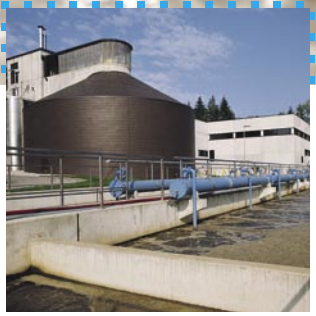
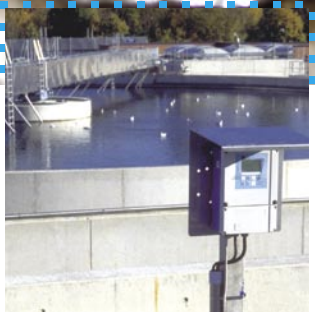




Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

A clean profit

Measuring technology for efficient wastewater treatment

Endress+Hauser

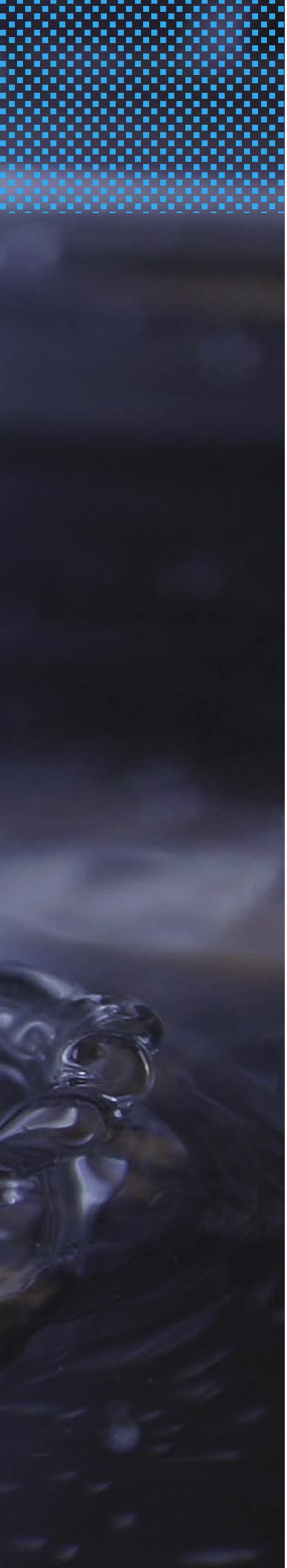
People for Process Automation

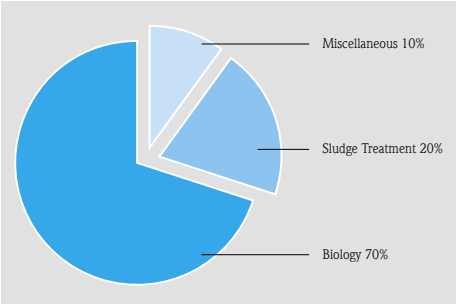
Wastewater treatment

Increasing industrialization and population growth has caused tremendous contamination of surface waters during the last decades. As a consequence, the laws regarding environmental protection have been tightened in many countries. To fulfill these regulations means increasing the number and the efficiency of wastewater treatment plants.

Today it is necessary to use ongoing treatment processes and control them by means of measurement and control systems. In-service monitoring has become more extensive and diverse. Wastewater treatment not only includes operating, supervising, servicing and repairing equipment, it also involves the key topics of operational flow, monitoring and controlling, measuring, analyzing, recording and evaluating. This ensures that the key processes, the reduction of hydrocarbons, of nitrate/ammonium and phosphates are carried out in a most efficient way in large as well as in small treatment plants.

The driving factor in today's investment in wastewater treatment must be cost reduction. The only way to maintain high standards while reducing costs is to invest in highly sophisticated measurement and control technology, ideally from a supplier offering the whole basket of instruments.

