Redefining non-invasive temperature measurement!

The alternative for harsh process conditions:
iTHERM SurfaceLine TM611

- iTHERM SurfaceLine TM611
- Your benefits
- Product design
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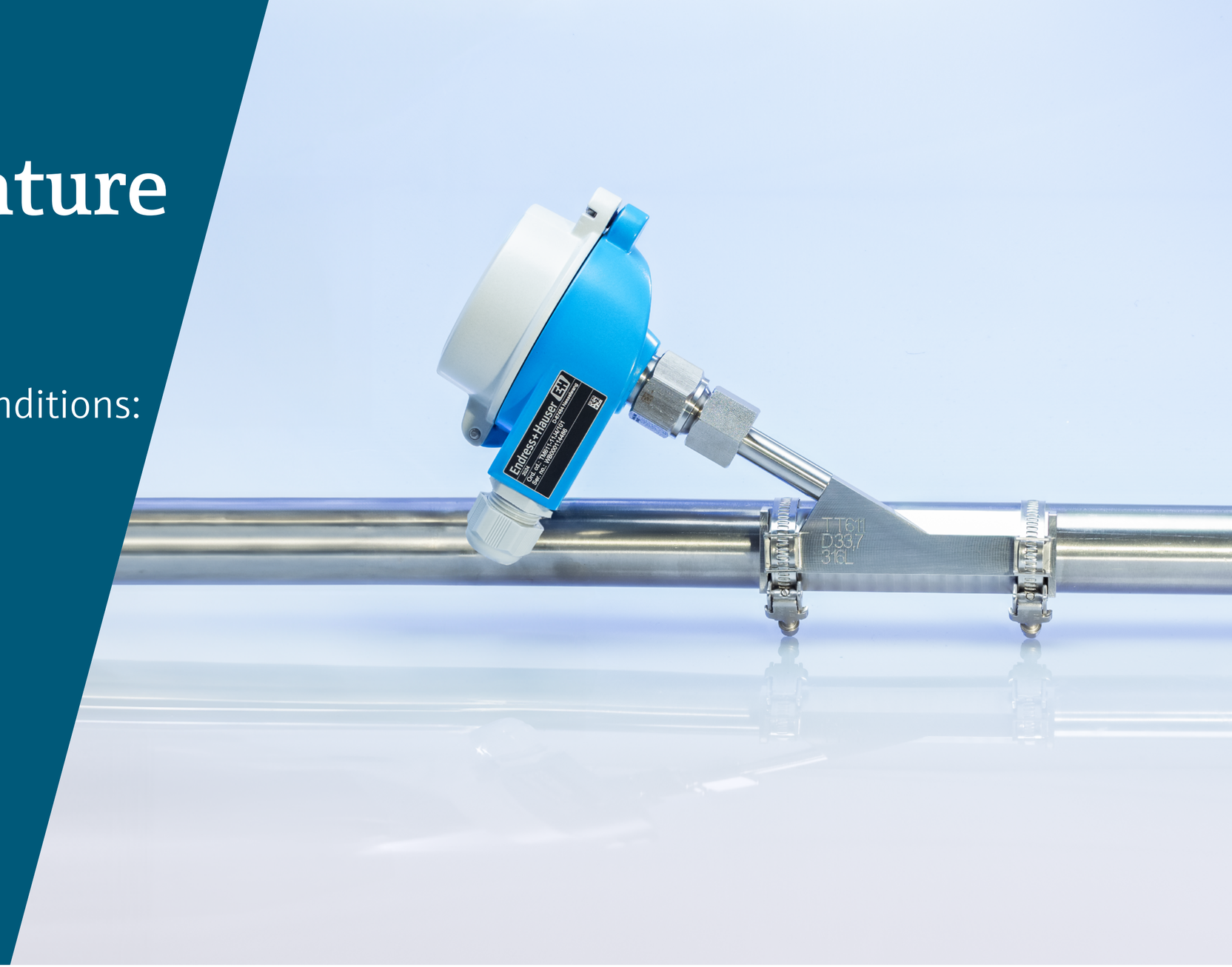
- Related offering



Endress+Hauser

iTHERM SurfaceLine TM611

Surface-mounted thermometer for a wide range of demanding industrial applications.

The non-invasive thermometer iTHERM SurfaceLine TM611 is used **across all industries** to measure temperature **without the risk of leakage and process disruption.**

The device is **safe and easy to install** and can provide the **same accuracy and response time as invasive** temperature measurement.

A specially designed thermal coupling element provides ideal thermal conductivity to the sensor and reduces ambient influences, resulting in superior measurement performance even compared to electronic compensation.

Visit the product website

Benefits at a glance

The main advantage of the iTHERM SurfaceLine TM611 non-invasive thermometer is that **no process opening** and **medium penetration** is required, thus **avoiding any risk of leakage.**

This major advantage is complemented by additional benefits:

- Superior accuracy
- Increased safety
- Significant time & cost savings

Significant cost savings:
- reduced development and project planning times
- reduced expenses for installation, certification and inspections
- no expenses for thermowells, nozzles and flanges, weld seam tests and pipe extensions

iTEMP temperature transmitters with all **common communication protocols** and **optional Bluetooth® connectivity**

Measuring accuracy and response time comparable to invasive measurements

No process opening necessary, **no risk of leakage**

Increased safety for personnel, system and environment

Simplicity from product selection and installation to maintenance

International certifications: e.g. explosion protection according to ATEX, IECEx, CSA and NEPSI; functional safety (SIL)

