Measurement & Analytics | Measurement made easy

Temperature measurement solutions
Precision and flexibility in temperature measurement for process efficiency

Power and productivity
for a better world™

Expertise in technology
More than a century of experience

To operate any process efficiently, it is essential to measure, actuate, record and control. With ABB's measurement and analytical products and solutions, you are receiving the best technology combined with the most reliable products available on the market.

ABB offers a broad range of life cycle services for optimum product performance. A global network of specialists delivers local service and support.

Research and development is a vital source of ABB's technology leadership. It builds on the foundation of existing technologies for new applications, and continues to develop the breakthrough technologies needed to meet the challenges of the future.

ABB and its heritage companies have been leaders in innovation and technology for more than 100 years.

Aztec
Bailey
BOMEM
Bush Beach Engineering Limited
FISCHER & PORTER
Hartmann & Braun
K-TEK
Kent
LGR Los Gatos Research
Pressductor®
SENSYCON
Schoppe & Faeser
Spirit
Taylor
TBI-Bailey
TORBAR FLOWMETERS LTD
TOTALFLOW

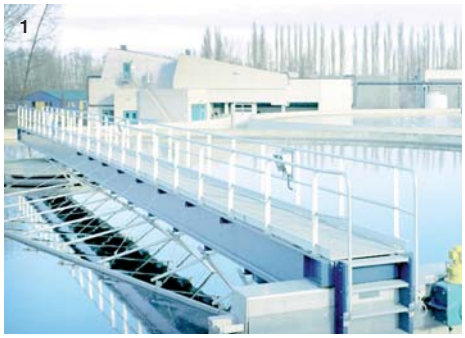
Comprehensive measurement solutions
Serving your industry

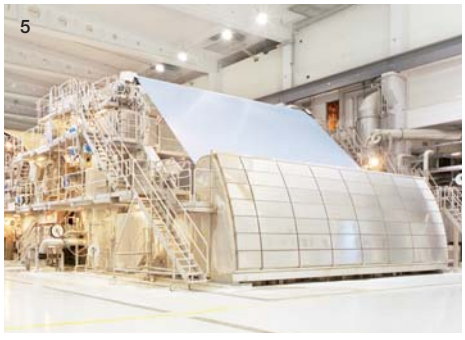
ABB's product portfolio:
- Analytical measurement
- Flow measurement
- Natural gas measurement
- Actuators and positioners
- Pressure measurement
- Temperature measurement
- Recorders and controllers
- Level measurement
- Device management
- Force measurement
- Service

ABB measurement and analytical products provide world-class solutions for any industry, utility or municipality. Innovations deliver technological solutions to make it easier for you to run your plants. ABB's measurement and analytical products are based on common technology, providing a common look and feel and method of operation. This results in products, that are easy to configure, easy to integrate, and easy to maintain.

For more information please visit:
www.abb.com/measurement

1 Water and waste water | 2 Power and industrial steam | 3 Chemical and petrochemical | 4 Oil and gas | 5 Pulp and paper | 6 Minerals | 7 Metals 8 Food and beverage | 9 Marine





Global access and availability
A partner to rely on

Wherever you are, whatever you need – you can rely on ABB service

ABB's vast base of globally installed products and systems is coupled with technical and process expertise, backed up by a broad scope of services that lay the foundation for end-to-end support for your enterprise. ABB's automated monitoring and reporting products are simple and accurate, so critical information is always readily accessible.

ABB's full scope of measurement and analytical products services cover everything from start-up and commissioning through to lifecycle support, giving you all you need to maximize the accuracy and reliability of your assets. The global strength of ABB means that service and support are available wherever and whenever help is needed.

Information whenever you need it – Device management, fieldbus and wireless

ABB's measurement and analytical products feature the latest in onboard diagnostics and intelligence to help you run your business more effectively. ABB gives you the choice to decide which communication protocols you would like to use to access this information. You can select from a family of tools and from different ways to manage the lifecycle of the devices in order to get the most out of your investment.

ABB's device management product range includes

- Fieldbus and wireless solutions
- Mobility handhelds
- Asset vision software
- Scalable service management

ABB service: available wherever you are

ABB's wireless measurement: truly autonomous with Energy Harvester

Temperature measurement solutions
Offering precision and flexibility

Precise temperature measurement is fundamental for successful process operations in a variety of industries. Customers benefit from ABB's extensive experience in the field of temperature measurement, yielding one of the most comprehensive product portfolios on the market. ABB provides the support needed to choose the device or system that perfectly suits your process requirements. A full range of reliable temperature measurement products tailored to serve special industry applications is available from ABB.

With innovative temperature sensors and transmitters from ABB, you benefit from low investment costs and standardized modules with impressive long-term stability. The versatile family of temperature measurement products is based on a modular design principle allowing for the utmost flexibility. ABB offers extremely short delivery times for its standard versions and a simple ordering process due to the clear portfolio structure.

Temperature measurement in an Oil and Gas application

High-temperature measurement for up to 1800 °C (3272 °F) solutions

SensyTemp temperature sensors
Portfolio overview

	Process measurement	High-temperature measurement
Product series	**SensyTemp TSP100 and TSP300**	**SensyTemp TSH200**
		
Applications	– Oil and gas industry – Petrochemical industry – Chemical industry – Power generation – Process industry – Plant construction	– Power generation – Metals processing – Cement industry – Glass industry – Garbage incineration – Basic industry
Process connections	– Insertion in an existing thermowell – Thermowells with cylindrical or conical thread connections – Thermowells with flanges in acc. with international standards	– Threaded socket – Stop flange with counterflange – Welded standard flange – Ceramic thermowell – Metal thermowell
Measuring ranges	– Resistance thermometers: -196…600 °C (-320.8…1112 °F) – Thermocouples: -40…1100 °C (-40…2012 °F)	Thermocouples up to 1800 °C (3272 °F)
Functional safety	SIL2 in accordance with IEC 61508	
Approvals for explosion protection	IECEx, ATEX, GOST, Other approvals are pending	
Data sheet	DS/TSP1xx, DS/TSP3xx	DS/TSH2xx

Process measurement

SensyTemp TSP series sensors allow for measuring inset replacement during operation. With their short response time and high vibration resistance these devices meet the most demanding process requirements.