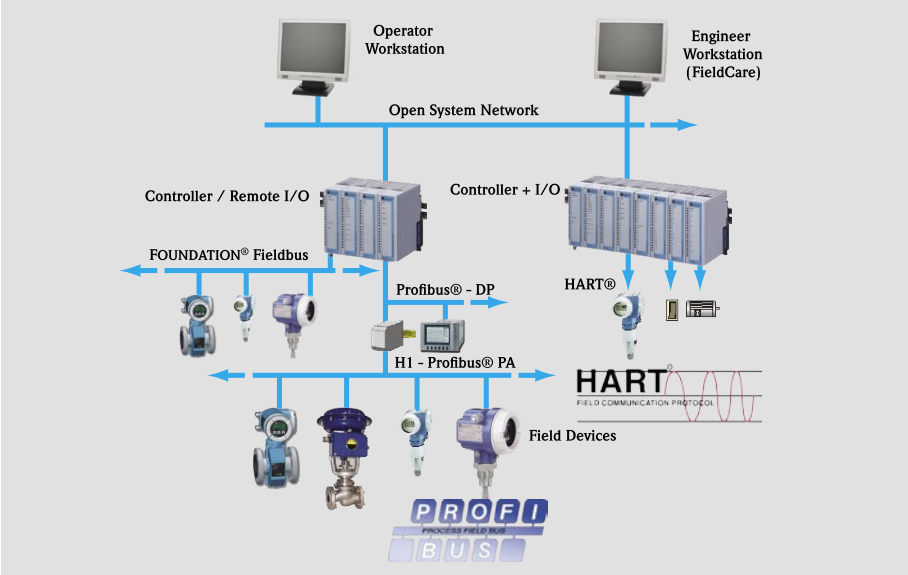




Typical share of energy costs in a wastewater treatment plant. Optimized measurement and control helps to reduce costs.

From integration to automation

With the introduction of communication technologies like HART®, PROFIBUS® and FOUNDATION™ Fieldbus a little more than ten years ago, the barriers between field instrumentation and the system level began to disappear. The instruments became more intelligent and an integral part of the automation architecture. Because we recognized this development at an early stage Endress+Hauser has been actively involved in different standardizing bodies and user organizations since the beginnings of fieldbus technology. In this way, we want to ensure that our customers stay in touch with new trends.



A fieldbus connection offers much more than a process variable from a field instrument. Instrument status, maintenance and diagnostic information are available to be transferred from the process to the control room. This information makes it possible to increase the availability of the plant and to optimize processes. Endress+Hauser ensures the integration of this information into the system environment.

To this end, we support both technologies that are established in the market as well as the new FDT integration technology for Plant Asset Management. FieldCare is a Plant Asset Management solution offering commissioning, condition monitoring and access to diagnostic information from the digital process instruments.

In addition, we offer comprehensive engineering services for the integration of field instruments into all relevant control and asset management systems in the process industry. Field instruments are the source of the information to be measured in order to perform wastewater treatment. Endress+Hauser can keep the process running by monitoring process complications due to inlet water flow and pollutant variations while helping to maintain effluent standards.

Plant supervision and control are useful tools in performing the treatment process in order to improve efficiency and save energy, reagents and other direct costs. The key is obtaining representative measurements as closely as possible to the true process conditions. Filtering and sampling systems used in conjunction with smart analyzers and plant supervision tools from Endress+Hauser can aid in improving the efficiency of the treatment process.

Our solution concept embraces these aspects, and if desired, automatic measuring stations can be supplied on specific designs. With Endress+Hauser, those involved in procurement and engineering can be confident in the knowledge that we have your needs in mind during start-up and commissioning of your measuring point requirements.

A range of services to suit your needs

Optimized processes with an analysis of the installed base
Operators of industrial plants find themselves increasingly under pressure to reduce costs. This involves optimizing processes, focusing on core processes. Water treatment is also subject to this trend. Safety, time and quality are becoming increasingly important. Optimal performance of measurement processes is essential to plant availability and product safety.

