption and our worldwide increased demand for access to safe water, continuous monitoring and measuring of the water treatment process and water quality becomes one of the most important elements to prevent water-related diseases caused by pathogens.

Producing a source of safe and reliable drinking water and the removal of harmful microorganisms are the primary goals of every drinking water treatment plant. Thousands were killed each year due to cholera, typhoid fever, dysentery and hepatitis before cities began treating drinking water with chlorine. Today, chlorine, ozone and UV are being used in primary disinfection at the pre-treatment stage and secondary disinfection in the final stage to inhibit or prevent regrowth of pathogens in the water distribution system.

Accurate on-line process instrumentation, such as pH, conductivity, chlorine, dissolved ozone, turbidity, and particle counters, plays a critical role in achieving the plant objective and meeting regulatory compliance at the local and federal level. Count on Emerson for the systems and solutions you need in an ever-changing, dynamic world. See us on the web at ***RAIhome.com.***

PLANTWEB® BRINGS IT ALL TOGETHER

Rosemount Analytical's instruments are part of Emerson Process Management's PlantWeb® field-based architecture: a scalable way to use open and interoperable devices and systems to build process solutions. The PlantWeb architecture consists of intelligent field devices, scalable platforms and standards, and integrated modular software, all working together to create, capture, use, and distribute information and process control data.

This architecture can reduce your capital and engineering costs, reduce operations and maintenance costs, increase process availability, reduce process variability, and streamline regulatory reporting.

To see what PlantWeb can do for *your* operation, call or visit us at ***PlantWeb.com/RunSafe***

Emerson Process Management provides the type of instrumentation your plant needs to monitor all aspects of water quality. Whether you need four-wire, two-wire or can make use of the advantages offered by wireless, we have your instrument.

Four-wire instruments

1057 - Choose pH/ORP/ISE or Contacting Conductivity/Resistivity, in any combination. Like the Model 1056 it has:

- A large, easy-to-read display of process measurements. Operators know at a glance if the process is within allowable parameters
- The units are easy to install and wire with modular boards, removable connectors, and easily connected sensors.
- Commissioning is easy with intuitive menu screens and advanced diagnostics and help screens.

The new Model 56 with a high resolution, full color screen shows faults and warnings in color for immediate recognition for an out of range parameter.

- Pinpointing process disruptions can be viewed n the color trending graphs. The user can zoom in to a specific time frame for detailed on-screen evaluation. Information can be downloaded in Excel format to a USB memory device.
- Proportional, Integral and Derivative (PID) control allow the analog current outputs to adjust a control device and any current output can be programmed for PID functions.
- Basic TPC (time proportional control) timer functions settings are available.

FOUR-WIRE

Features	1056 Series	1057 Series	56 Series
Power Requirement	115 - 230 VAC or 24 VDC	115 - 230 VAC or 24 VDC	115 - 230 VAC or 24 VDC
Number of 4-20 mA Outputs	Two	Four	four
Number of Sensor Inputs	Two	Three	Two
Available Measurements	pH/ORP/ISE, Conductivity, Resistivity, % Concentration, Dissolved Oxygen, Ozone, Flow,* Turbidity,* Chlorine (Total, Free, Monochloramine, pH Independent Free Chlorine)	pH/ORP/ISE, Contacting Conductivity	pH/ORP, resistivity/ conductivity/TDS, % concentration, ratio conductivity, total and free chlorine, dissolved O_2, dissolved ozone, turbidity, pulse flow, temperature and raw 4-20mA input
SMART pH	Yes	Yes	Yes
HART Compatible	Yes	No	Yes
FOUNDATION fieldbus Compatible	No	No	No
Wireless THUM Adaptor compatible	Yes	No	Yes
Multi-lingual Menus	Yes	Yes	Yes
Relays	4	4	4
PID Control	Timer control only	Timer control only	Yes
Advanced Diagnostics Capability	Yes	Yes	Yes
Area Classifications	Class I, Div 2	Class I, Div 2	Class I, Div. 2
Available Approvals	FM, CE, CSA, UL	CE, UL, CSA	Pending

Wireless instrumentation

Remote locations and engineering costs are no longer barriers to getting the process and diagnostic information you require for critical applications. Wireless can do this efficiently and cost-effectively.

- High accuracy and reliability for monitoring and control applications
- Self-organizing network for high data reliability and network stability
- Industry leading wireless security

Two-Wire instruments

The Model 5081 is for applications requiring NEMA 7 housing for Class I, Div 1 and 2 explosion proof applications.

The Model 1066 is a two-wire liquid instrument with a broad range of measurement parameters, advanced communications capability, and unique ease-of-use. The Rosemount Analytical Model 1066 Transmitter is suitable for many industrial applications including those with exacting performance requirements such as pharmaceutical and food and beverage, and in difficult environments such as chemical plants, metals processing, and effluent monitoring.

For host monitoring and configuration, the unit uses HART version 7 and Foundation fieldbus digital communication protocols.

The large, easy-to-read display gives users information on their process measurements at a glance. The display has user-definable measurement diagnostic parameters.

"The flexibility of Emerson's self-organizing wireless technology makes it much easier to troubleshoot problems as well as evaluate new applications."
Jan Huijben
Technochem

	WIRELESS	TWO-WIRE	
			
Features	**6081 Series**	**5081 Series**	**1066 Series**
Power Requirement	Lithium power module	24 VDC	24 VDC
Number of 4-20 mA Outputs	Wireless	One	Two
Number of Sensor Inputs	One	One	One
Available Measurements	pH and contacting conductivity	Select one: pH, ORP, Conductivity, Resistivity, Dissolved Oxygen, Ozone, Chlorine, Gaseous Oxygen	Select one: pH, Resistivity, Dissolved Oxygen, Ozone, Chlorine
SMART pH	Yes	No	Yes
HART Compatible	Yes	Yes	Yes
Foundation fieldbus Compatible	No	Yes	Yes
Wireless THUM Adaptor compatible	NA	Yes	Yes
Multi-lingual Menus	Yes	No	Yes
Relays	NA	NA	NA
PID Control	No	Yes/Ff	Future/Ff
Advanced Diagnostics Capability	Yes	Yes	Yes
Area Classifications	Class 1, Div. 1	Class I, Div. 1 & Div. 2, Explosion proof	Class I, Div. 1 & Div. 2
Available Approvals	CE, CSA, ATEX Spectrum Approvals	CE, FM, CSA, ATEX	Pending

MORE ANALYTICAL SOLUTIONS FROM EMERSON PROCESS MANAGEMENT

Emerson is the world's largest provider of gas chromatography, process gas, combustion and environmental analysis solutions.

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Emerson Process Management
Analytical Division
2400 Barranca Parkway
Irvine, CA 92606
T 949.757.8500
T 800.854.8257
F 949.474.7250

ASIA-PACIFIC
Emerson Process Management
Asia Pacific Private Ltd.
1 Pandan Crescent
Singapore 128461
Republic of Singapore
T 65.6.777.8211
F 65.6.777.0947

EUROPE
Emerson Process Management
Services Ltd.
Blegistrasse 21
P.O. Box 1046
CH 6341 Baar
Switzerland
T 41.41.768.6111
F 41.41.761.8740

MIDDLE EAST AND AFRICA
Emerson FZE
P.O. Box 17033,
Jebel Ali Free Zone - South
Dubai
United Arab Emirates
T +971.4 8118100
F +971.4 8865465

LATIN AMERICA
Emerson Process Management
Analytical Division
11100 Brittmoore Park Dr.
Houston, TX 77041
T 713.467.6000
F 713.827.3329

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