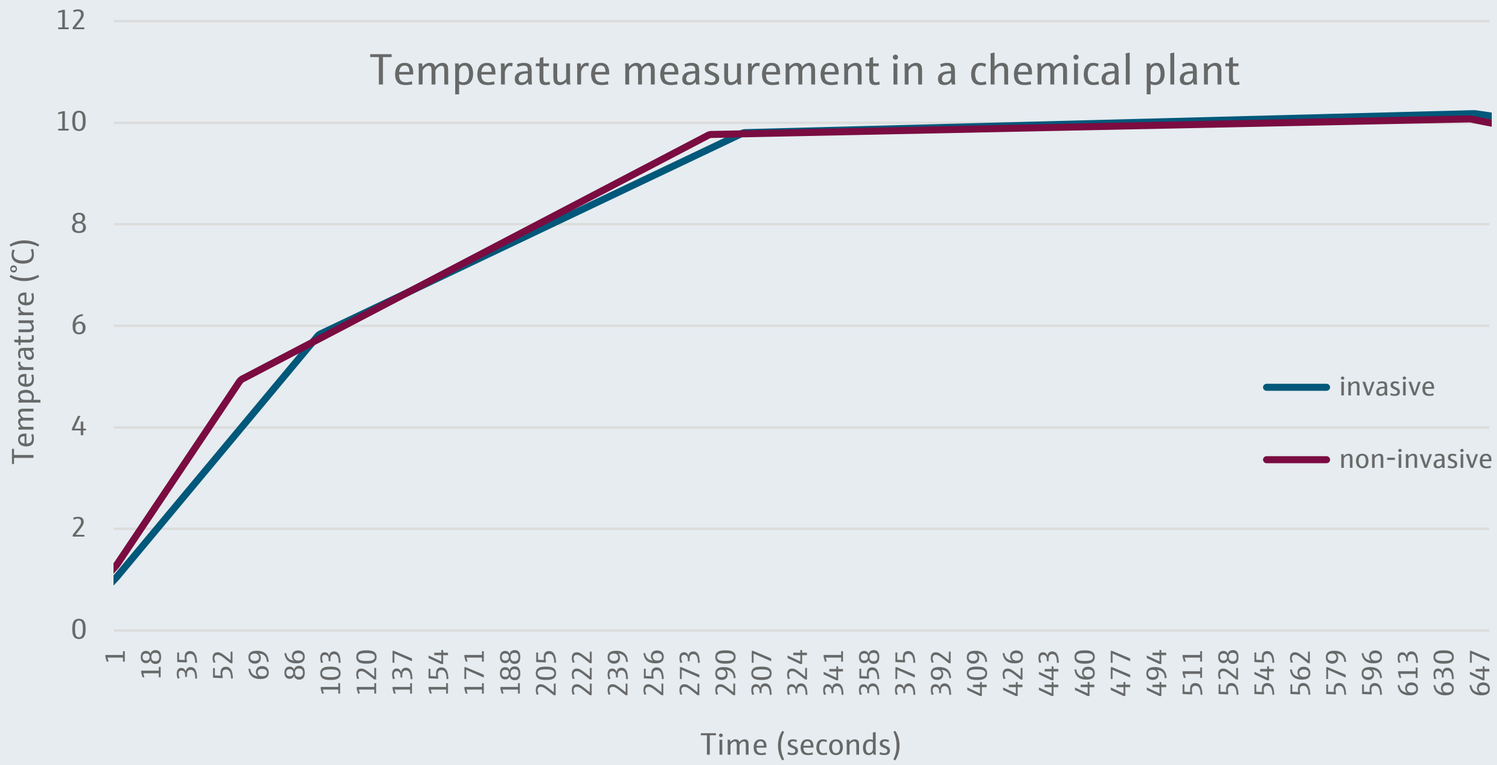
Superior accuracy

iTHERM SurfaceLine TM611 delivers superior measurement results in terms of **accuracy and response time among non-invasive thermometers**, even matching the performance of invasive temperature measurement.

Thanks to thorough development process and extensive field testing, the challenges of non-invasive surface measurement were effectively addressed.

The figure on the right shows a section of a temperature measurement in a chemical process, comparing invasive and non-invasive measurements taken at the same point on the pipe at a sampling rate of 1 second.

The results show that non-invasive measurement provides nearly the same results as invasive measurement and can even be faster.



The challenge

- Poor accuracy with high temperature difference (delta T) between process and ambient temperature
- Very small contact surface to the pipe, high heat transfer resistance pipe to surface sensor
- Complex algorithms and electronic compensation still sensitive to changing ambient conditions (e.g. wind, sun, ...)
- Poor repeatability of measurement results

Our solution

- Enhanced components and geometry for optimal thermal conductivity and low thermal mass
- Large contact surface to the pipe
- Insulation of measuring point recommended
- No calculations, algorithms, predictions
- Performance comparable to invasive measurement (sensor response time and measurement accuracy)

Increased safety

Non-invasive thermometers measure the process temperature on the surface of a pipe without penetrating the pipe wall. This eliminates the risk of leakage, process contamination and flow disturbance. In addition, there is no wear on thermowells or influence from vortex-induced vibration, reducing the risk of failure and plant downtime.

This greatly increases safety for personnel, plant, and the environment. Additionally, **specific product features** of iTHERM SurfaceLine TM611 help to further increase safety.

Non-invasive in general

- No threat of undetected welding defects
- No threat of damage due to changing process conditions
- No wear on thermowells
- No influence of vortex induced vibrations
- Easy and safe installation
- Reduced risk of failures

iTHERM SurfaceLine TM611

- Full range of temperature transmitters with advanced diagnostics according to NAMUR NE107
- Functional safety (SIL) certification
- International explosion protection according to e.g. ATEX, IECEx, CSA and NEPSI

Significant time & cost savings

In contrast to traditional invasive methods, non-invasive thermometers offer significant time and cost savings at various steps from project engineering to procurement, installation and operation.

