



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



Solutions

Your Partner in Pulp and Paper

Committed to listening and delivering solutions



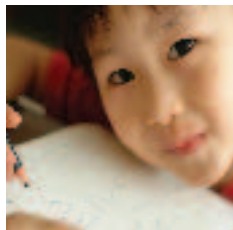
Your global partner in pulp and paper



“To measure is to know for certain,” someone once said. Each and everyone of us with experience in the pulp and paper industry can admit this statement certainly is true, but very difficult to achieve. This is particularly so when it comes to the harsh and demanding conditions we face in this industry. The key is to find a solution that enables 24/7 operation, as well as being able to identify and interpret the key parameters. Endress+Hauser has been working in the field of automation for decades and is constantly striving to improve our product endurance and operability.



Throughout the years, Endress+Hauser has been the inventor of several unique features that help users worldwide get the most from their investments. Our global presence and strategic alliance with Metso Automation ensures that we can develop and deliver solutions for large projects and greenfield mills. Mills such as Zellstoff Stendal in Germany, Ningbo and UPM Changshu in China, Mondi Richards Bay and Merebank in South Africa, among many more. These examples are a good indication of our global project performance.



This brochure serves as an overview of what Endress+Hauser has accomplished to date for the pulp and paper industry. What you will find are examples and solutions that we have delivered to various mills. Beyond reliable measurement, we have been able to decrease maintenance needs in applications. Replacing old technology with the new standards set by Endress+Hauser also gives back a return of investment.



Wood handling

Trucks, trains and even boats arrive to the pulp mill with the raw material of woods. Eucalyptus, acacia, spruce, pine and birch are some of the types that are used depending upon the geographic location of the mill and required quality of pulp to be produced. The logs are unloaded to be either stored or directly fed into the intake process.

The logs are washed and fed into the debarking equipment. The bark is later used to produce steam and power for the mill. After debarking, the logs are turned into wood chips and conveyed to the pulping process. The chips are screened to maintain proper size and to take out hazards such as stones and metal pieces before they are conveyed to the pulping process. Since wood handling is mainly a mechanical process with mostly solid materials, the major part of the instrumentation needed is for level measurement.

Being able to solve level measurement by utilizing a non-contact method is always preferable, especially in wood handling where wooden logs and later wood chips give sensors a hard time if they are exposed to the media. Since the 1960s, Endress+Hauser has developed ultrasonic radar sensing techniques and radiometric gamma programs to help solve these difficult applications. This has led to our Prosonic and Gammapiot series with user friendly set-up and intelligent software for handling the various applications that can be found.

Typical process steps are:

- Wood intake and infeed
- Debarking
- Chipping
- Chip handling and storage
- Bark handling

Typical measurement applications are:

- Level measurement - in stock pile, chip bins and bark silos
- Limit detection in wood chips chute
- Temperature measurement in grinder

Powerful ultrasonic level

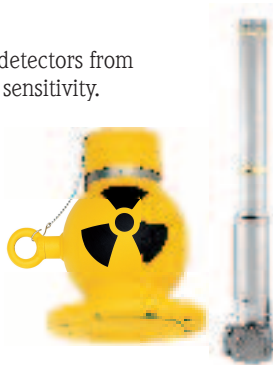
Our largest ultrasonic sensor in the Prosonic series is powerful enough to measure a stock pile of wood chips all the way down to the ground. With ranges up to 70 meters this sensor's high power and sophisticated signal handling in the transmitter assures a reliable level measurement. This sensor is also suitable in other applications e.g. Chip bins, Bark silos etc.



Radiometric level

With limited space and harsh conditions Endress+Hauser's answer for level control is the Gammapilot. By measuring from the outside through the walls of the vessels one will achieve a safe and reliable limit switch and/or continuous measurement without contacting the product. This guarantees a maintenance-free fail-safe method.

State-of-the-art Gammapilot scintillator detectors from Endress+Hauser bring fast response and sensitivity. The use of Cesium 137 sources with half life time values of 30 years guaranteed maintenance-free measurement. Long measuring ranges are possible with several slave detectors in the series with easy set-up from the master via HART protocol or the remote menu-guided operating display.