Instrument Management Solutions
Instrument Management Solutions (IMS) is an efficient, cost-effective process that optimizes the installed base. The advantages are:

- Increased plant up time
- Emergency planning
- Quick availability of spare parts
- Reduction of maintenance costs
- Documentation, including electronic records

The basis for IMS is a plant audit of the installed base. Endress+Hauser evaluates and documents the measurement system and its condition. This results in the definition of the critical parts of the plant, the discovery of optimization possibilities in spare parts inventories, type reduction, phase-out planning and recommendations in a detailed maintenance plan.

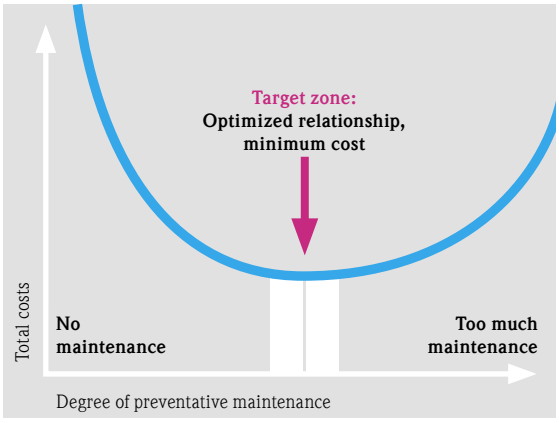
Preventative maintenance
Endress+Hauser also offers support in the form of additional services such as:

- Calibration service on site or at the factory, in one of our accredited laboratories
- Maintenance contracts for the installed instrumentation
- Start-up
- Training — customer-specific content, content on demand (service, basics in measurement technology and/or industries)
- Repairs on-site or at the factory
- Spare parts service and consultation in the selection of components
- Instrument rentals as a means for making decisions prior to purchase or for mobile temporary measurement requirements

Summary
Endress+Hauser is the full-range supplier for measuring technology:

- Flow
- Level
- Temperature
- Pressure
- Analysis
- Recording or system components
- Services in the areas of calibration, maintenance, repair, commissioning and more

Challenge us today!



The safety approach


Cerabar S pressure measurement


Micropilot M radar level


Promag 50W magnetic flowmeter


Prosonic S flow/ultrasonic level measurement

The safety approach
As a global supplier, Endress+Hauser takes a proactive approach to safety issues. Requirements and legislation in one part of the world may ultimately affect other areas.

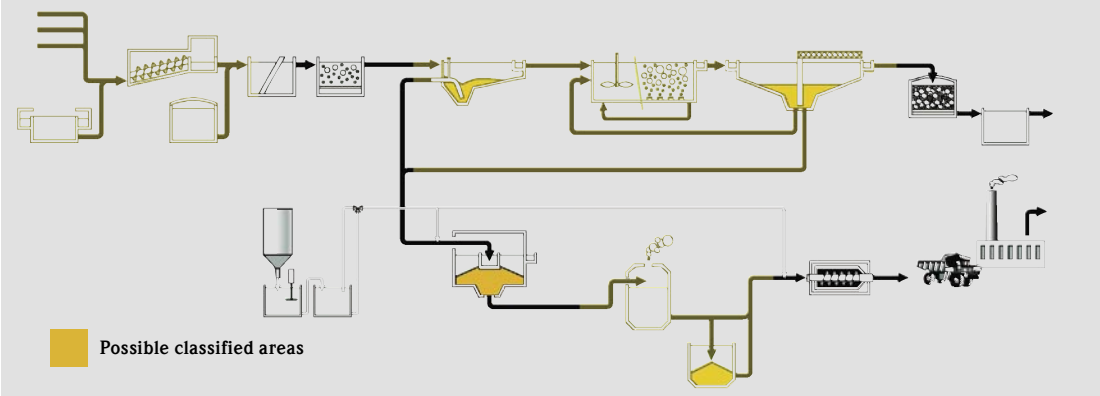
The implementation of recent ATEX directives concerning explosion protection has impacted equipment design, instruments and the plants themselves. Throughout Europe, parts of the plants need to be classified according to a risk assessment procedure that defines the classification of a hazardous area (see the Zone identification diagram). Typical wastewater processes with ATEX classification are the sewer, some reagent compartments, close aerated basins, and the anaerobic digester with the associated bio gas tanks.