Development and design times are drastically reduced by eliminating the need for wake frequency and insertion depth calculations.

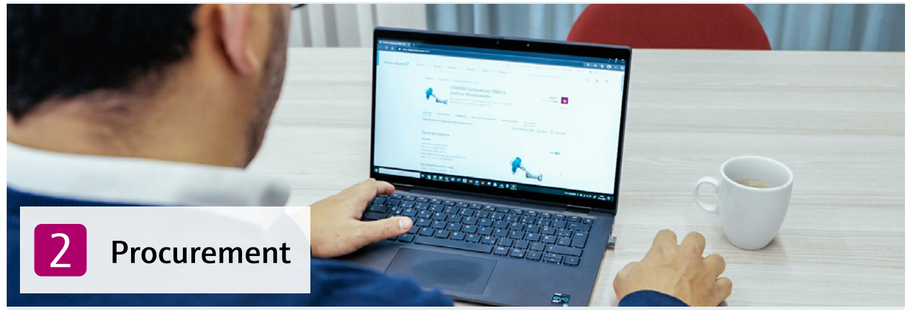
Installation becomes more economical with reduced material expenses for thermowells, nozzles, pipe extensions and flanges.

This cost efficiency even extends to services such as weld seam tests and material certification. In addition, non-invasive thermometers minimize lifecycle costs by eliminating risks such as thermowell breakage, leakage and regular inspection.

1 Project engineering

Reduced time

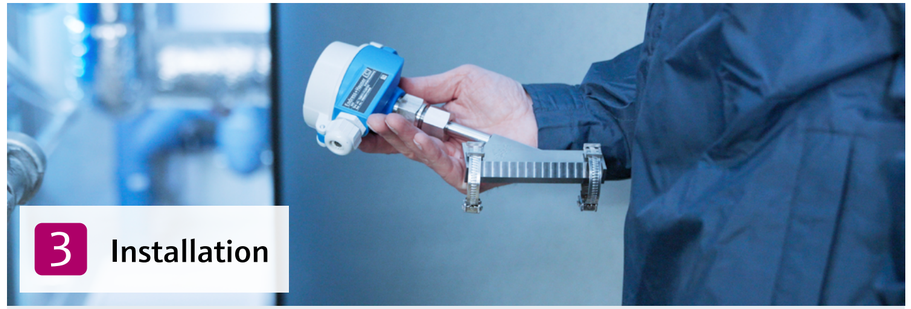
- NO wake frequency calculation
- NO outside contractor and design expenses
- NO piping considerations
- NO sensor/material compatibility selection
- NO 3D modeling, drawings
- NO determination of style, location, insertion depth
- NO need for process data, only pipe size



2 Procurement

Reduced expenses

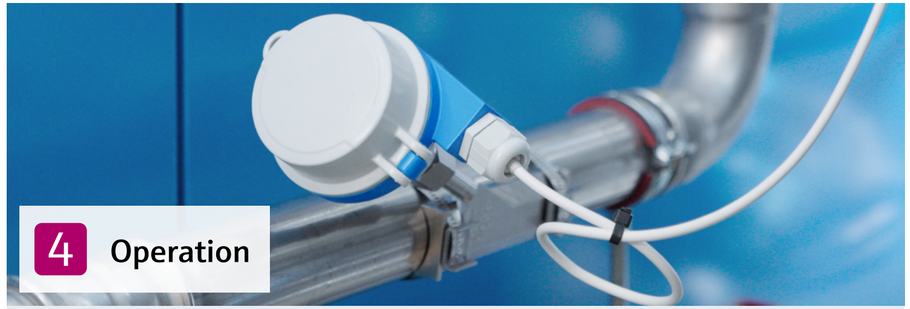
- NO thermowells, nozzles, flanges, weld seam tests
- NO pipe extensions
- NO special materials, alloys, coatings
- NO material certifications



3 Installation

Reduced complexity

- NO complex thermowell and sensor installation
- NO lengthy safety instructions
- NO cutting or welding
- NO plant downtime
- NO welding checks
- NO expensive inspections
- NO specific tools necessary