Precision ultrasonic level

Power is not always the decisive factor. For small ranges and rapid changes there is a need for sensors specially adapted to these demands. Prosonic in compact version is the answer with a blocking distance of only 0.25m, pulse frequency of 2 pulses per second, suitable ranges down to 0.2m and millimeter resolution. One typical application in wood handling, where all of these features come into use, is in the screening of wood chips. As seen on the right: level measurement control with a range of 0 to 100% is only 20cm. The detection of centimeter changes in the tumbling wood chips over the screen rolls must be achieved.





Pulp making

Pulp can also be produced in many different ways. One of the most common processes is chemical kraft pulping, whereby wood chips are cooked in a pressure vessel (known as a digester) with cooking liquor. The chemicals in the liquid dissolve the central laminae in the wood, i.e. the lignine, so that the fibers are liberated and the so called delignification can be further processed.

Typical chemical pulping process steps are:

- Cooking
- Washing and screening
- Bleaching
- Drying, or feed directly into the paper mill
- Bale handling

Influence of high pressure and temperature difference between process and outdoors makes this environment difficult for transmitters. Black liquor often builds scaling on wetted surfaces and devices require specific solutions.

Typical mechanical pulping process steps are:

- Fiber separation
- Washing and screening
- Bleaching
- Thickening

Pulp can be produced by mechanical separation of the fibers or a combination of chemical and mechanical treatment. Manufacturing processes are less complicated than those used to produce chemical pulp, partly because there is no need to have a recovery system for chemicals. On the other hand it doesn't give the same strength performance as pulp from chemical kraft pulping.

There are two main types of mechanical pulp: ground wood pulp and refined pulp. There are also variants of both types. The mechanical pulping process happens by grinding debarked logs in a grinder (ground wood pulp) and refining chips in a refiner mostly under elevated temperature and pressure (thermo-mechanical pulp). In this process we find similar chip silo measurement needs as in the pulp mill. To control the refining process and pulp quality, reliable pressure, temperature and flow transmitters are required. The re-use of wastepaper to get usable fibers is also growing in all countries around the world. The waste paper is delivered to the mill in bales. The bales are dissolved in water in a pulper featuring a rotor fitted with knives in the bottom. The pulp concentration can be 3-6% or 12-15% depending on the type of pulper used.

Typical waste paper pulping process steps are:

- Slushing
- Coarse cleaning
- De-inking
- Post-cleaning/thickening

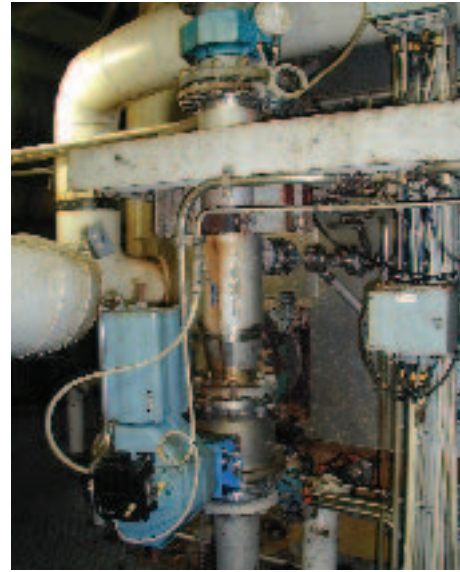
Depending on the source of the raw material and the pulp grade made, process solutions vary. Particularly, rejects from the cleaning and screening processes contain erosive particles that harm the performance of transmitters. Chemical pulping is the most demanding process with high temperatures, presence of vacuum, corrosive and abrasive media, vibrations and other difficult process conditions. The instruments that can be used in these processes are often specially developed to cope with these harsh conditions.

Electromagnetic flowmeter

The electromagnetic flowmeter (EMF) tubes in chemical pulping around the digester are subjected to vacuum, high temperatures and corrosive chemicals. The rugged Endress+Hauser Promag with our specially developed metal reinforced PFA liner resists vacuum down to zero bar absolute and up to 180°C. The flowmeter from the blowline of the digester has been proven for several years without any maintenance required.



The black liquor extraction flow at the digester is another well known application often causing liner damage to the EMF tube. The Promag metal reinforced PFA liner with high temperature version sensors considerably extends the life cycle of the flowmeter.



