

Temperature Profiling

Engineered Solutions for the
Oil & Gas, Petrochemical Industries

Temperature Engineered Solutions



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Introduction

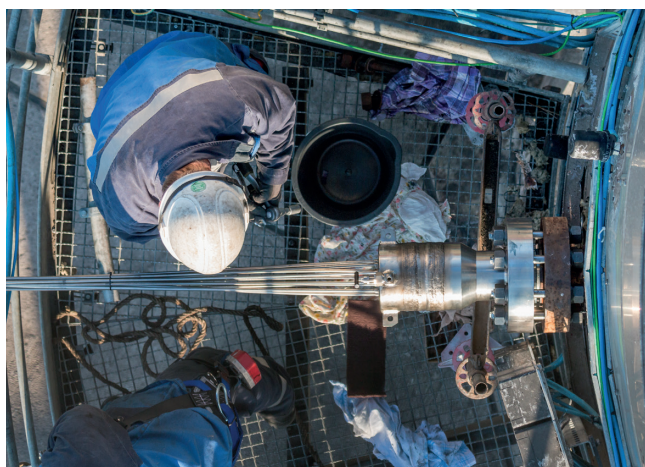
Excellence in temperature measurement instrumentation, services and project support

The Endress+Hauser Group

A global leader in measurement instrumentation, services and solutions for industrial process engineering. The Swiss family-owned business employs approximately 14 000 personnel across the globe. Since its creation in 1953, Endress+Hauser has been a pioneer for cutting edge measurement and process automation solutions.

Committed to innovation Our solid business performance, a sustained investment in R&D and an impressive number of patent applications allows us to drive the development of ground-breaking technologies.

A complete portfolio of standard, compact and modular thermometers, thermowells, measurement inserts, engineered solutions, system components and accessories is available for all major process industries.



Products

Tapping into a long history of delivering complex and challenging projects in partnership with customers worldwide, Endress+Hauser bundles its vast industry knowledge and application know-how to deliver an innovative and field-proven offering of standardized and customer-specific engineered temperature solutions.

iTHERM MultiSens A complete offering of innovative temperature measurement assemblies, accessories, tests and services developed to increase process efficiency, plant safety and project success while reducing complexity.

Services

Endress+Hauser is your partner during all phases of your project – from small to large-scale and from start to finish:

- Project management
- Active support during turn-around planning
- Design studies
- Installation and supervision
- Field tests, complete in-house validation test packages
- Immediate on-site or remote service and consultation
- Maintenance, training
- Expert support throughout the entire life cycle
- Comprehensive documentation package





Typical downstream applications for temperature profiling in the petrochemical industry include: Hydrocracking, hydrotreating, hydrodesulfurization, crude distillation, catalytic reforming, fluid catalytic cracking, coking, isomerization, visbracking, aromatic extraction, gasification, alkylation, storage and blending

Upgrade your unit performance

Accurate multipoint temperature profiling unlocks potential

Refineries, petrochemical and chemical plants worldwide are faced with the complex technical, regulatory, environmental and economical challenges of a volatile product and business environment.

Reducing complexity, cost and risk while at the same time increasing product throughput and quality requires processes to run as safely, efficiently and consistently as possible.

Accurate and reliable temperature measurements play a crucial part in getting the last bit of performance out of your new or existing units while also helping to prevent untimely shutdowns or potentially catastrophic events.

Factors for success To help achieve maximum safety and efficient operations, measuring the reactor or storage unit's internal heat distribution and behavior is key. In these applications, high quality multipoint instruments offer major advantages over conventional single-point measurements.



Benefits at a glance

- high measuring point availability
- low invasiveness and process disturbance
- advanced safety features
- low cost of ownership
- more insightful data for better process control



Minimally invasive,
single point-of-entry design

Maximum flexibility and
low cost of ownership

Advanced safety features to
prevent loss of containment,
enable predictive maintenance

The right instrument for every
reactor vessel or storage application

iTHERM MultiSens family

Complete portfolio of standardized, and engineered multipoint temperature assemblies, accessories and services

Temperature profiling The iTHERM MultiSens product family comprises linear and flexible RTD or thermocouple (TC) multipoint assemblies, accessories and services that can be fully customized to meet the most challenging process requirements while offering you the utmost simplicity.

Innovative features The innovative, standardized design and construction allows you to quickly configure devices according to your individual application requirements, eliminating the need for complex reengineering and lengthy ordering processes.

Online configurator The unique Endress+Hauser online configuration tool streamlines the process of specifying and configuring complete multipoint temperature solutions with just a few simple clicks.

The digital platform also provides quick insights into what options are available to further enhance your temperature measurement capabilities. Comprehensive documentation for all devices help you make informed decisions before, during and after your project.

Connectivity The offering is flanked by a comprehensive range of temperature transmitters, system products and data managers for seamless system integration, visualization and communication.

MultiSens Flex



MultiSens Linear



MultiSens Slim



MultiSens Bundle



Data managers

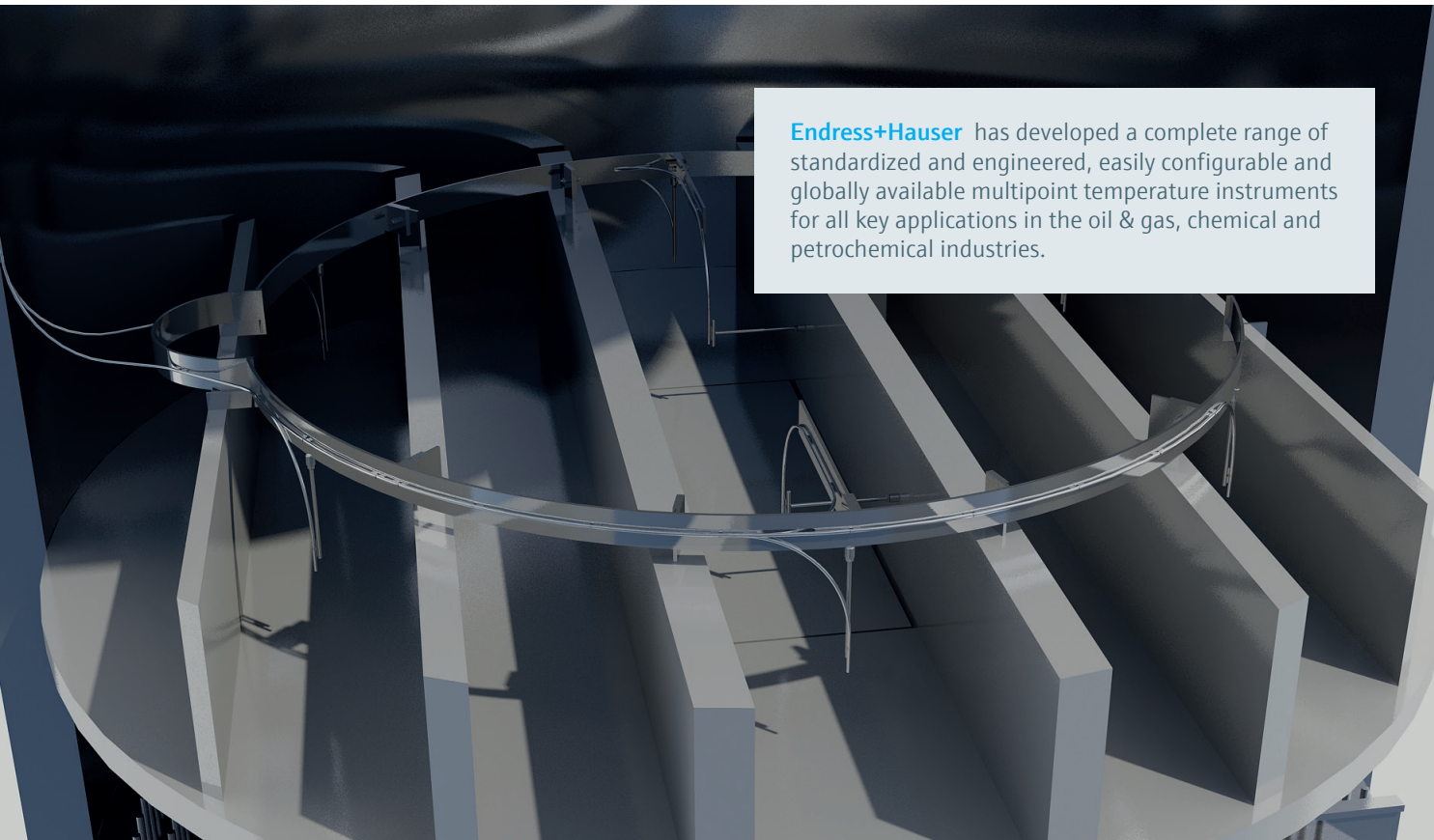


Indicators



Temperature transmitters

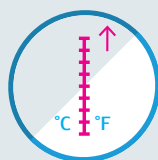
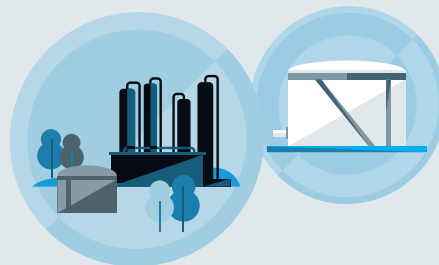




Endress+Hauser has developed a complete range of standardized and engineered, easily configurable and globally available multipoint temperature instruments for all key applications in the oil & gas, chemical and petrochemical industries.

iTHERM MultiSens standardized, modular temperature assemblies are available with different classes of robust, accurate RTD or thermocouple sensors, on-board or remote Ex-e/ia or Ex-d terminal heads and standard flanges to deliver the appropriate configuration and measurement performance for the desired application.

Typical applications include: Fixed and fluidized bed reactors, distillation columns, topping units, FCC units, HDT, HDS, hydrocrackers, gasifiers, as well as tube bundle reactors, ammonia process, pilot plants, syngas treatment, polymer processes, feed and product storage tanks and silos.



Engineering and production Expert design, selected materials and highest production standards guarantee instrument longevity in all types of process media, pressure and temperature ranges.