4 Operation

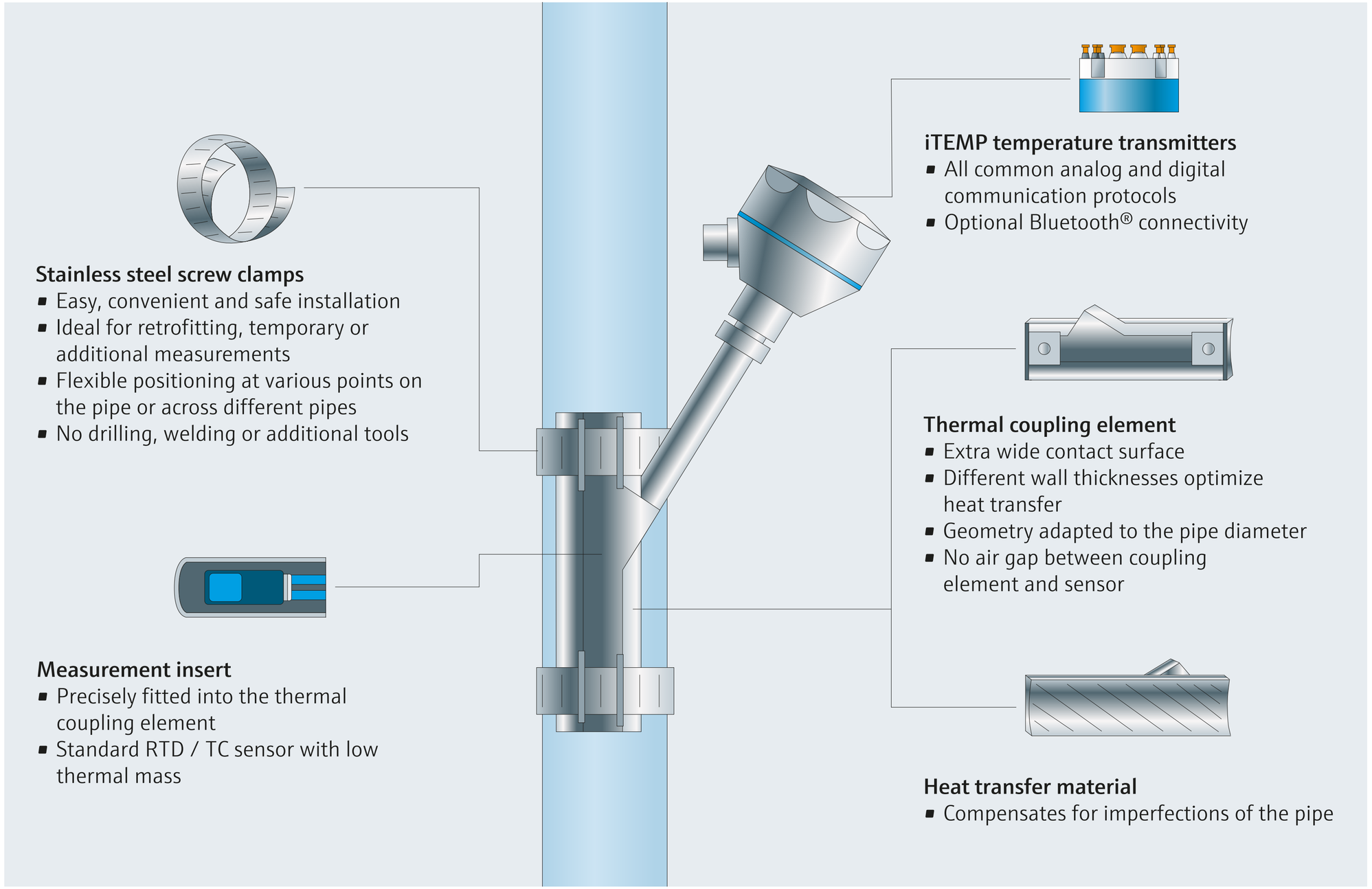
Reduced effort

- NO thermowell breakage
- NO plant downtime
- NO stocking of different product variants

Product design

Our product is designed and optimized with carefully selected materials, precise surface finishes, and advanced geometry to ensure the most uniform heat transfer possible.

Through comprehensive thermal analysis of all components and the **significant reduction in heat transfer resistance**, we achieve superior accuracy in non-invasive temperature measurement.



Stainless steel screw clamps
- Easy, convenient and safe installation
- Ideal for retrofitting, temporary or additional measurements
- Flexible positioning at various points on the pipe or across different pipes
- No drilling, welding or additional tools

Measurement insert
- Precisely fitted into the thermal coupling element
- Standard RTD / TC sensor with low thermal mass

iTEMP temperature transmitters
- All common analog and digital communication protocols
- Optional Bluetooth® connectivity

Thermal coupling element
- Extra wide contact surface
- Different wall thicknesses optimize heat transfer
- Geometry adapted to the pipe diameter
- No air gap between coupling element and sensor

Heat transfer material
- Compensates for imperfections of the pipe

Industry focus

The product can be used universally in all industries. It is ideal for **demanding process conditions** such as high flow velocities, high process pressures, highly viscous, abrasive or corrosive media, pigging or small pipe diameters.

In addition it is the perfect solution for **greenfield projects, retrofitting measurements** in existing systems for **energy and safety monitoring or temporary measurements** as it can be flexibly positioned either at various points on the pipe or across different pipes in a plant.

- Oil & Gas
- Chemical
- Power & Energy
- Water & Wastewater

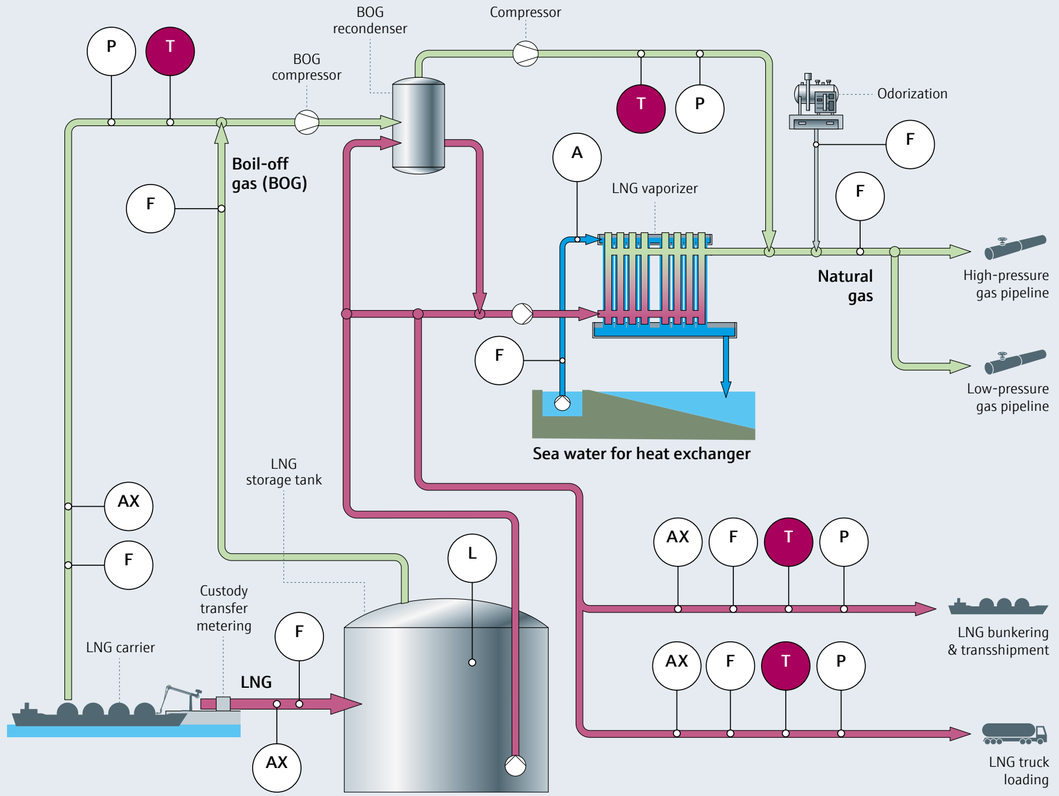
Enhance safety and increase reliability of LNG regasification terminal