Ceramic cell pressure

Pressure transmitters with metal membranes typically require corrective maintenance or replacements due to wear and tear. Endress+Hauser's durable Cerabar S and DeltabarS ceramic membranes eliminate these problems. This example shows the pressure of the pulp inlet to the wash press section. After changing from metal membrane to ceramic type, maintenance of this measuring point is no longer needed. Other typical applications of ceramic in the pulping plant are in the chlorine dioxide stages with all wetted parts in non-metallic materials. Rejects from pulp screens are also a good application for Cerabar.



Radar level

The Micropilot radar level device measures the high consistency stock tower level of 35 meters.

Some advantages of the Micropilot are:

- A real alternative to differential pressure, floats and displacers
- Non-contact measurement
- Easy installation and operation
- High temperature applications
- Applications in safety related systems
- Two frequency ranges - 6GHz and 26GHz for every application
- Beam focus of only 4° by using a parabolic antenna





Chemical recovery in pulp mills

One of the most important processes from an economical point of view in chemical kraft pulping is the recovery of spent cooking chemicals. Liquor from the digester and wash out from the brownstock washers are concentrated and burned to recover cooking chemicals and to generate process steam.

The first process step is the evaporator. The evaporator system takes waste product (weak black liquor) from the digester and washing to produce fuel (thick black liquor) for the recovery boiler. Measurements in the evaporation process make sure that the heat input from steam leads to constant thickening and increase of the solid content from one effect to the next one. The black liquor feed to the boiler requires very uniform conditions. Upsets in the flow could cause sudden choking of the burners.

The recovery boiler system takes thick black liquor with up to 85% dry solid content from the evaporators and burns it. This in turn produces steam and electrical energy for use in the mill and green liquor, which is processed in the causticizing department. This operation regenerates the spent cooking chemicals that are recovered from the pulping process. The plant receives raw green liquor from the recovery boiler smelt dissolving tank. This green liquor is converted to cooking liquor, known as white liquor, through a number of physical and chemical processing operations, where lime from the limekiln and green liquor is mixed to be recausticized in the following steps. The last major process step is calcination with a rotary lime kiln. The kilns are used to convert the lime mud generated by the causticizing reaction to lime.

Pulp mills usually have other type of boilers in addition to the recovery boiler. These other types are often multi-fuel boilers used to burn bark and other traditional fuels when the recovery boiler is down.

Typical measurement applications are:

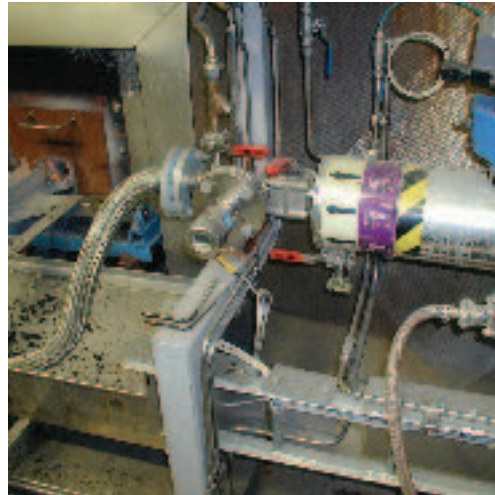
- Corrosive pressure applications on black liquor
- Density measurement of black liquor, green liquor and lime mud
- Radar level measurement in liquor storage tanks and lime silos
- Conductivity and other analytical parameters
- Vortex technology for saturated steam flow
- Critical temperature for combustion efficiency
- Energy management
- Thermal mass flow measurement for pressurized air

Lime silo level



This is the level measurement of lime with Levelflex guided radar after the lime kiln. The guided radar is not affected by the angle of the material, so the installation and start-up is very simple and quick. The transmitter can be mounted separately to avoid the harsh conditions.

Pressure black liquor to burners



Traditionally, metal membrane devices had to be replaced at least a couple of times per year due to the abrasiveness caused by the high solids content (74%). The Endress+Hauser ceramic membrane has shown no signs of wearing out.

Green liquor density & flow

The green liquor flow of 90 liters per second from the dissolvers is measured by an electromagnetic flowmeter. The green liquor density which ranges from 1000 to 1300 kilograms per cubic meter is measured by the Gammapiot radiometric device with high sensitivity and stable zeropoint due to the usage of scintillator technology.