Four types of designs with different mechanical properties to cover all vessel applications, reactor designs and storage tank layouts:







- MultiSens Flex - 3D with flexible layout
- MultiSens Linear - with primary thermowell
- MultiSens Slim - linear without thermowell
- MultiSens Bundle - rope layout



iTHERM MultiSens

Standardized multipoint temperature assemblies

iTHERM MultiSens device selection

Model	Flex TMS01		Flex TMS02		Linear TMS11	Linear TMS12	Slim TMS21	Bundle TMS31	
Design									
Type	direct contact	individual thermo-wells	direct contact	individual thermo-wells	multiple, primary thermowell		annealed tube	annealed tube with flexible part	stainless steel flexible rope
Response time	■■■■■	■■■■■	■■■■■	■■■■■	■■■■■		■■■■■	■■■■■	■■■■■
Layout / bendability	■■■■■	■■■■■	■■■■■	■■■■■	-		■■■■■	■■■■■	■■■■■
Diagnostic capabilities	-		Advanced		Basic	Advanced	-		
Individually replaceable sensors	✓	✓	✓	✓	✓	✓	-		
Max. number of points	48 (linear or 3D) 80 (Profile-Sens)	48 (linear or 3D)	52 (linear or 3D) 80 (Profile-Sens)	48 (linear or 3D)	16 (linear)	12 (linear)	59 (linear)		20 (linear)
Max. pressure in bar (psi)	100 (1,450)		200 (2,900)		240 (3,481)		90 (1,305)		100 (1,450)



Benefits at a glance

- Measurement and recording of a temperature profile for control of the process in the reactor
- Shortest response time enabled by high number of temperature probes
- Easily configurable and globally available
- Coverage of all key applications in the Oil & Gas, Chemical, Petrochemical industries
- Defective thermocouples can be replaced during shutdown
- Increased safety thanks to a diagnostic chamber able to contain the process in the event of leakages through the primary seals (PED certified chamber)



iTHERM MultiSens Flex TMS01, TMS02

Multipoint thermometer family

Fine-tune your catalytic refining processes

The modular iTHERM MultiSens Flex TMS01 and TMS02 multipoint temperature assemblies are engineered to deliver reliable temperature profiling in demanding catalytic refining and petrochemical applications. The high-performance instruments provide accurate 3D temperature maps in reactors and vessels.

Fully customizable to meet your specific requirements, the serviceable assemblies are available with or without thermowells as well as with different types of RTD or thermocouple sensors.

Advanced diagnostic capabilities provide additional safety and valuable process information for predictive maintenance.

The patented iTHERM ProfileSens multipoint cable probe technology offers maximum long-term reliability even under extreme conditions.



iTHERM MultiSens Flex TMS01 & TMS02
3D flexible multipoint assemblies

Your benefit

Value	Benefit	Feature
Lower risk and cost Higher process safety	<ul style="list-style-type: none">▪ Reduced risk of unplanned plant shut-downs, environmental hazards or health and safety related incidents	<ul style="list-style-type: none">▪ Advanced diagnostic chamber as secondary process barrier for additional safety, capable of pressure monitoring for predictive maintenance
Higher process efficiency and product quality	<ul style="list-style-type: none">▪ Precise temperature profiling▪ Higher catalyst charge▪ Less channeling	<ul style="list-style-type: none">▪ High number of measuring points (up to 30/48)▪ 3D flexible multipoint cable probes▪ Minimally invasive
Reliable and cost-effective design	<ul style="list-style-type: none">▪ High mechanical strength▪ Low maintenance▪ Fast installation▪ Individual sensor replacement	<ul style="list-style-type: none">▪ iTHERM ProfileSens technology▪ Modular configuration▪ Optional thermowells▪ Optional diagnostic chamber

Application

- Easy to use, flexible design, specially developed for demanding applications in the oil & gas and petrochemical industries
- Certifications and approvals for critical components: ATEX, IEC-Ex, EAC-Ex, UL, FM, CSA and NEPSI

For more information please visit
www.endress.com/tms01
www.endress.com/tms02

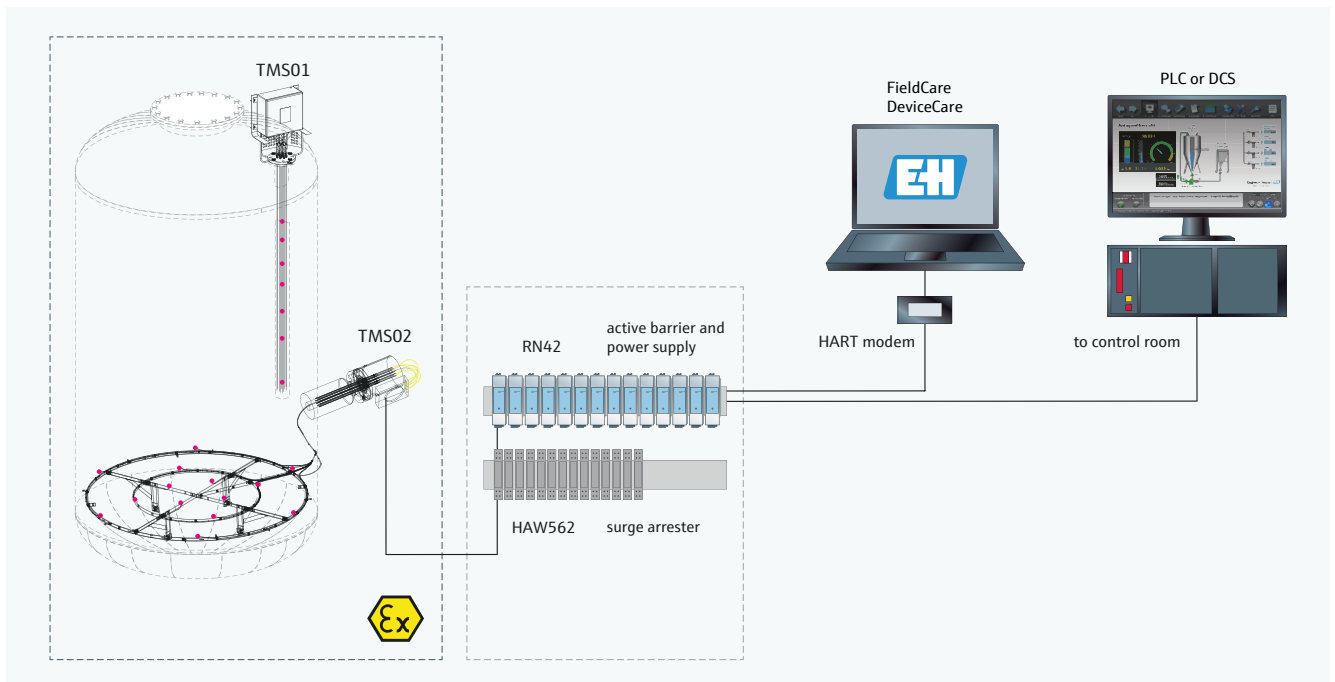
Features and specifications

Measuring range (RTD):	–200 to 600 °C (–328 to 1,112 °F)
Measuring range (TC):	–270 to 1,100 °C (–454 to 2,012 °F)
Static pressure range:	Up to 100 bar (1,450 psi) / up to 200 bar (2,900 psi)
Protection class:	Up to IP66/67
Communication:	Analog output 4 to 20 mA, digital protocols (with temperature transmitters)

Model comparison

	TMS01	TMS02
Direct contact	✓	✓
Thermowells	optional	
Hazardous areas	✓	✓
Diagnostics	-	advanced

Integration and system architecture



Related offering

Product	Feature
Active barrier RN42	<ul style="list-style-type: none"> Multi-voltage power supply unit, global Ex approvals and SIL2 Safe separation of 4 to 20 mA standard signal circuits Front side HART® communication jacks and integrated 250 Ohm resistor
Surge arrester HAW562	<ul style="list-style-type: none"> DIN rail surge arrester according to IEC 60715 Safeguards electronic components in measuring instruments against overvoltage surges Application in Ex areas; available with SIL2 intrinsically safe approvals (optional)
Endress+Hauser Service	<ul style="list-style-type: none"> Application experts for defining process integration, consulting, planning and training Installation service and safety check guarantee optimal startup Complete life cycle management including maintenance and repair Calibration service with complete documentation

For more information please visit
www.endress.com/tms01
www.endress.com/tms02

iTHERM MultiSens Linear TMS11, TMS12

Multipoint thermometer

Linear profiling in harsh process conditions

The ultra-durable, modular iTHERM MultiSens Linear TMS11 and TMS12 multipoint temperature assemblies are engineered to deliver reliable linear temperature profiling in demanding catalytic refining and petrochemical applications.

Fully customizable to meet your specific requirements, the easily serviceable assemblies with thermowell are available with RTD or thermocouple sensors.

Advanced diagnostic capabilities provide additional safety and valuable process information for predictive maintenance, increasing process safety and maximizing reactor performance.



iTHERM MultiSens Linear TMS11 & TMS12
linear multipoint assemblies

Your benefit

Value	Benefit	Feature
Lower risk and cost Higher process safety	<ul style="list-style-type: none">Reduced risk of unplanned plant shutdowns, environmental hazards or health and safety related incidents	<ul style="list-style-type: none">Primary thermowell functioning as first and second process barriers
Higher process efficiency and product quality	<ul style="list-style-type: none">Precise temperature profilingHigh reliability	<ul style="list-style-type: none">High mechanical strengthHigh number of measuring points (up to 16/12)
Easy installation, integration and maintenance	<ul style="list-style-type: none">Customizable configurationElectrical and Pressure Directive complianceServiceable: Individual sensor replacement even during operation	<ul style="list-style-type: none">Modular instrument designHighly robust primary thermowellInserts according to standards IEC 60584, ASTM E230 and IEC 60751Advanced diagnostic chamber (TMS12)

Application

- Easy to use, flexible design, specially developed for demanding applications in the oil & gas and petrochemical industries
- Certifications and approvals for critical components: ATEX, IEC-Ex, EAC-Ex, UL, FM, CSA and NEPSI

For more information please visit
www.endress.com/tms11
www.endress.com/tms12

iTHERM MultiSens Slim TMS21

Multipoint thermometer family

Minimally-invasive and highly accurate

The iTHERM MultiSens Slim TMS21 multipoint thermometer is specially designed for applications in the chemical industry, where it combines high accuracy with a small footprint. The lightweight, single-nozzle probe is easy to install and guarantees minimum process disturbance.