While our European customers require ATEX product certifications, our US customers require FM approvals and our Canadian customers, CSA. Endress+Hauser produces compliant devices that can be applied in critical safety instrumented systems in accordance with good engineering practice for SIS (Safety Instrumented Systems) Endress+Hauser's task is to provide customers with fully compliant instrumentation.


Topclean automatic PH measurement

Liquisys M CCM 253
Total Chlorine


FMX 167
Waterpilot



Zone identification

Full range partner in wastewater

With our extensive product basket, Endress+Hauser has emerged as the only supplier able to meet all the instrumentation needs of today's wastewater treatment facilities. Below are a few examples:

Flow
Promag 10 W:
A safe and reliable solution for flow measurement in wastewater treatment. Polyurethane or hard rubber lining and empty pipe detection are standard in our flow meters.

Level
Deltapilot S:
Continuous hydrostatic level measurement with a condensation-free and water tight measuring cell.

Open channel flow
Prosonic S:
Contactless flow and/or level measurement with hermetically welded ultrasonic sensors and pre-programmed channel and weir configurations as well as pump control function.

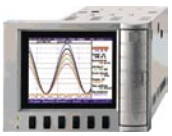
Pressure
Cerabar M:
Pressure measurement with overload resistant ceramic measuring cell including function monitoring and dynamic measuring range.

Analysis
Stamolys CA 71:
Automatic analysis of ammonium, phosphate, and other ions by colorimetric methodology.

Analysis
Liquisys M:
Modular instrument for measurement of pH, ORP, conductivity, dissolved oxygen, residual chlorine, turbidity and suspended solids.

Analysis
Stamosens CSM 750/CSS 70:
Sensor and transmitter analysis system specifically designed to monitor nitrates and dissolved organics in water and wastewater treatment applications.

Data acquisition
Videographic paperless recorder Memograph:
Includes software package for wastewater applications. Programmable groups of signals. Highest protection level against manipulation.



Process efficiency

Elimination of organic components
In aeration tanks, an almost complete reduction of the biologically degradable organic components in wastewater is possible. The reduction is carried out by bacteria in the activated sludge and requires additional oxygen input to the wastewater by aerators. Continuous measurement of the sludge and the oxygen concentration in the aeration tank is needed in order to control the process, ensuring efficient cleaning even with varying degrees of contamination of the inflowing water.

Precondition for efficient elimination of organic components in the wastewater is the control of activated sludge returned to the aeration tank. Satisfactory elimination occurs only if sludge concentration and sludge age is adjusted to the contamination of the inflowing water. Besides the bacteria, additional oxygen must be introduced into the aeration tank. The correct oxygen value is given by the consumption of the bacteria. An insufficient oxygen concentration results in incomplete reduction of organics, and too much oxygen simply costs money.

Since aeration is the most costly process in the treatment plant, the measurement of oxygen results in a direct return of investment in two ways:
- Reduced energy costs for the blowers
- No extra costs caused by exceeding limit values at the outlet of the plant

Dissolved oxygen measurement via multiple technologies (optical, amperometric), transmitter Liquisys M and COS41 – offering fast calibration and polarization as well as a self-check function of the sensor.