Steam flow

Endress+Hauser's vortex meter calculates mass flow of steam, liquids and gas, all in one instrument. The Prowirl vortex meter is insensitive to water hammer, temperature shocks, plugging and its design provides vibration immunity.





Paper and board mills

Making paper is a complex industrial process. Paper, tissue and board making is the conversion of individual pulps or blends of pulps and fillers into paper. The fibres are generally, but not always, cellulose based. The different grades are measured in grams per square meter (g/m^2) that we call basis weight. The paper making process measurements are often less demanding than the conditions in the pulp mill. However, the devices must be able to detect incremental changes because the requirements of accuracy and repeatability are high. Particularly, all measurements in control loops with short response time are important. The production of different grades means slight differences to the process but the basic measurement applications can be identified.

Typical process areas are:

- Bale pulping
- Refining/stock preparation
- Stock proportioning
- Short circulation/approach system
- White water system
- Broke handling
- Steam and condensate system
- Additives system/coating kitchen

Typical measurement applications are:

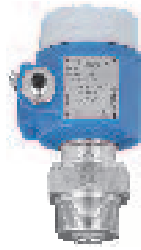
- Headbox, level and pressure
- Direct mass flow measurement for chemical additives to the machine
- On-line viscosity measurement for high quality paper making
- Stock preparation flow applications
- Abrasive pressure applications from press section to calendars
- Fully automated pH measurement on white water

Each step of the paper mill process contributes to the final quality of the product and is equally important. For example, poor pressure measurement in the headbox makes the exact stock feed to wire impossible in accordance with the machine speed. Various flow measurements are important for the right stock mix and additives. Endress+Hauser has successfully supplied mass flow meters to coating kitchens where erosive pigment additives are handled while looking at the best technical and economical measurement solutions available.

Headbox level and pressure

Pressure measurement

Cerabar with 1.5 inch threaded connection and a flush mounted ceramic membrane ensures a robust and reliable measurement in the paper stock flow of the headbox. The ceramic cell is totally free of any filling. It also improves the zero point stability dramatically compared to traditionally used oil filled diaphragm sealed pressure transmitters.



Level measurement

Our capacitance probe Multicap with build-up protection is not effected by scaling, temperature or density changes. The probes are used as a complement or alternative to pressure devices in the headbox level measurement. This application has been proven for many years on the market place.

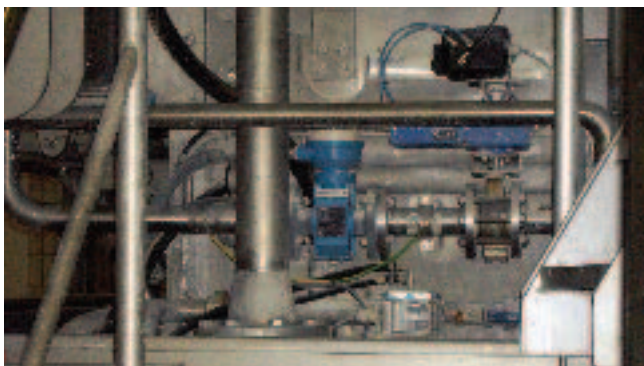


Chemical additives mass-flow

To improve measurement accuracy and avoid scaling problems on electrodes which occurs on traditionally used electromagnetic flowmeters in all the additives to the approach flow, a Promass massflow meter with a single straight tube is used. Therefore, the need for cleaning due to scaling of electrodes disappears. Promass with straight pipe system does not need any special installation support, which considerably lowers the cost of installation.



Flow to headbox



The ability to control flow to the headbox of the paper machine was often a problem due to cat-ionic interference. Attempts to control flow through the CV characteristic on the control valve by building an algorithm did not work. The electro-magnetic flowmeter designed for high consistency pulp from Endress+Hauser was the solution to control the stock flow within the required accuracy.

Fully automated pH measurement





Effluent treatment in pulp and paper

The pulp and paper industry has worked over the years to establish a consistent, scientifically defensible approach for monitoring the effects of pulp and paper production on the environment. The Environmental Effects Monitoring Program EEMP is being implemented in many manufacturing countries around the world. Efforts and associated expenses should be used to further understand the environment, processes and issues related to the pulp and paper industry.