Up to 59 thermocouple sensors are packaged into a linear or flexible, low-diameter probe to establish a complete temperature profile in tube reactors, vessels or storage tanks.

Its flexible thermowell can be bent to accomodate the routing required by your application.



iTHERM MultiSens Slim TMS21
linear, bendable multipoint probe

Your benefit

Value	Benefit	Feature
Cost-effective	<ul style="list-style-type: none">▪ Quick installation▪ Easy process integration	<ul style="list-style-type: none">▪ Customizable design: Sizing, materials, configuration (linear or flexible)
Better process control and product quality	<ul style="list-style-type: none">▪ Precise temperature profiling▪ Fast sensor response times	<ul style="list-style-type: none">▪ Up to 59 thermocouple sensors▪ Compact thermowell
Safety by design	<ul style="list-style-type: none">▪ Minimal process disturbance	<ul style="list-style-type: none">▪ Single process connection▪ Low-impact probe design

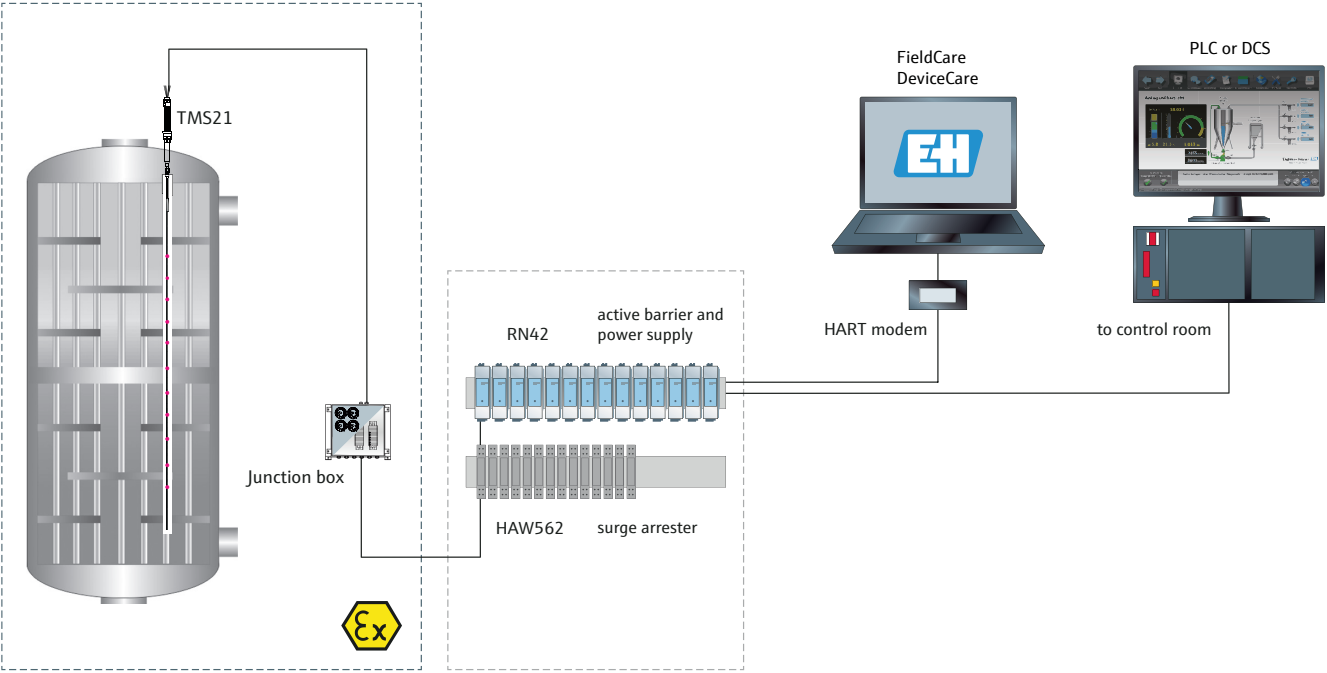
Application

- Easy to use, flexible design, specially developed for light chemical applications
- Certifications and approvals: ATEX Ex-ia

Features and specifications

Measuring range (TC):	-270 to 1,100 °C (-454 to 2,012 °F)
Static pressure range:	Up to 90 bar (1,305 psi)
Protection class:	Up to IP66/67
Communication:	Analog output 4 to 20 mA, digital protocols (with temperature transmitters)

Integration and system architecture



Related offering

System component	Feature
Active barrier RN42	<ul style="list-style-type: none">Multi-voltage power supply unit, global Ex approvals and SIL2Safe separation of 4 to 20 mA standard signal circuitsFront side HART® communication jacks and integrated 250 Ohm resistor
Surge arrester HAW562	<ul style="list-style-type: none">DIN rail surge arrester according to IEC 60715Safeguards electronic components in measuring instruments against overvoltage surgesApplication in Ex areas; available with SIL2 intrinsically safe approvals (optional)
Endress+Hauser Service	<ul style="list-style-type: none">Application experts for defining process integration, consulting, planning and trainingInstallation service and safety check guarantee optimal startupComplete life cycle management including maintenance, repair and overhaulCalibration service with complete documentation

iTHERM MultiSens Bundle TMS31

Multipoint thermometer family

Flexible temperature profiling in storage tanks and bulk silos

The iTHERM MultiSens TMS31 multipoint assembly offers maximum versatility for temperature profiling in silos and storage applications, where high mechanical robustness and flexibility are crucial.

The modular thermocouple or RTD assembly is a cost-effective solution various tank gauging, feedstock quality and condition monitoring applications. It provides reliable temperature data via several communication protocols. Instruments are available with a wide range of accessories, different process connections and probe configurations that simplify system integration to accomodate various installation setups.



iTHERM MultiSens Bundle TMS31
flexible multipoint assembly

Your benefit

Value	Benefit	Feature
Reduce overhead costs	<ul style="list-style-type: none"> ▪ Easy installation ▪ Adapts to different silos and tank operating conditions (filling, emptying, storage, ...) ▪ Cost-effective design and maintenance 	<ul style="list-style-type: none"> ▪ Modular configuration ▪ Robust, flexible probe design ▪ Long instrument life
Minimize risk	<ul style="list-style-type: none"> ▪ Control product quality, prevent microbial growth ▪ Prevent temperature runaways ▪ Avoid unplanned maintenance ▪ Prevent product loss or damage 	Up to 20 highly accurate temperature measuring points for accurate feed stock level and condition monitoring

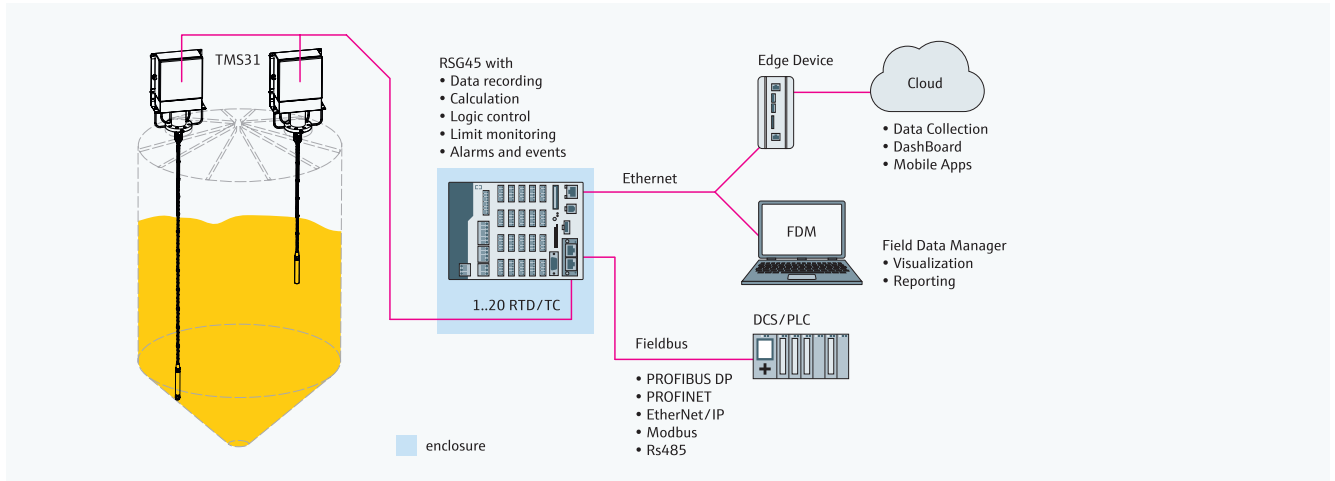
Application

- Ready to use device, flexible design, specially developed for storage applications
- Certifications and approvals for critical components: ATEX, IECEx, EAC, UL, FM, CSA and NEPSI