Natural gas is transported and stored in liquid form because its volume is 600 times smaller than in its gaseous state. When the gas is cooled down to around -162°C (-259 °F), it condenses and becomes liquid. Regasification is the process of heating liquified natural gas (LNG) back to its gaseous state so that it can be used as a fuel for power generation and heating systems.

The process takes place at large onshore or floating terminals where LNG carriers unload their LNG cargo. At these terminals, the gas is stored in liquid form in tanks, and then regasified to be transported as natural gas through a gas pipeline network to the end user.

For all utilities (heat ex-changers, re-condensers, compressors, pumps, high-pressure pipelines), the challenge is to ensure the highest level of **safety** with the lowest risk of leakage risks due to the multiple pipes and transition joints throughout the whole regasification process. **Reliability** is another key challenge in terms of consistent quality and energy transfer up to the end user during the gas distribution. All of this is achieved with the right temperature measure-ment in terms of fluid disturbance and in terms of accuracy.

LNG regasification process



Your challenge
Measuring task: temperature measurement
Measuring point: inlet and outlet pipelines to and from condensers and heat exchangers, transition joints to and from pumps and compressors
Medium: gaseous or two-phase natural gas, seawater, air, heated steam
Process temperature: -160 to 350 °C (-256 to 662 °F)
Specific challenges:
- Accurate and fast response time
- Vibrations
- Hazardous environment

Our answer
iTHERM SurfaceLine TM611 is the right temperature instrument, thanks to its perfect balance between high accuracy and response time.

There is no risk of leakage as the non-invasive thermal coupling element is designed to ensure perfect thermal contact of the sensor without being wetted by the process fluids.