Sample collections for physical, chemical and toxicological analysis include effluent, sediment, receiving water and tissues. Critical measurement parameters in secondary effluent treatment include: thermal mass flow, pH, dissolved oxygen and turbidity. For efficiency and operating cost, control analyzers are available online for ammonium, chlorine, nitrite, iron, manganese and phosphate as well as organics in TOC, COD, BOD, and SAC.

Typical measurement applications are:

- Fully automated pH measurement system
- Reliable DO and turbidity measurement for effluent treatment
- Measurement based on spectral absorption of nitrate in UV range instead of UV sensor
- SAC instead of TOC, COD, BOD and DOC. Measurement online based on spectral absorption of organic substances in the UT range

Analysers in effluent treatment

Dissolved oxygen:

Continuous dissolved oxygen measurement helps to assure a level of oxygen adequate for the demand of the organic content of the waste water without being wasteful or promoting foaming.



SAC, Spectral Absorption Co-efficient:

SAC can replace the measurements of: BOD/COD/TOC/DOC UV range, for the most organic absorbed substance lay on 254nm.



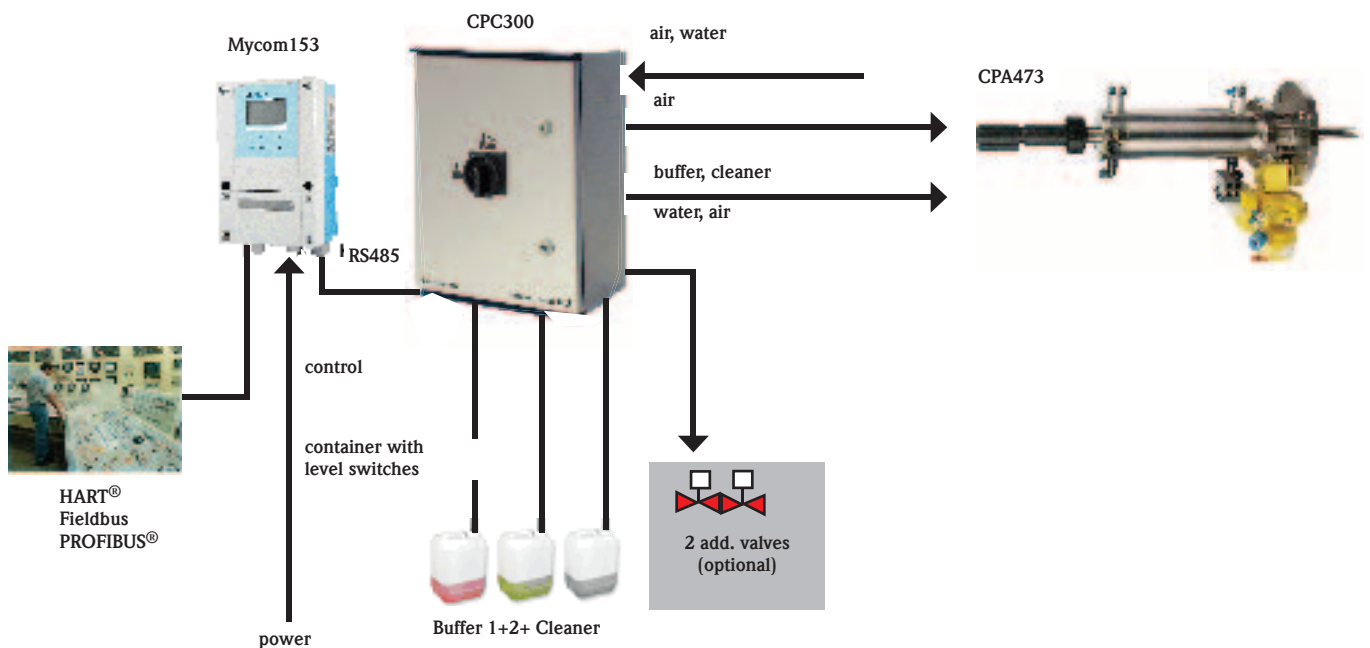
Turbidity:

Turbidity is indispensable for recycling of service water and for controlling the outlet of sewage treatment plant.