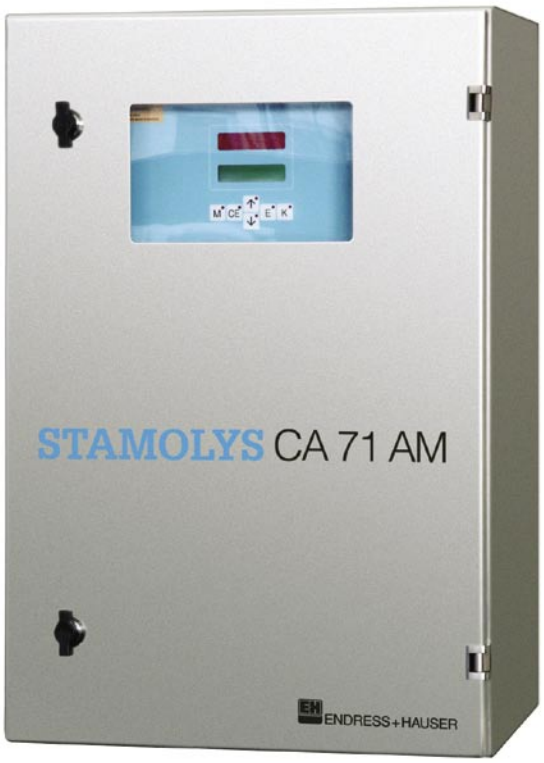
Turbidity measurement transmitter CUM 740 with CUS 65 four-beam pulsed infrared light method sensor, with automatic compensation of soiling, specifically designed to control the aeration systems.

Biology

Elimination of Ammonium and Nitrates
The reduction of N-components is accomplished by a combined process called nitrification/denitrification (NH_4 -> NO_2 -> NO_3 -> N_2). Apart from temperature and pH value, the sludge age and concentration of degradable organic components is of importance.

In order to use the full denitrification capacity of the treatment plant, a continuous measurement of the nitrate concentration at the outlet of the pre-located denitrification step is useful. The recirculation of the wastewater into the denitrification tank is controlled with this measurement very efficiently.
A low nitrate value, measured at that location, means a most efficient degree of recirculation. This means cost savings. The measurement can be done using optical sensors Stamosens CNM 750/CNS 70.

Elimination of Phosphates
A high concentration of phosphates in the effluent of a treatment plant leads to significant algae growth in rivers and lakes. Because of this, phosphates must be eliminated during the treatment process, by dosing chemical precipitants such as iron chloride into the wastewater. Often, the contamination of the wastewater with phosphates is not constant, therefore flow proportional dosing is not efficient. Continuous measurement of the phosphate concentration ensures optimized dosing of chemicals and helps to save money. Controlled elimination of phosphates leads to reduced sludge development which means additional cost reduction in sludge treatment as well.
Chemical analyzers such as CA 71 pH, including the sample preparation, measure the correct values needed for efficient dosing of the chemicals online.



Phosphate measurement: Chemical analyzer Stamolys CA 71 for sample preparation.

Optical nitrate measurement by UV absorption needs no reagents. Stamosens CNM 750 and Sensor CNS 70.

Process efficiency

In wastewater treatment plants, large quantities of sludge must be handled. Sludge has to be removed in the primary clarifier, recirculated as activated sludge in the biology and separated from the treated water in the second clarifier. Most countries have very strict regulations regarding the maximum load of sludge particles in the effluent of the treatment plant. Getting rid of the sludge separated from the water is an important cost factor and will become more costly in the future.

Primary sedimentation tank
In order to ensure efficient water treatment, the primary sludge has to be removed. The task is to control a pump or slide valve. Most essential is to make sure that the sludge concentration is at least 1.5 to 2% DS (dry solids). A lower concentration will create tremendous costs in later stages of sludge treatment (e.g. sludge conditioning and de-watering).