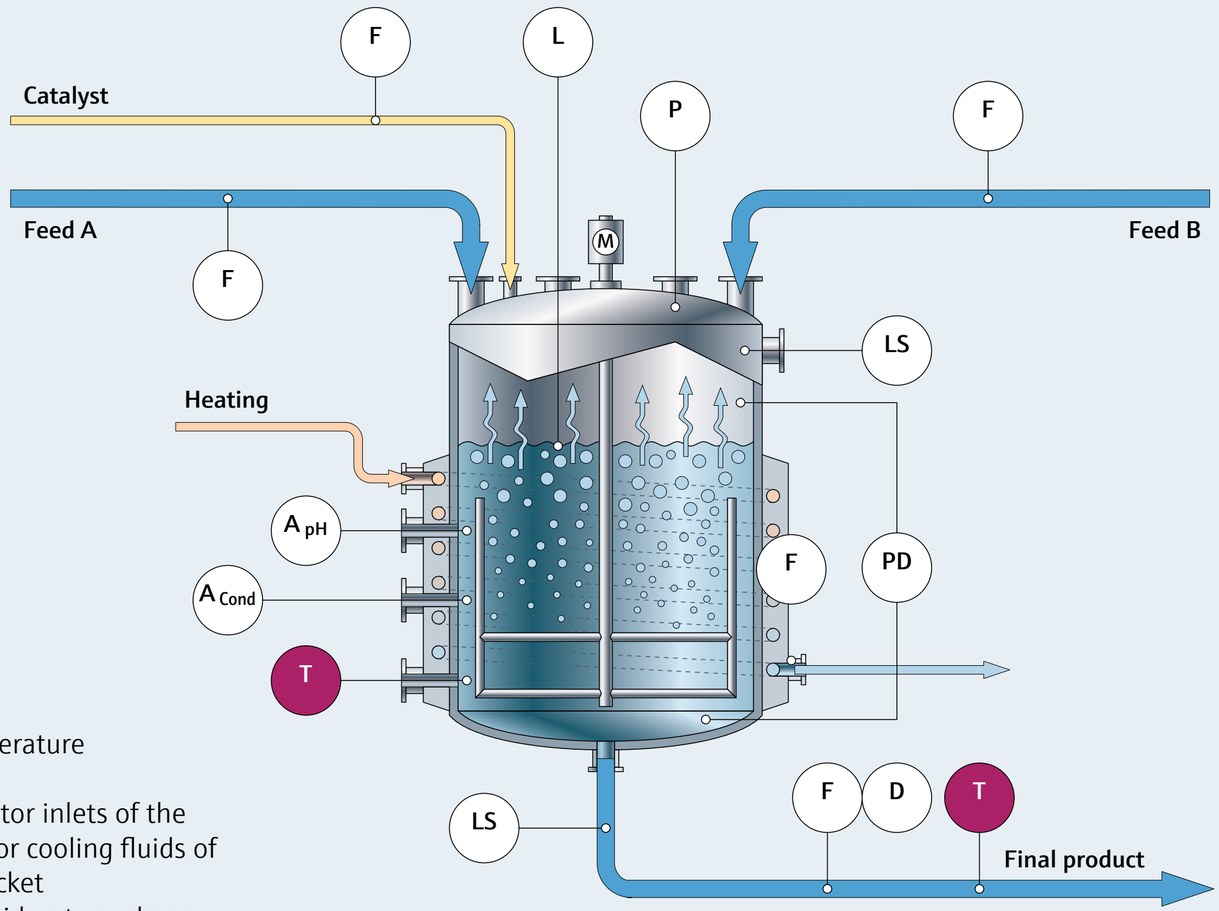
Increase yield in batch reactors

A batch reactor is the core utility of chemical processes that operate by introducing reactants into one reactor without adding any additional components or removing any until the reaction is completed, resulting in a single batch process. Another type of batch reactor involves reactants added at once and then gradually removing the converted product.

Advantages of batch reactors are mainly based on their versatility and frequent use in various chemical segments where temperature, pressure and mixing speeds are the key operating conditions to be controlled.

The batch reactor performances are mainly measured trough the quality of the final product compared with the consumption of the reactants and the needed or absorbed energy. Temperature is one of the key parameter to control the performances and therefore to get the best yield either in terms of quality or capacity.

Ensuring the uniform composition throughout the reactor with an unsteady state of the fluids considering also the poor handling of highly heat-sensitive reactions, requires very accurate and fast response time temperature measurement to monitor the behavior of the reactions.



Your challenge
Measuring task: temperature measurement
Measuring point: reactor inlets of the feeding lines, heating or cooling fluids of the heating/cooling jacket
Medium: gaseous, liquid or two-phase fluids with various composition
Process temperature: -40 to 250 °C (-40 to 482 °F)
Specific challenges:

- Accurate and fast response time
- Toxic fluids
- Hazardous environment

Our answer
iTHERM SurfaceLine TM611 is the right temperature instrument, thanks to its perfect balance between high accuracy and response time. As there is no direct contact to the medium, there is no risk of leakage, no disturbance of the fluid, but still high reliability of the heat exchange measurement. Ultimately, this results in increased yield capacity with an optimized feedstocks and energy consumption.

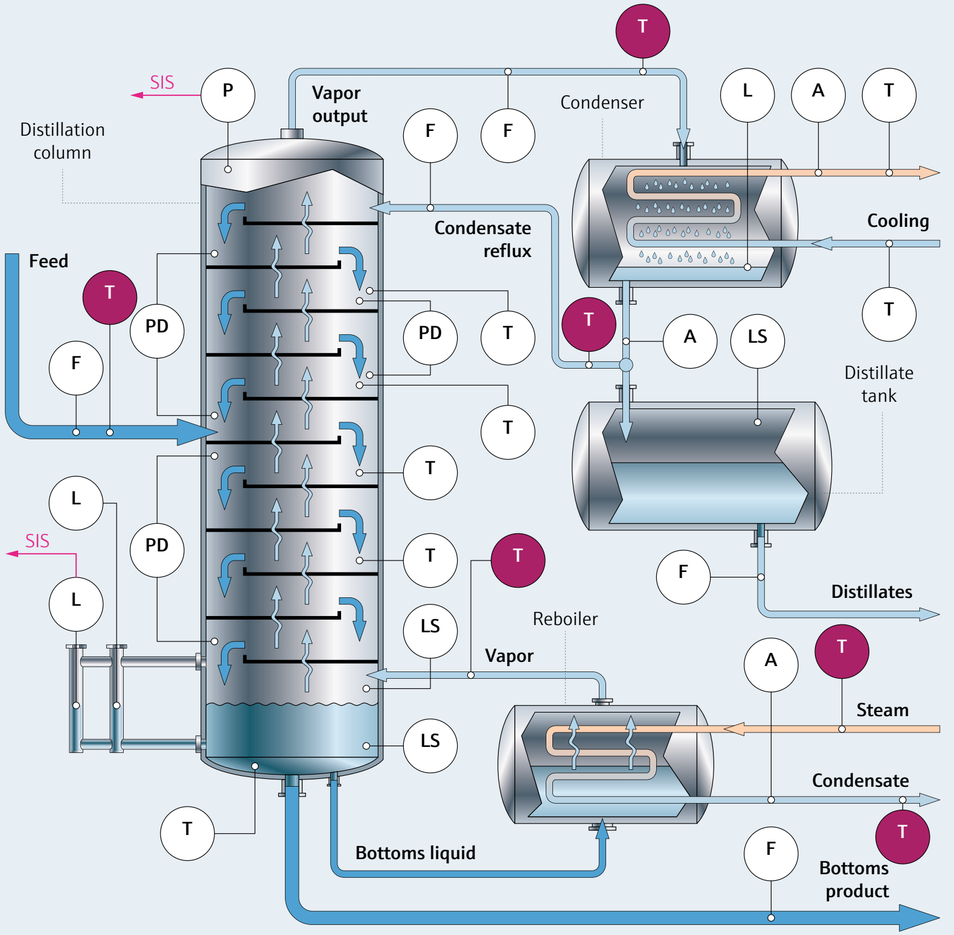
Operational expenditures in distillation

Distillation is the process of separating mixtures of liquids into their basic components by acting on the boiling points. It involves several units such as a distillation column, reboiler, condenser and reflux drum (separator). The distillation process is one of the most energy consuming processes due to the significant amount of heat that must be transferred to extract the vapors from the liquid mixture and to operate the condensers, separators and pumps.