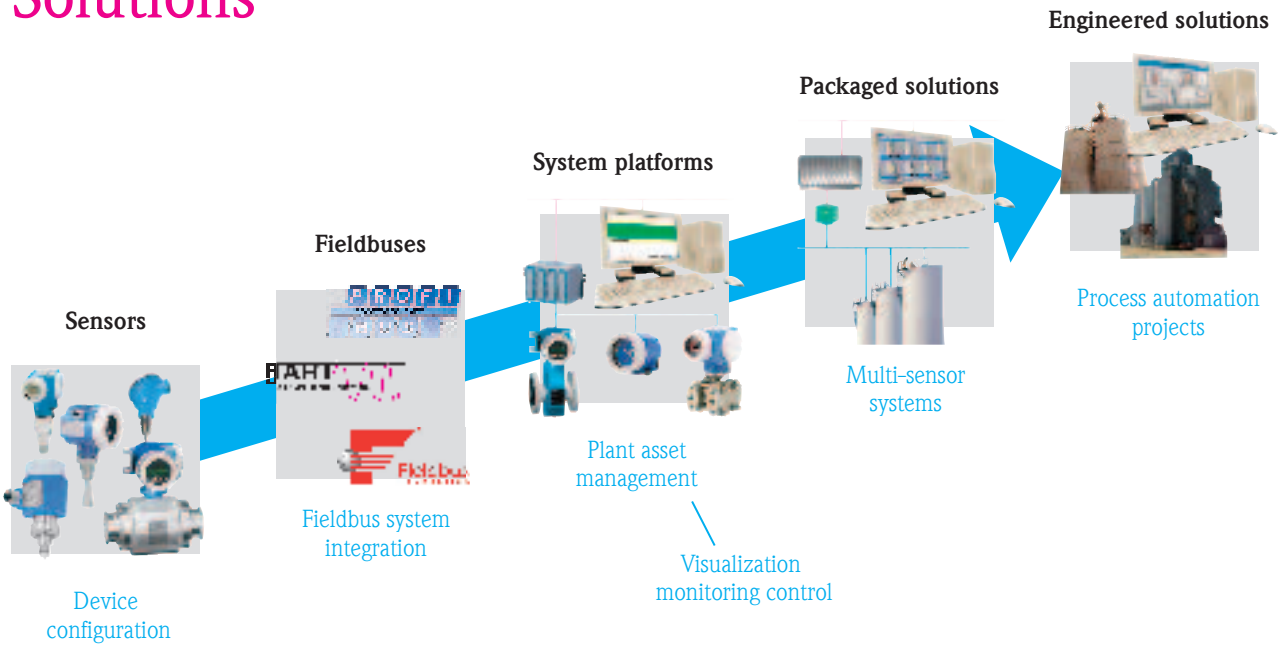
Nitrate:

Measurement based on spectral absorption of nitrate is in the UV range of 214nm. We have online measurement with or without sample taking or conditioning.

Fully automated pH measurement system



Solutions



The core competency of Endress+Hauser is the development of instruments that acquire, transmit and use process information. As field instruments have become intelligent and able to communicate, new challenges have arisen. Innovative systems, solutions, support and services are required to get the most from today's fieldbus instruments. Endress+Hauser's objective is clear: to ensure customers using fieldbus technology get the best possible support and service. We strive to ensure that Endress+Hauser instruments are perfectly integrated into all major automation and asset management systems.

To accomplish this, Endress+Hauser is active in the various user and vendor organizations. Additionally, we operate a fieldbus laboratory which is also a PROFIBUS® Competence Center and subject all our devices to multi-vendor tests in a variety of systems. This competence means we are capable of troubleshooting problems at both the instrument and system level.

FieldCare



Plant Asset Management
All-round support throughout the plant life-cycle

Fieldgate



Data acquisition and remote monitoring of field devices

Fieldbus



Excellence in competence with Fieldbus technologies

Services

Total support for you and your instruments

- Start-up
- Instrument Management Solutions (IMS)
- Help desk
- 24-hour emergency support
- Spare parts & consumables
- Factory repairs
- Field service
- Tools & software
- Maintenance agreements
- Calibration
- Instrument maintenance training
- Measurement technology training
- System solutions
- E-services



Endress+Hauser 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 flow
- Open channel
- DP flow
- Thermal mass 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

- Start-up
- Training
- Calibration
- Maintenance contracts
- Instrument Management Solutions



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