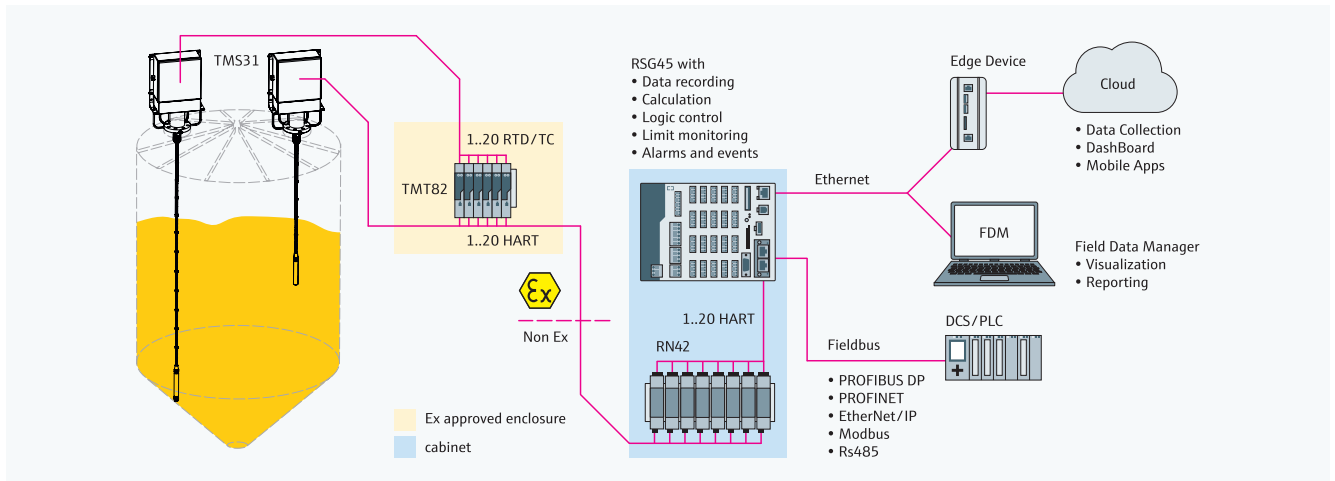
Features and specifications

- Measuring range (RTD/TC): −200 to +600 °C (−328 to +1,112 °F) / −270 °C to 800 °C (−454 to 1,472 °F)
- Static pressure range: Up to 40 bar (580 psi)
- Protection class: Up to IP66/67
- Communication: Analog output 4 to 20 mA; digital protocols (with temperature transmitters)

Typical installation: Non-Ex / RSG45 DIN rail



Typical installation: Ex / RSG45 DIN rail + System Components



Integrated product and service offering

System component	Feature
Active barrier RN42	<ul style="list-style-type: none">▪ Multi-voltage power supply unit, global Ex approvals and SIL2▪ Safe separation of 4 to 20 mA standard signal circuits▪ Front side HART® communication jacks and integrated 250 Ohm resistor
Data management Memograph M RSG45 DIN rail	<ul style="list-style-type: none">▪ Tamper-proof data storage and access▪ HART® gateway; Up to 40 HART® devices connected at a time▪ Communication protocols: Modbus, PROFIBUS DP, PROFINET, EtherNet/IP
Surge arrester HAW562	<ul style="list-style-type: none">▪ DIN rail surge arrester according to IEC 60715▪ Safeguards electronic components in measuring instruments against overvoltage surges▪ Application in Ex areas; available with SIL2 intrinsically safe approvals (optional)
Endress+Hauser Service	<ul style="list-style-type: none">▪ Application experts for defining process integration, consulting, planning and training▪ Installation service and safety check guarantee optimal startup▪ Complete life cycle management including maintenance and repair▪ Calibration service with complete documentation

Upgrade your technology

Innovative features to boost your technological leadership

Sensor technology Time and again Endress+Hauser has established benchmarks in the field of temperature measurement through innovations such as the iTHERM StrongSens technology or iTHERM ProfileSens designed to withstand even the most challenging process conditions.

Advanced diagnostics Multipoint temperature assemblies from the iTHERM MultiSens family are available with an innovative multi-barrier safety concept that adds a vital containment layer for high-pressure, high-temperature and corrosive environments. The advanced diagnostic chamber also enables you to identify, evaluate and predict potentially dangerous process conditions.



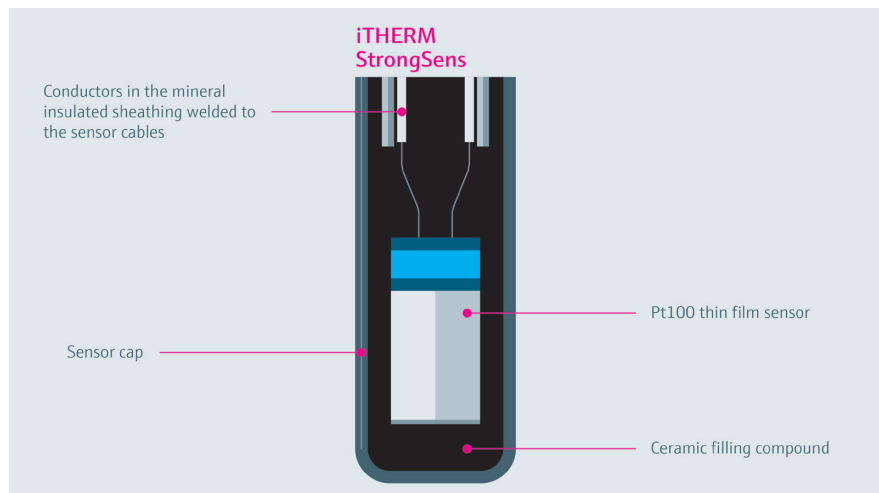
Serial innovator

Endress+Hauser's has been at the forefront of innovation in the process automation and measurement instrumentation business from its very beginnings. Today we own more than 7,000 patents and patent applications aimed at making your processes safer, more efficient and more environmentally friendly.

iTHERM StrongSens

With the world's highest vibration resistance, the iTHERM StrongSens Pt100 RTD sensor technology keeps performing in rough environments often found near pumps and rotating equipment. Extend your instrument lifetime by considerably reducing failure rates.

- Shock and vibration resistance: >60g (tested: 63g according to IEC 60751)
- Measuring range: -50 °C to +500 °C (-58 °F to 932 °F)



Benefits

- Higher process safety
- Reduced maintenance and downtime
- Reduced life cycle costs

iTHERM ProfileSens TS901

The new multipoint sensor cable has been specially developed to reduce maintenance intervals and the risk of untimely shutdowns due to sensor failure. It accurately measures temperature profiles in the most demanding applications such as distillation units, cracking and hydrotreating reactors.

Reliable and durable temperature measurement instruments need to be capable of withstanding high temperatures, high pressure and corrosion. The new iTHERM ProfileSens TS901 cable probe offers outstanding performance, delivering precise temperature profile information. Its mechanical properties and the complete electrical independence of the multiple internal sensors make it the most robust and reliable multipoint probe available today.

- Measuring range: -40 to 920 °C (-40 to 1 688 °F)
- Static pressure range: up to 400 bar (5 800 psi)
- Protection class: IP65 and above
- Outer diameter: 12.7 mm, 9.5 mm or 8 mm

Less is more The sensor internals are minerally insulated (MgO powder) and each sensor wears an additional metal coating. Nevertheless, the flexible probe drastically reduces process perturbation due to its minimally-invasive design, increasing safety and reactor performance.

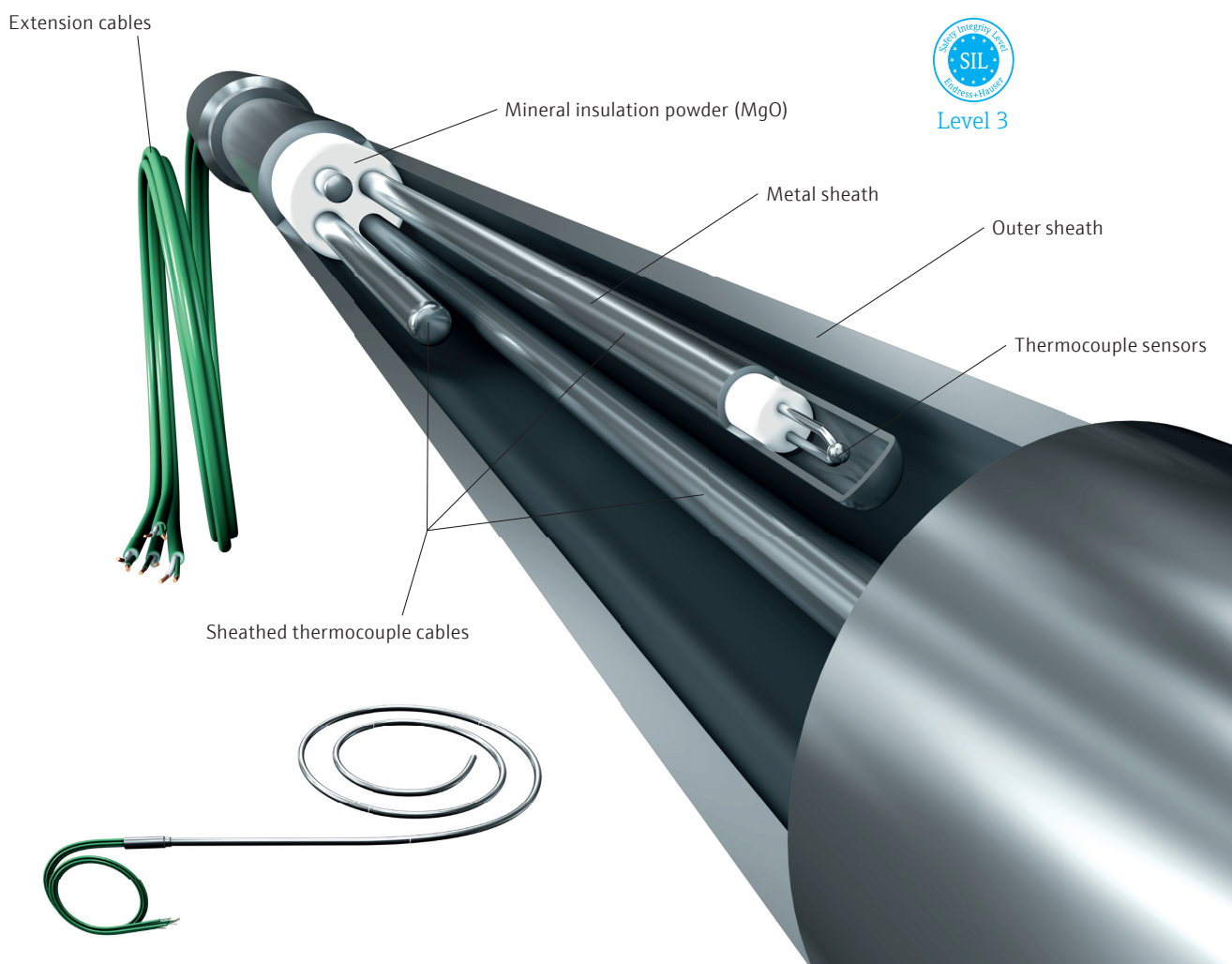
Catalytic processes in particular profit from a denser catalyst charge and the resulting greater product yield.

iTHERM ProfileSens TS901 cable probe technology is available as a standard option in combination with the iTHERM MultiSens Flex TMS01 and TMS02 multipoint temperature assemblies.