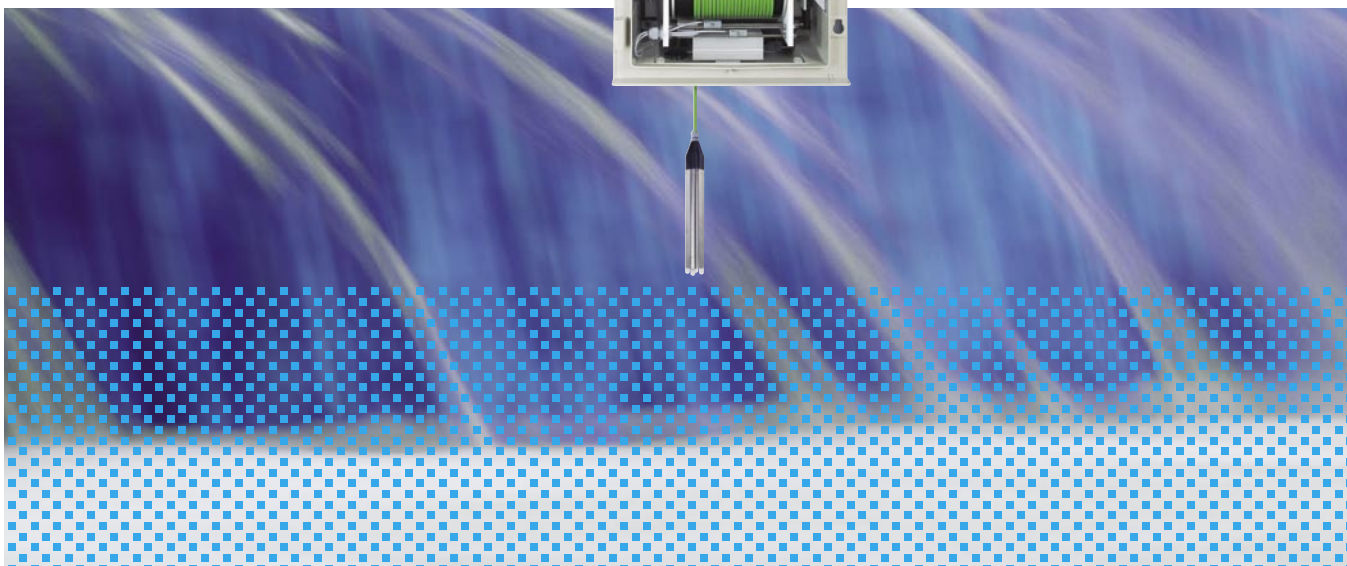
The CUS 41, an optical sensor, is most suitable for measuring the solids concentration directly in the sludge pipeline and can be used easily to switch off the pump at too low concentrations. For sludge level measurement in the primary clarifier, an ultrasonic device such as CUM 750/CUS 70 is highly recommended, since it does not come into direct contact with the difficult product and it has no mechanical parts that can be blocked.

Second sedimentation tank
Sludge collected in the second sedimentation tank is different from that in the primary clarifier.
Pump control and concentration monitoring is important. Often there is additional functionality needed: the sedimentation behavior, the sludge quality and also the sludge age must be known.

This information can be determined by a sludge concentration profile. Such a profile can be determined with a CUC 101 unit, an optical sensor which measures the different sludge concentrations between the bottom of the sedimentation tank and the water surface.