Distillation efficiency depends on several parameters such as column size, height/diameter ratio, materials used, internal design and, most importantly, feed composition and heat distribution and exchange in several steps inside and outside the column.

The efficiency of the distillation column and the long-term ability of all the other auxiliaries to operate in stable conditions are the key challenges in extracting the most elementary compounds from the mixture, especially when they differ by a small delta boiling temperature. Another challenge is to quickly reach a new optimized efficiency of the whole process, in case the composition of the feedstock may change, to always guarantee the best quality of the obtained fractions.

Your challenge
Measuring task: temperature measurement
Measuring point: column feed lines, outlet lines, reboiler and condenser inlets and outlets, reflux feed lines
Medium: gaseous, liquid or two-phase fluids with various composition, saturated or superheated steam
Process temperature: 250 to 450 °C (482 to 842 °F)
Specific challenges:
- Accurate and fast response time
- Turbulent and fast-moving fluids
- Hazardous environment



Our answer
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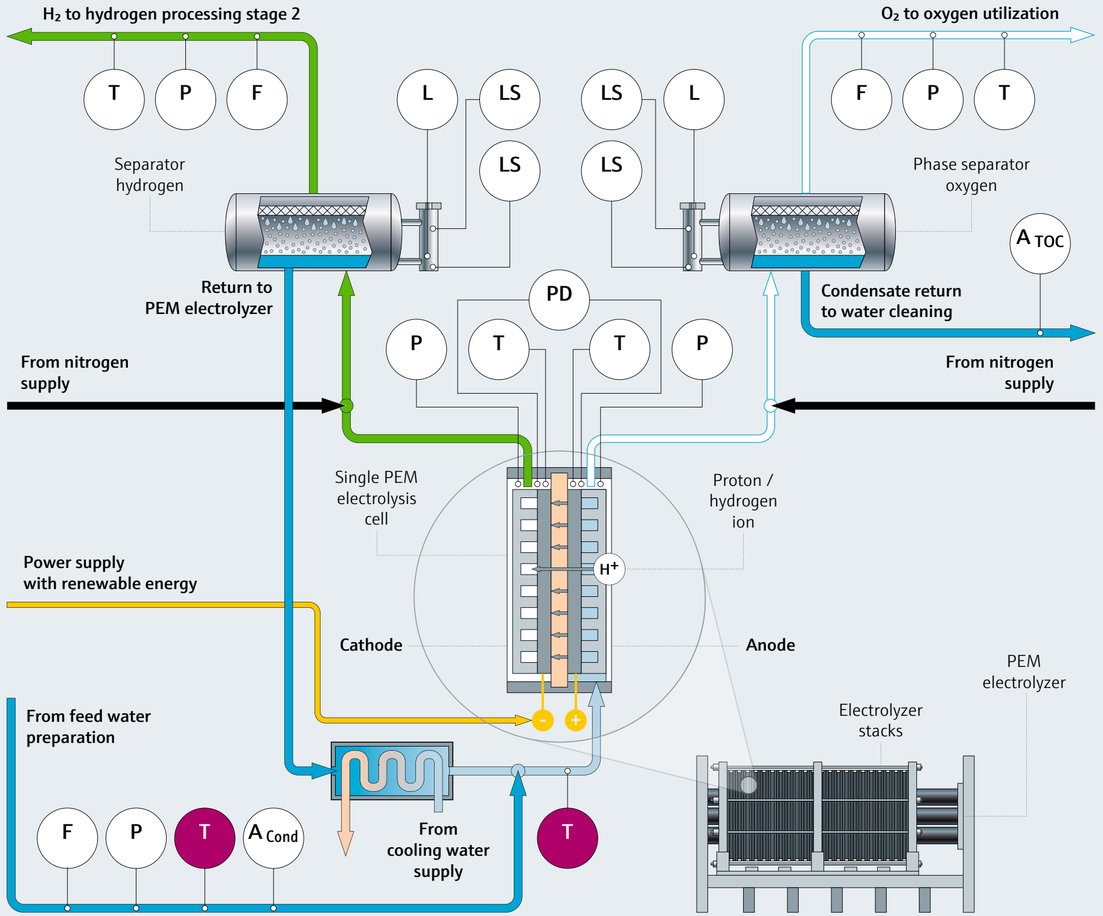
There is no risk of leakage as the non-invasive thermal coupling element is designed to ensure perfect thermal contact of the sensor without being wetted by the process fluids.

Green hydrogen: water supply for PEM electrolyzer

An essential part of green hydrogen production is the electrolyzer, which splits water into hydrogen and oxygen. The water is treated to an absolutely clean quality (ultrapure) and must be monitored before entering the electrolyzer.

The consumption of ultrapure water in the stack is an important KPI for monitoring the health and the cost of the hydrogen produced with temperature measurement. The requirements for a temperature sensor are hygienic design, minimal contact with the medium and high accuracy.