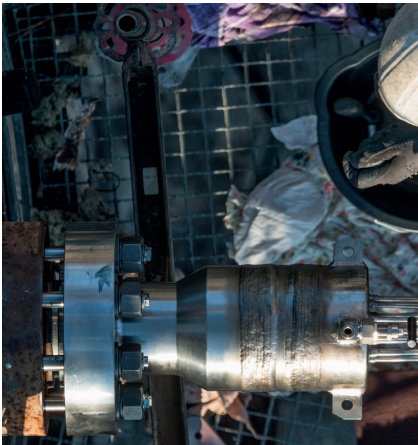
Benefits

- Fewer process connections required (nozzles)
- Less process perturbation with multiple individual thermocouples, single or duplex, per probe
- Long operative life time guaranteed also in aggressive media



iTHERM ProfileSens TS901 cable probe for accurate and reliable temperature profiling in harsh environments

iTHERM MultiSens with unique diagnostic capabilities

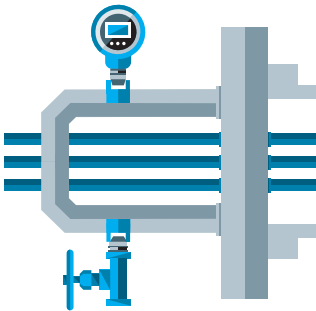


iTHERM MultiSens multipoint temperature assemblies are available with a unique and innovative diagnostic chamber, providing additional safety and valuable process information to enable predictive maintenance. In addition to containing potential and

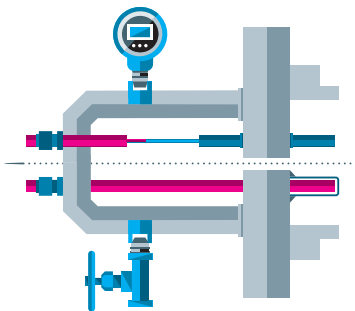
hazardous process leakage, diagnostic chambers are equipped to provide valuable additional process data which can be used to analyze leakage events and plan timely counter-measures or predictive maintenance and lifecycle activities.


A flexible design with replaceable parts for configurations with or without thermowells increases maintenance flexibility and ultimately reduces plant downtime.

Basic



Advanced



 Valuable process information
Analyze leakage event data

 Plant uptime
Maintenance flexibility thanks to replaceable parts

 Increased plant safety
Contain process leakage

 Predictive maintenance
Efficient planning of lifecycle activities

Diagnostic concept Hydrogen permeation through the metal structure or leakages due to defective seals is a serious risk factor in hydrocarbon processing units. The Endress+Hauser diagnostic concept built around the diagnostic chamber addresses this risk while also generating valuable information about the application. By monitoring and analyzing selected physical parameters such as pressure trends or the chemical composition of fluids inside the diagnostic chamber, operators are provided valuable data for predictive maintenance.

- Basic diagnostics: On demand detection of system pressurization. Fluid composition analysis can be performed to evaluate the system's condition.
- Advanced diagnostics: Continuous monitoring of system pressurization, generating a data record for further trend analysis (baseline comparison) and fluid composition analysis.

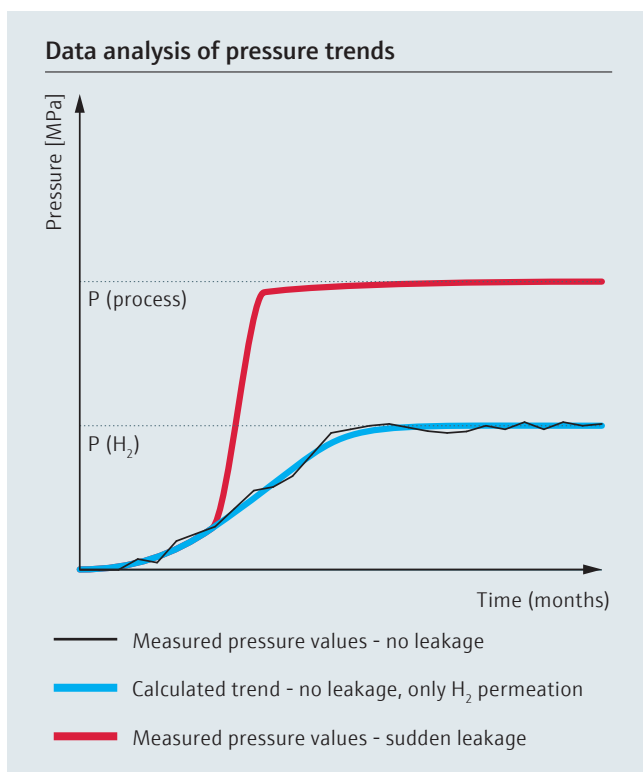
Pressure trend analysis By comparing the pressure trend inside the diagnostic chamber with its theoretical baseline over a period of time, indications toward the reactor internals and structural integrity can be drawn.

Endress+Hauser provides evidence of the theoretical trend during the engineering phase, taking into consideration material choices, volumes and design conditions. The data recorded can be fed into a dedicated data manager such as the Endress+Hauser Memograph M RSG45, building a tamper-proof database and a clear visualization of measured values.

Pressure trends derived from the record provide indications as to the instrument's health and help extrapolate maintenance recommendations for every turnaround.

Fluid composition analysis An analysis of the chemical composition and the identification of fluid concentrations inside the diagnostic chamber (molecule size, delta pressure) can provide valuable information about the nature of cracks and leaks, their dynamics and their path.

Endress+Hauser offers on-site fluid sampling services using specialized portable equipment. Our experts analyze the results and guide you through the subsequent maintenance planning while taking into consideration the estimated residual life time of the devices surveyed.



Example of different diagnostic scenarios for predictive maintenance as provided by the multipoint device



Special portable equipment for on-site fluid sampling from the diagnostic chamber

Inventory and condition monitoring solutions

Temperature sensors and components for silos and bulk storage

Food and beverage In addition to oil & gas and chemical applications, Endress+Hauser provides temperature measurement solutions aimed at improving bulk and solids storage applications typically found in the food & beverage industry.

The offering for safe and reliable inventory and condition monitoring solutions encompasses a wide range of sensors and transmitters, interfaces and software combined to cover different application requirements of bulks, solids and grain silos.

Temperature profiling Organic products such as grain, pellets or other bulks risk undergoing chemical reactions when exposed to environmental contaminants, inevitably spoiling the product.

Such reactions cause an increase in temperature (hot spots) which can be detected through accurate temperature profiling. Monitoring environmental conditions inside tanks and silos is therefore a crucial factor in safeguarding product quality.

Data derived from the profiling solution is used to control air conditioning systems, lowering the risk of thermal reactions and increasing energy efficiency.

Level and humidity monitoring

In addition to temperature profiling, silo condition monitoring solutions can also be equipped to measure level and humidity parameters. The complete data is fed into a historical records database for trend and quality monitoring.

Data management components

Our condition monitoring solutions are available with different standard communication protocols for easy system integration. Information can be transferred to control rooms or human interfaces via cables or wirelessly.

Endress+Hauser data managers such as the Memograph M RSG45 provide a built-in webserver for direct and global access. Data can also be fed into existing ERP systems via standard software protocols.