CUM 750/CUS 70
ultrasonic sludge level measurement

CUC 101 continuous sludge level measurement



Sludge management

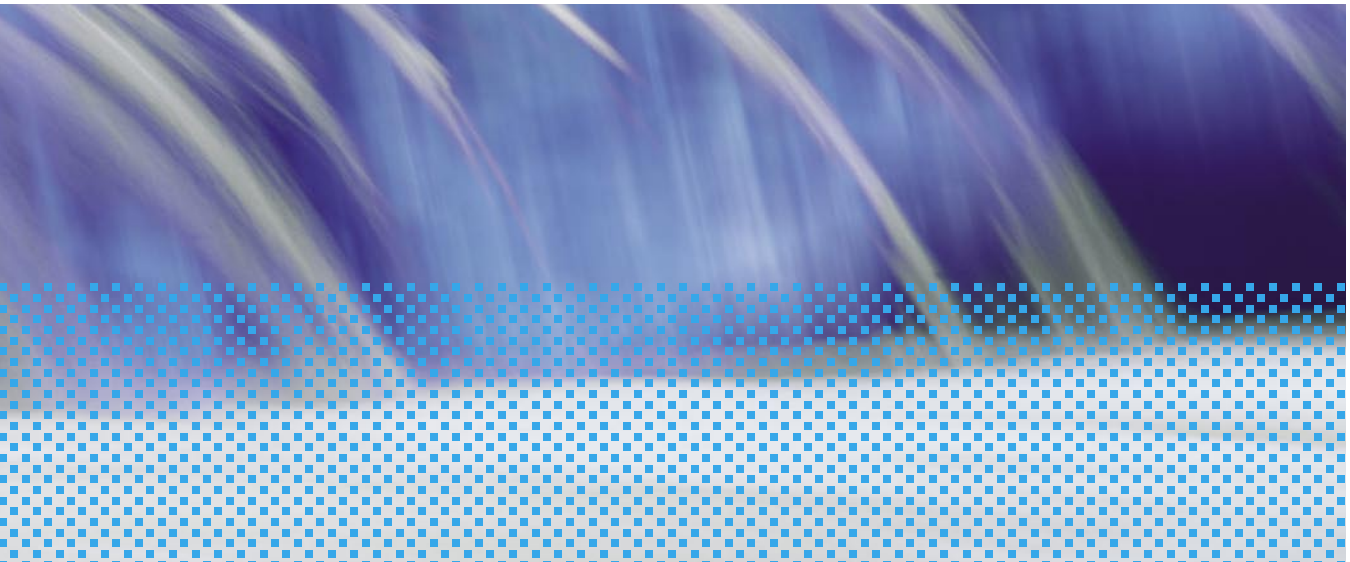
Sludge digestion
The production of biogas in the digester leads to a reasonable cost reduction. Up to 60% of the electrical energy needed in the treatment plant can be produced by biogas if the sludge is well conditioned. Sludge concentration, temperature and pH value have to be kept stable.
The beginning of any sludge treatment is sludge thickening. This is carried out in static thickeners, centrifuges or flotation cells. Primary sludge and excess sludge is mixed with a coagulation agent. By adding chemical additives, the pH value is maintained to ensure that the methane bacteria work most efficiently. Both parameters, pH and sludge concentration are measured online in the sludge pipeline to the digester.

The sludge is kept in the digester approximately 28 days at a temperature between 104° (40°C) and 122°F (50°C) according to the process used. During this time the sludge is permanently circulated. Under less ideal conditions the sludge in the digester has a tendency to develop foam. The worst case is if the security valves open and the foam contaminates the installations on top of the digester. To avoid this situation, often there is a second level measurement installed at the top, in addition to the standard hydrostatic level measurement which is installed at the bottom of the digester.
The Micropilot FMR 230 can detect the foam in the digester so that de-foaming steps can be taken in time and biogas production losses can be avoided.

Sludge de-watering
Digested sludge contains about 95% water. Before the sludge can be deposited in a landfill or burned, it must be de-watered in thickeners, belt filter presses, or centrifuges. All thickening processes usually require flocculation agent dosage, which is controlled by a volumetric flow measurement, and a sludge concentration measurement. Exact dosing of polymers is important because a dosage that is too high increases costs for the chemical agent and decreases the efficiency of the de-watering process. In addition to the cost savings for chemicals, the de-watering reduces the sludge volume so that disposition cost are reduced as well.

Sludge flow measurement with Proline® Promag electromagnetic flowmeter

FMR 230 foam detection using radar level measurement



Endress+Hauser's product portfolio

Level

- Capacitance (RF)
- Conductive
- Mechanical
- Vibration
- Ultrasonic
- Radar
- Guided radar (TDR)
- Hydrostatic

Pressure

- Gauge/absolute
- Differential pressure
- Hydrostatic

Flow

- Electromagnetic
- Vortex shedding
- Coriolis mass flow
- Ultrasonic
- Open channel
- D/P flow

Temperature

- Temperature transmitters
- RTDs/thermocouples
- Sensors

Liquid Analysis

- Conductivity
- pH/ORP
- Chlorine
- Dissolved oxygen
- Turbidity
- Chemical analyzers
- Nitrate/organic sensors
- Sludge level

Recorders

- Paperless recorders
- Visual data managers
- Safety data managers

Components

- Displays
- Active barriers
- Process transmitters
- Power supplies

Service

- Total support for you and your instruments

E-direct

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