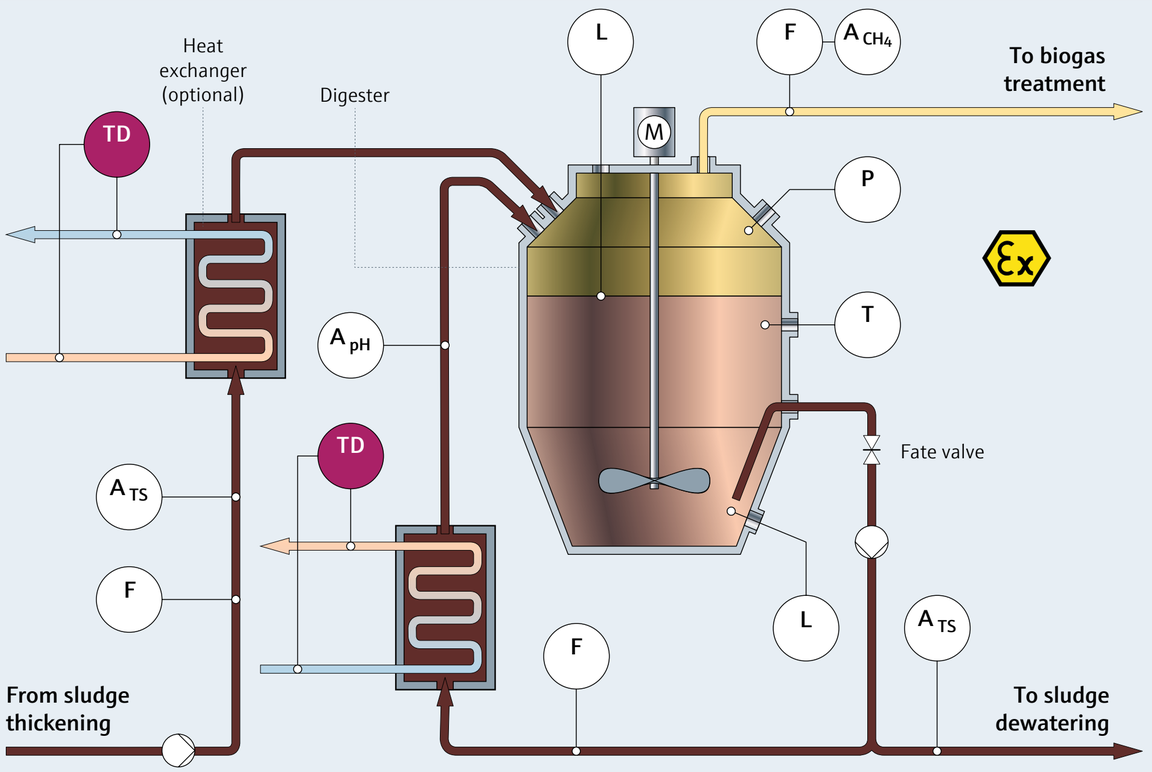


Your challenge
Measuring task: temperature measurement
Measuring point: ultrapure water supply to the PEM stack and in the circuit
Medium: water
Process temperature: up to 75 °C (167 °F)
Specific challenges: ultrapure water (very few impurity ions)

Our answer
iTHERM SurfaceLine TM611 is the ultimate sensor for measuring temperature without the risk of leakage, process interruption and product contamination. This innovative sensor is based on an enhanced **thermal coupling element** that ensures superior measurement performance.

Sludge treatment optimization: digester control

Under anaerobic conditions, special bacteria break down organic substances from the primary and waste activated sludge to produce biogas. The result is a reduction in sludge volume and its stabilization. Retention times of 2-3 weeks are common at temperatures of 30-50 °C (86-122 °F), while continuous sludge circulation is important. The process offers opportunities for heat recovery and energy recovery of biogas. Temperature is one of the most important factors influencing bacterial activity. Incoming sludge is preheated in a heat exchanger. To ensure the efficient operation of the heat exchanger, it is necessary to measure the temperature difference at the inlet and the outlet of the heat exchanger.



Your challenge
Measuring task: temperature measurement
Measuring point: differential temperature at the heat exchanger
Medium: water
Process temperature: 10 to 40 °C (50 to 104 °F)
Delta T: 5 to 10 °C (41 to 50 °F)
Specific challenges:
- Reliable and accurate measurement
- Optional Ex certification

Our answer
iTHERM SurfaceLine TM611 is the ultimate sensor for measuring temperature without the risk of leakage, process interruption and product contamination. This innovative sensor is based on an enhanced **thermal coupling element** that ensures superior measurement performance. The device is available as explosion-proof and SIL-compliant versions.

Related offering

Discover other useful products from our Endress+Hauser portfolio to improve your plant and processes, including our system products, such as the active barrier RN22, WirelessHART Adapter SWA70, the field temperature transmitter iTEMP TMT162 or the ultrasonic clampon flowmeter Proline Prosonic Flow W 400.

iTEMP TMT162 temperature transmitter

- Field transmitter with large illuminated display
- Remote mounting in small spaces or with poor accessibility
- HART®, FOUNDATION Fieldbus or PROFIBUS® communication
- Two universal sensor inputs
- Suitable for use in hazardous areas and SIL 2

Visit the product website

WirelessHART Adapter SWA70

- Interface module with power supply for wireless transmission of 4...20mA/HART signals to a Fieldgate
- Easy installation for temporary or additional measuring points

Visit the product website

RN22 active barrier

- For supplying devices in hazardous areas
- Galvanically isolated signal output according to NAMUR NE 175
- Suitable for safety instrumented systems up to SIL 2
- 1/2-channel/SD for 4 to 20 mA, HART® transparent with 24 V DC as well as active/passive input and output

Visit the product website

Proline Prosonic Flow W 400 ultrasonic clamp-on flowmeter

- Non-invasive, without process interruption
- Reliable, flexible, zero maintenance
- Consistently accurate, even in limited spaces
- Suitable for energy monitoring in combination with iTHERM SurfaceLine TM611

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