iTHERM MultiSens Bundle TMS31



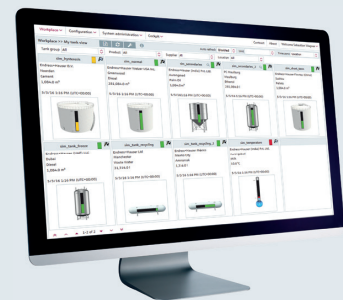
Multipoint temperature assembly

Memograph M RSG45 Advanced data manager



Data recorder with integrated webserver

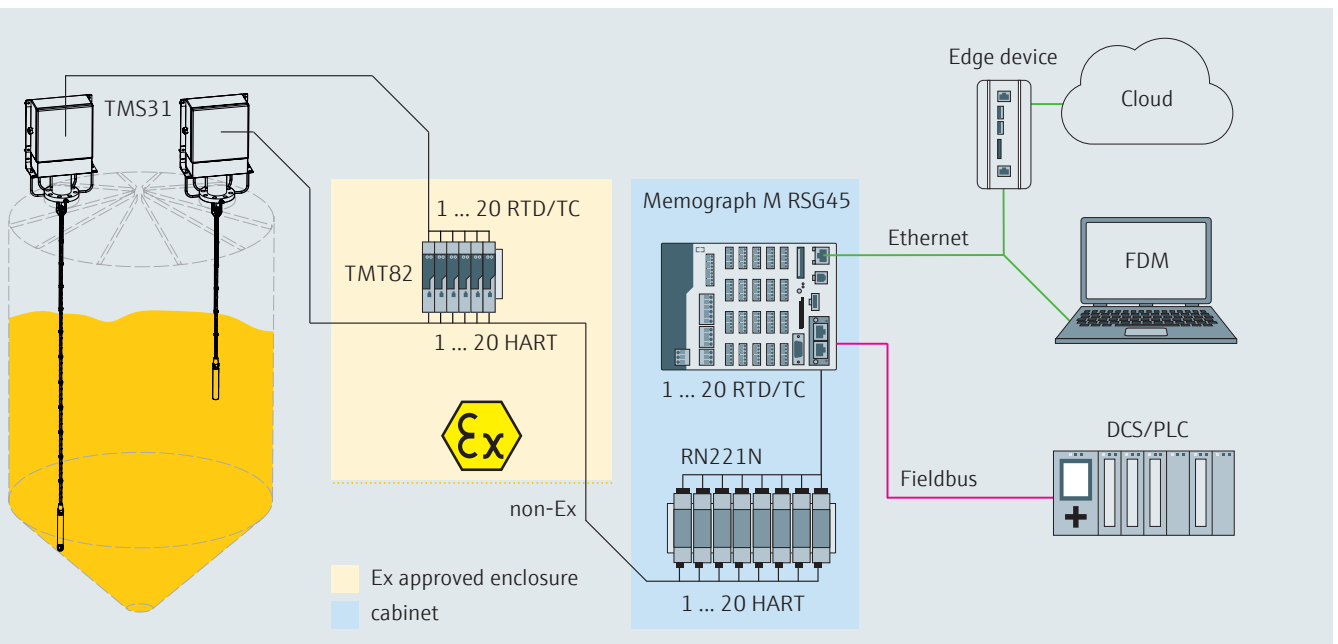
Software solutions



SupplyCare for local and cloud-based monitoring



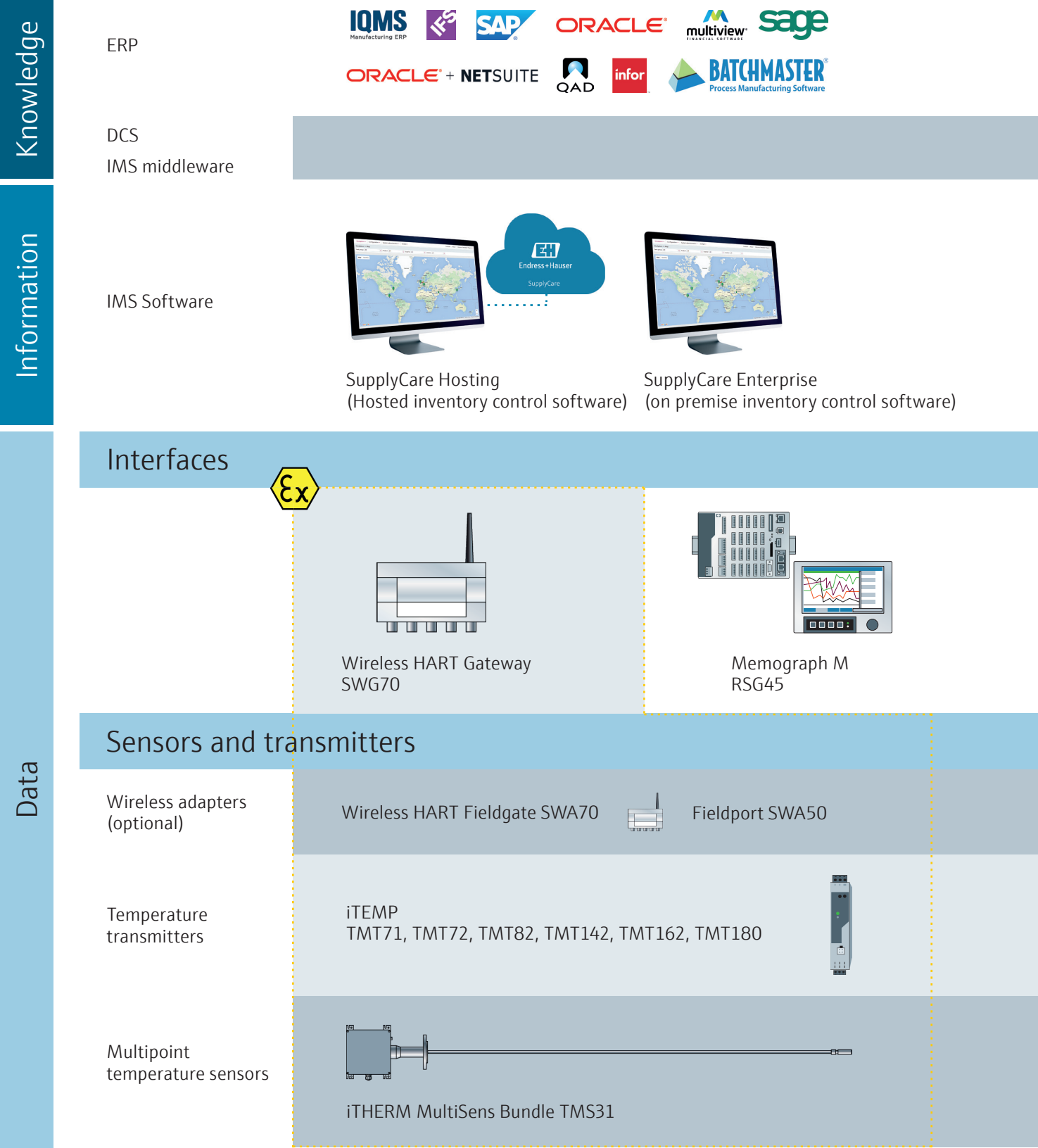
System integration with data manager and system products



Typical system integration of a temperature monitoring solution in a grain silo application (hazardous environment)

Components and system integration

From sensor to boardroom: Inventory and condition monitoring solutions





Knowledge

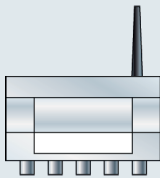


SupplyCare Hosting
(Hosted inventory control software)

SupplyCare Enterprise
(on premise inventory control software)

Information

Interfaces (non-Ex)



Wireless HART Gateway
SWG70



Memograph M
RSG45

Sensors and transmitters

Wireless HART Fieldgate SWA70



Fieldport SWA50

Data



iTHERM MultiSens Bundle TMS31

Temperature transmitters

Getting the most out of your sensor signals

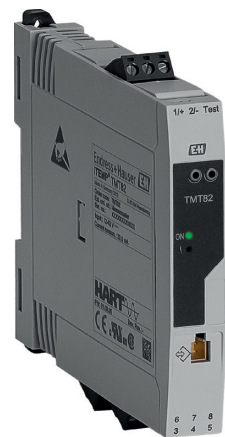
Electronic temperature transmitters are recommended to transform the sensor output signal into a stable and standardized analog or digital communication signal. Measurement accuracy, electric safety and high flexibility are their key features. Transmitters are available in three types of housings: DIN rail mounted devices suitable for panel installation, head transmitters for direct installation in thermometer terminal heads or junction boxes and robust field transmitters for direct connection near the process application.



iTEMP TMT85
DIN B standard head transmitter



iTEMP TMT162
Field transmitter for Ex d or XP applications



iTEMP TMT82
DIN rail transmitter

Safe, accurate, compatible

Endress+Hauser engineered temperature devices can be equipped with all standard transmitter types whether they are configured with resistance (RTD) or thermocouple (TC) sensors. Our portfolio includes single or dual-input transmitters with international approvals and certifications for all applications and intrinsic safety levels, offering safety and accuracy throughout the entire measurement loop.

Transmitter-sensor matching

Measurement accuracy in modern transmitters can be further improved by means of a transmitter-sensor matching specific to the assembly.

Communication protocols While the standard temperature sensor output signal is typically analog 4 to 20 mA / HART®, Endress+Hauser temperature transmitters are also available with standard fieldbus protocols such as PROFIBUS® PA and FOUNDATION™ Fieldbus with quick and cost-effective system integration and reliability.



Communication standards



Our temperature transmitters and compatible sensors are available with SIL2/3 to meet the industry safety requirements of SIL loops connected to a safe PLC via 4 to 20 mA.

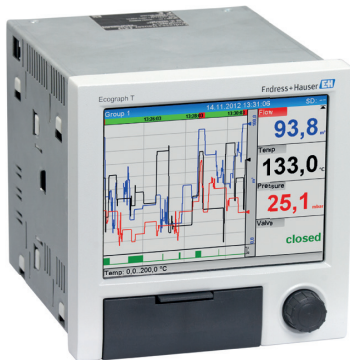
For detailed information please refer to the 'Field of activities' brochure:

Temperature Measurement (FA00006T/09/EN)

System products

Data managers

Data managers provide the basis to reliably record, visualize, automate and connect analog or digital process data gathered from measurement instruments. Endress+Hauser data managers for panel and DIN rail mounting provide powerful and complete solutions for the loop, ensuring a gapless instrument monitoring, safe recording, storage and communication of process data in the field or to higher-level systems.



Universal data manager
Ecograph T RSG35



Advanced data manager
Memograph M RSG45



Advanced data manager
Memograph M RSG45 DIN rail

✓ Benefits at a glance

- Directly connect multipoint temperature assemblies via sensor cables without the need for additional transmitters
- Pre-programmed software application packages for many common applications
- Data transmission via standard communication protocols such as PROFIBUS® DP, Modbus or OPC server
- Tamper-proof data recording for baseline comparisons, predictive maintenance

Digital process indicators

Digital process indicators for fieldbus integration such as the RID14 or RID16 play a crucial part in providing instant visual process information on site, enabling experienced staff to make calculated decisions without the need to rely on a slow information chain.

Capable of displaying up to 8 values of e.g. a multipoint thermometer anywhere in the field, engineers and operators get quick access to a safe and ergonomic window into the process.



Digital process indicators RID14 and RID16 for PROFIBUS® PA or FOUNDATION Fieldbus™ network integration provide valuable information in hazardous areas

i For more information please refer to the 'Field of activities' brochure:
System components and data managers (FA00016K/09/en)

Services

Complete service packages for your project success

The Endress+Hauser service philosophy, dedication, process knowledge and technical expertise are what sets us apart.

With our global workforce of over 2,000 seasoned experts, we deliver outstanding service and meet your most complex project requirements from start to finish, always with the

aim to optimize your operations and plant performance.

From help desk support to request for quotation, from commissioning to start up and from maintenance to calibration to replacement: All project phases are handled by an international team of experts, adhering to the same global standards and equipped with the same tools and skills.

We support you with open communication and transparency to bringing projects to completion in time and on budget.

Regardless of your industry, the size of your project or location, our service is tailored to your needs, taking into consideration the project variables to deliver the best solution for success.





Engineering & Consulting

Temperature monitoring is a challenging mission when process conditions are extreme, where many obstacles can interfere with the temperature probes, when special materials are needed and special design is mandatory.

Accurate and reliable temperature measurement is the result of a multitude of factors, including correct instrument design, sensors, support structures, wiring, electronics and installation. Endress+Hauser supports you through a continuous consulting relationship from the early project phases, through on-site plant surveys, drawings, and flexibility on the solution design.



Project management

Project process coordination is becoming increasingly complex and challenging. Projects with custom solutions for temperature measurement in particular require a higher degree of coordination between customer, manufacturer and suppliers.

Endress+Hauser offers seamless project support with dedicated and experienced project teams at your service worldwide.



Calibration

Regular calibration is essential to keep the instrumentation controlling your critical processes in spec.

Endress+Hauser offers a full range of timely, traceable, and cost-effective calibration services for your instrumentation equipment that covers on-site verification tests, accredited laboratory calibrations, certificates and traceability to ensure compliance.



Tests & Certifications

When it comes to international, national or specific standards applicable to instrumentation, Endress+Hauser fulfills any requirement related to product design, manufacturing, tests and commissioning.

Certifications can be issued for the complete sensor, individual parts, or the complete measuring chain, saving you time- and cost-consuming tasks necessary for the plant certification.



Maintenance

Maximizing your unit's uptime, safety and product quality while reducing operating expenses is the recipe for successful operations. Proper maintenance planning, from inspections to preventive services including replacement parts, are major contributing factors.

Endress+Hauser products are designed for maximum durability and easy maintenance. Modular configurations allow for flexible and efficient exchange of worn out parts.



Installation & Supervision

Endress+Hauser qualified personnel is there to assist you during installation, supervision and beyond, putting all its know-how at your disposal with in-depth product and application knowledge, outstanding team management and time and cost effective planning.

And because we understand that greenfield projects, turnarounds or revamps are complex enough as they are, our installation and supervision services for temperature engineered solutions are available in three easy packages:

- Standard package
- Extended package
- Advanced package

Depending on your requirements, we will help you select the right solution for your needs, saving you time, cost and effort.

The Standard Package for Installation and Supervision includes the following services:

Standard Package		
Activities and description	Installation	Supervision
Safety checklist (safety requirements checked and agreed on)	✓	✓
Standard Operating Procedure	✓	✓
Entrance document management	✓	✓
Safety courses attending	✓	✓
Safety document sharing	✓	✓
Standard and Special PPE procurement Endress+Hauser provides required PPE for its personnel. Please advice for special requirements.	✓	✓
Qualified personnel Special activities need qualified personnel with the necessary certificates or licenses	Endress+Hauser ensures qualified personnel	Endress+Hauser checks certificates or licenses of qualified personnel
Clear addressing of activities between involved parties	✓	✓
Installation Gantt chart	Endress+Hauser provides the Gantt chart	Endress+Hauser supervisor checks the Gantt chart
Installation Equipment and Tools check	✓	✓
Visual inspection of packaging and devices	✓	✓
Optional functionality test When applicable (e.g. long periods between production and installation) an optional functionality test will be performed before the installation starts	✓	✓
Work permit compliance Endress+Hauser personnel follow the requirements stated on the work permits and comply with any other information given by the responsible personnel	✓	✓
Site inspection Site and reactor inspection is necessary before any activity starts (operated by Endress+Hauser)	✓	✓
Dye penetrant liquid test Endress+Hauser will inform about which welds may require a mandatory dye penetrant test to ensure a proper installation	Endress+Hauser supervises the activities required	Endress+Hauser supervises the activities required
Device Support frames Installation and inspection of the support frames	✓	Endress+Hauser supervises the activities required
Mounting and visual check of the device Perform the activities according to the operating manual	✓	Endress+Hauser supervises the activities required
Probe installation, routing and sensor cabling	✓	Endress+Hauser supervises the activities required
Functional and wiring test	✓	Endress+Hauser supervises the activities required
At the end of the installation Endress+Hauser executes a final inspection with the end-user/customer	✓	✓

In addition to the items included in the Standard Package, the Extended Package offers the following:

Extended Package

Activities and description	Installation	Supervision
Location Thermal Test LTT (on iTHERM MultiSens 3D configuration)	✓	Analyze results
Diagnostic features training	✓	✓
Loop test (when applicable)	✓	Analyze results
Hydrostatic/pneumatic pressure test	Analyze results	Analyze results
Helium leakage test	Analyze results	Analyze results
PMI test	Analyze results	Analyze results
Volumetric non-destructive test (x-ray or ultrasonic)	Analyze results	Analyze results
Dye penetrant liquid test (to perform and sign)	✓	Analyze results

In addition to the items included in the Extended Package, the Advanced Package offers the following:

Advanced Package

Activities and description	Installation	Supervision
Training on the job - How to install the devices	✓	✓
System connection to purging lines	✓	Analyze results
Device fittings integrity check	✓	Analyze results
Training on the product and /or accessories	✓	✓
Sensor(s) calibration on site is subject to product type	✓	Analyze results

At your service

The Endress+Hauser Installation and Supervision services are designed to meet all your requirements and adapt to all project constellations:

- **Our Installation offering** aims to provide a complete service from the first site inspection to the final product installation with a turn-key approach.
- **The Supervision package** provides a complete service from the first site inspection to the final product installation by supporting and leading third party companies during the installation.



Nothing left to chance Endress+Hauser Installation and Supervision packages include preparation, training, tooling, equipment, documentation and reporting.

Preparation Project success roots in good preparation. Endress+Hauser experts set up a preparatory meeting (on-site, via telephone or videoconferencing) with you and/or third party companies to discuss and prepare planning for the following items and steps:

- Kick-off meeting on-site with end-user, third party company and Endress+Hauser.
- Endress+Hauser personnel will participate in any required safety trainings according to customer or legal requirements in addition to our own standards.
- Personal Protective Equipment (PPE)
- Endress+Hauser provides the list of activities in which project responsibilities and ownerships are clearly defined.
- Endress+Hauser provides a Gantt chart that allows the customer to best schedule the activities.

Tooling and equipment are an essential part of every installation operation. In order to make the process as streamlined and efficient as possible, Endress+Hauser offers service packages that provides the necessary tooling and consultancy for every situation. The supervision service includes consultancy on the tools needed for the different activities.

When opting for the Endress+Hauser installation service, all the necessary tooling is provided.

- Endress+Hauser provides the tooling package necessary for a time- and cost-efficient installation
- The right tooling for installation ensures the quality of the installed devices and the process equipment
- The right equipment for testing guarantees the best performance of the installed devices

Note: Depending on the region, some tools, equipment or services may not be available, such as:

- Scaffolds, fixed or mobile platforms, basket lift, etc.
- Transportation and lifting equipment (e.g. forklifts, cranes, etc.)
- TIG welding machine including accessories (e.g. gas cylinders)
- Equipment for non-destructive tests (NDT)
- Operators licenced according to some particular regional norms

For details, please contact your Endress+Hauser partner.

Training Hone your staffs' professional skills and increase your process efficiency. Endress+Hauser offers industrial training that corresponds to your business requirements and matches your employees' schedules.

Our instructors are seasoned professionals with expert product knowledge and years of real-world experience in measurement.

The service includes device installation and maintenance as well as in-depth product and accessories training.

Professional documentation and reporting provides a traceable record of any activity performed on-site, including but not limited to:

- Engineering documentation (wiring, assembly drawings, third-party documents, etc.)
- Endress+Hauser Standard Operating Procedure for Health and Safety
- Relevant Endress+Hauser documentation (operating manuals of relevant tools and equipment, technical information, safety instructions).

Depending on the package level, the documentation and reporting will include the items listed on the next page.

Professional documentation and reporting items for handover

Standard Package	Extended Package	Advanced Package
<p>During the installation and supervision on-site, Endress+Hauser technical personnel will generate the following documents:</p>	<p>In addition to the documentation provided with the Standard Package, the Extended Package includes the following documents:</p>	<p>In addition to the documentation provided with the Extended Package, the Advanced Package includes the following documents:</p>
<ul style="list-style-type: none"> ■ Kick-off meeting report ■ Inspection report ■ List of activities report ■ Gantt chart ■ Status of work in progress report ■ Test reports ■ Site acceptance test report ■ End of activities report ■ Deviation list report 	<ul style="list-style-type: none"> ■ Kick-off meeting report ■ Inspection report ■ List of activities report ■ Gantt chart ■ Status of work in progress report ■ Test reports ■ Site acceptance test report ■ End of activities report ■ Deviation list report 	<ul style="list-style-type: none"> ■ Kick-off meeting report ■ Inspection report ■ List of activities report ■ Gantt chart ■ Status of work in progress report ■ Test reports ■ Site acceptance test report ■ End of activities report ■ Deviation list report
	<ul style="list-style-type: none"> ■ Functionality test report ■ Hydrostatic or pneumatic pressure test report ■ Helium leakage test report ■ PMI test report ■ Volumetric non-destructive test (NDT) report 	<ul style="list-style-type: none"> ■ Functionality test report ■ Hydrostatic or pneumatic pressure test report ■ Helium leakage test report ■ PMI test report ■ Volumetric non-destructive test (NDT) report
		<ul style="list-style-type: none"> ■ Sensor(s) calibration certificate ■ Tightness check report ■ Diploma of training on accessories ■ Diploma of training on how to install Endress+Hauser thermometers



Benefits at a glance

- Endress+Hauser service relieves you from additional work while safeguarding the highest quality and safety standards.
- All service activities are subject to a gapless documentation process for a full service history.
- Support in identifying and planning the resources required for installation.
- Early involvement helps prevent unexpected events that may cause costly project delays.
- Endress+Hauser consulting services ensure optimum efficiency during the installation process.
- Traceability of all the activities performed on site, providing the proper documentation and facilitating the lifecycle management of instruments installed.
- Instrumentation information is safely stored with Endress+Hauser and accessible to customers worldwide, 24/7.

Online configurator

Digital tool: A few easy steps from technical specification to fully documented configuration

Efficiency starts with your engineering needs: Whether you are seeking to replace or upgrade your unit instrumentation during turnaround, looking for spare parts, service support or designing large-scale projects, Endress+Hauser helps you every step of the way. We believe that you should get the information you need, when you need it.

24/7 availability Timezones and work shifts should be no obstacle. Our free web-based service for quick and easy product configuration is accessible anytime and from any online device.

Select, configure, print The tool enables you to select, configure and print a configuration summary of all our available standardized temperature measurement devices, assemblies and accessories, including iTHERM MultiSens multipoint solutions.

Looking for a quick spec sheet? We have developed our device configurator to be a relief to your operation. It offers a time-saving way to ensure a perfect match between your specific requirements (e.g. process connections, sizing parameters, materials, electrical connections) and our standardized offering.

From configuration to quotation All relevant technical information and documentation is always a click away. That way your information loop from specification to quotation is transparent and streamlined.

Flexibility and individualization In the event that your application requires a tailor-made configuration not directly covered by the standard offering, the global Endress+Hauser sales organisation is at your service.

Online configurator

The free online tool offers guided instrument configuration and is available 24/7 on www.endress.com

Quick selection, easy configuration The Endress+Hauser online configurator is a free service providing a comprehensive, feature-rich platform to engineers, operators and project managers.

From product selection it is just a click away: The 'Configure' button on every product web page brings you straight to the configuration interface.

 **Configure**

Benefits at a glance

- 24/7 free online accessibility
- Guided application and product selection
- Guided product configuration
- Quick configuration summary (PDF format)
- Quick and transparent quotation
- Option of special engineering and individualization



Iplom enhances catalyst life, process safety and efficiency

Temperature profile monitoring of the catalyst bed

IPLOM

Iplom SpA is an Italian oil refining company located near the Metropolitan City of Genoa. With a maximum production capacity of 1.89 m tons per year, Iplom produces bitumen, diesel oil for automotive and fuel oil with a very low sulfur content.

"Thanks to reliable temperature measurements we are now able to guarantee the safety in the catalytic reaction process for the entire life cycle of the catalyst (24 months or more). The device's diagnostic chamber enables us to promptly detect any anomalies and better plan future interventions. The solution from Endress+Hauser is a true gain in terms of safety and yield."

Stefano Galli
Instrumentation and analysis
Iplom SpA



Solutions for the oil & gas industry | Iplom SpA refinery in Busalla, Italy

Iplom SpA sought to optimize its refining process, to extend its catalyst life and to increase safety in a hydrodesulfurization (HDS) application through precise 3D temperature profiling.

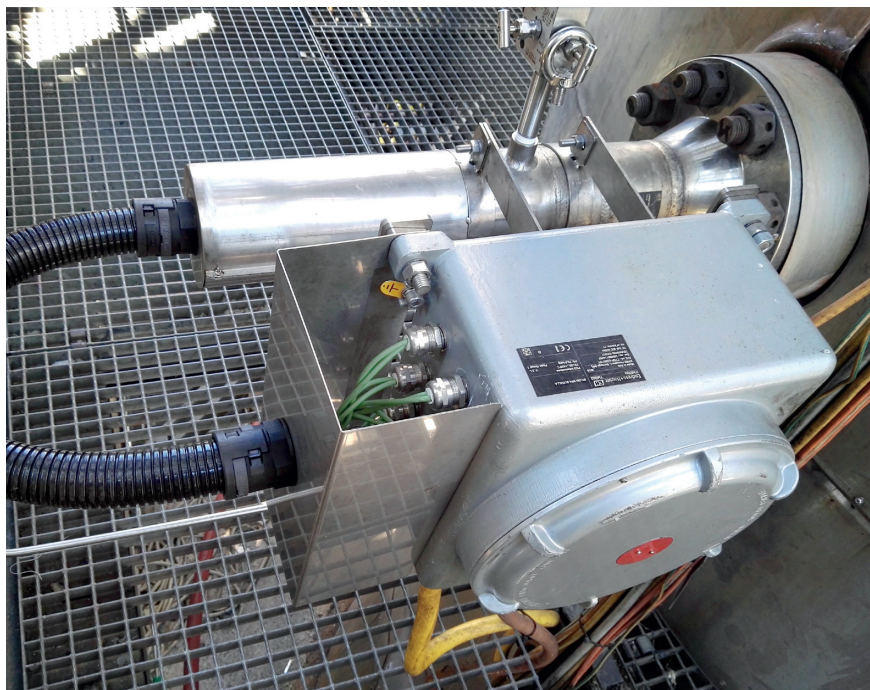
Summary Given the inevitable price volatility of its product, Iplom searched for ways to increase both process efficiency and product quality to strengthen its position within the highly competitive oil & gas market. A focus on plant safety was, as always, a given.

Endress+Hauser provided a tailor-made temperature profile measurement solution consisting of an iTHERM MultiSens Flex TMS02 multipoint assembly as well as expert guidance from configuration to installation, bringing the project to completion in time and on budget. This solution has led to considerable improvements by optimizing process performance, extending catalyst life and increasing plant safety.

Challenge To ensure safe and efficient chemical reaction control, operators depend on critical insights and data from the process as well as state-of-the-art instruments that provide additional safety barriers against extreme process conditions. An uneven temperature distribution (hotspots) lead to the fact that the catalyst degraded faster than necessary and the process was not running at its peak capacity. Iplom thus set the following targets:

- Optimize process monitoring and control, reduce hotspots
- Gain meaningful data for future improvements
- Increase catalyst life
- Increase product quality
- Further increase plant safety

Solution Our MultiSens Flex multipoint thermometer offered a robust, single-nozzle, multi-sensor solution by monitoring the temperature profile of the catalyst bed in a 3D layout. The device's on-board diagnostic chamber adds a vital process containment layer.



Endress+Hauser iTHERM MultiSens Flex TMS02 with built-in diagnostic chamber

Application details The harsh process conditions of approximately 75 bar and 430 °C under which the HDS reactor is operating, as well as the presence of corrosive chemicals such as sulfur and hydrogen, called for a robust and long-lasting solution. The multipoint assembly was installed on the level 4 catalyst bed of the diesel oil reactor to monitor the temperature at two different heights. It now enables Iplom to establish a precise

temperature profile, to maximize process efficiency and to yield a high quality product according to strict industry specifications.

Solution components

The multipoint thermometer chosen was a standardized iTHERM MultiSens Flex TMS02 in a configuration carrying 20 measuring points, 12 of which are innovative TS901 ProfileSens inserts currently being developed

and field-tested. The remaining eight single-point thermocouples are used in parallel as reference. The built-in diagnostic chamber provides valuable data for monitoring the condition of the multipoint assembly itself as well as to detect and contain potential process leakage. The device is fitted with a Cerabar PMP71 digital pressure transmitter and iTEMP TMT182 temperature transmitters communicating via 4 to 20 mA HART protocol with Iplom's DCS system.

Due to the time-critical nature of the plant's shutdown period, the reactor needed to be fully operational without delay. In addition to delivering the hardware, Endress+Hauser performed a series of services that helped streamline the entire replacement process from quotation to installation:

- Project management
- Detailed instrument engineering
- 3D routing calculations and installation layout engineering
- Factory acceptance test
- Installation supervision

Our experienced technicians guided the process all the way to completion in time and on budget.

Results Iplom tested the MultiSens Flex TMS02 with the new ProfileSens cable sensors in substitution of a traditional system and are very pleased with the devices' performance as well as the services provided.

Successful reactor revamp at Preem refinery

Efficient HDS, HC temperature control with multi-point solutions



Preem is the largest fuel company in Sweden, with a refining capacity of more than 18 million m³ of crude oil every year between its two refineries in Gothenburg and Lysekil.

The company refines and sells gasoline, diesel, heating oil and renewable fuels to companies and consumers in Sweden and abroad.



iTHERM MultiSens



Preem refinery in Lysekil

From standard temperature control to customized, engineered temperature solutions: iTHERM MultiSens multipoint assemblies optimize temperature control and process efficiency.

The results

- Longlasting solution that endures two turnaround cycles (about 12 years)
- Precise temperature profiling for accurate process temperature control
- Single, pre-existing nozzle as reactor entry point, without compromising catalyst discharge
- Higher reliability with independent sensors
- Increased safety: Leakage prevention, detection and management

Customer challenge Setting out to leading the transition towards a sustainable society, Preem is one of the most modern, energy-efficient and environmentally friendly refinery in Europe. Its hydrocracking and hydrodesulfurization reactors in the

Lysekil plant were due for a new temperature measurement solution to increase accuracy and fine-tune process control. Preem expected the new instruments and their installation to comply with the following requirements:

- High reliability of the temperature probes
- Leakage prevention and detection
- Entry through reactor drain nozzle
- Tight turnaround timeframe of only five days

Solution Endress+Hauser delivered a custom-engineered solution tailored to Preem's specifications, which included:

- Two iTHERM MultiSens multipoints for its HDS and HCU
- Professional support during all phases of the project, including site inspection and installation supervision

Harsh process conditions inside the reactors (corrosive media, high temperature and pressure, high mechanical stress) warranted a thorough testing scheme including documentation



The iTHERM MultiSens multipoint assembly with 27 independent thermocouple sensors provides accurate temperature profiling in the reactor.

to ensure the integrity of the devices, a safe startup and operation:

- Dye penetrant test
- Ultrasonic inspection
- X-ray analysis on diagnostic chamber and on TC hot joints
- 5-point TC calibration
- PED certification.

Solution components

- Instruments: 2 iTHERM MultiSens multipoint assemblies
- Sensor elements: 27 individual thermocouples type K, Ø8 mm, up to 21 m long
Construction according to ANSI MC 96.1
- Process connection: Flange 6"; #900
- Accessories: Diagnostic chamber with 3-way manifold for draining and pressure control

Project success was ensured by the experienced Endress+Hauser project team:

- **Thorough preparation**
Site visits and requirements clarification meetings
- **Planning and consulting**
Constant and intensive contact with the Preem engineering office was key to quickly and accurately specify the optimal design and features
- **Production**
Following order placement in November 2014, the multipoint assemblies were manufactured to spec and shipped on time
- **Installation**
Five days were needed for the installation of the device and its support frames. Installation was completed in April 2015.
- **Post-installation support**
Professional service and support after installation ensured trouble-free startup of the units



Further information

- Temperature measurement
FA00006T
- Calibrating thermometers
CP00004R
- Competence in Oil & Gas
SO00502A



See as download under:
www.endress.com/download



Have you found "Your" device?
We would be pleased to send
you further detailed Technical
Information.

www.addresses.endress.com

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