High-temperature measurement

SensyTemp TSH series temperature sensors have been designed to meet the requirements of temperature applications from 600 °C to 1800 °C (1112 °F to 3272 °F). ABB assists customers in selecting the appropriate thermowell for demanding high-temperature measurements in combustion, annealing or smelting processes.

Temperature sensors
Components

1. Connection head
Connection heads of temperature sensors comply with EN 50446. This industry standard defines the electrical and mechanical connection conditions for the thermowell, measuring inset or transmitter and the connection cable. For decades, ABB has continuously advanced the connection head design for one and two transmitters.

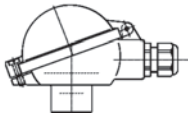
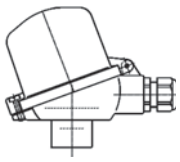
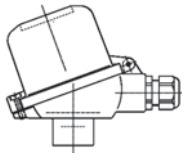
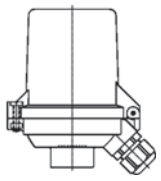
2. Extension tube
The extension tube protects the electronics from high process temperatures. When process lagging is used, the extension tube enables accessibility of the connections above the lagging.

3. Process connection
Measuring elements can be connected directly into the process using compression fittings. When a thermowell is used it can be connected to the process via a screwed connector or a flange to any of a number of international standards. Additionally a thermowell may also be provided in a design suitable for welding into position.

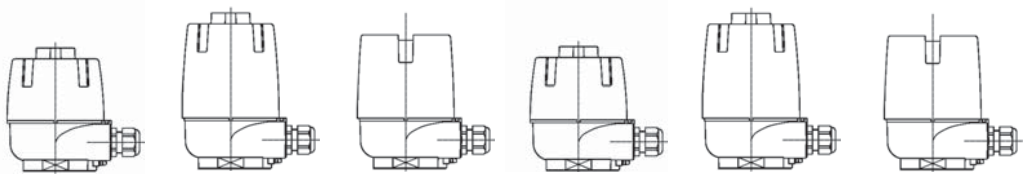
4. Thermowell
A fabricated thermowell consists of a seamless pipe sealed at the process end with a welded piece. A solid drilled thermowell is manufactured from a single piece of bar material with a hole drilled to within a few millimeters of the tip. Both of these thermowell types provide protection for the temperature sensor.

(a) Measuring inset
The measuring inset protects the temperature sensor and increases measuring accuracy. The measuring inset can be replaced at any time while the system is running, without opening the process or shutting down the plant. This allows for easy calibration of the measuring inset.

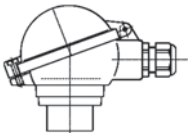
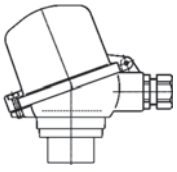
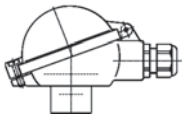
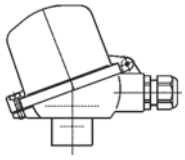
SensyTemp TSP series 100
Advanced sensors for the process industry

Product series	TSP111	TSP121	TSP131
			
Process connections	– Without thermowell - Insertion in an existing thermowell	– With welded tubular thermowell - Screw-in thread - Flange - Compression fitting	– With drilled barstock thermowell - Screw-in thread - Flange - Weld-in socket
Modular design	– Flexible - Measuring inset, thermowell, extension tube, connection head, transmitter - Interchangeable measuring inset – Connection heads - BUZ: Aluminum, with hinged cover - BUZH: Aluminum, with upper hinged cover - BUZHD: Aluminum, with upper hinged cover and LCD indicator type AS - BUKH: Plastic, with upper hinged cover - Other heads in various designs and materials – Transmitter in connection head (4...20 mA HART, FF, PA) – Suited to explosion protection, intrinsic safety		
Measuring ranges	– Resistance thermometers: -196...600 °C (-320.8…1112 °F) – Thermocouples: -40…1100 °C (-40…2012 °F)		
Measuring insets	In accordance with DIN 43735, replaceable		
Display (optional)	Transmitter-controlled graphic (alphanumeric) LCD indicator type AS for process-, sensor- or current-value display		
Functional safety	SIL2 in accordance with IEC 61508		
Approvals for explosion protection	IECEx, ATEX, GOST, other approvals are pending		
Connection heads	 BUZ	 BUZH	 BUZHD Display type AS	 BUKH
Data sheet	DS/TSP1x1		

SensyTemp TSP series 300
Meeting most demanding requirements

Product series	TSP311	TSP321	TSP331
			
Process connections	– Without thermowell - Insertion in an existing thermowell	– With welded tubular thermowell - Screw-in thread - Flange - Compression fitting	– With drilled barstock thermowell - Screw-in thread - Flange - Weld-in socket
Modular design	– Sturdy and versatile - Measuring inset, thermowell, extension tube, connection head, transmitter - Interchangeable measuring inset – Connection heads - AGL: Aluminum, with screw-on cover - AGLH: Aluminum, with upper screw-on cover - AGLD: Aluminum, with screw-on cover and LCD indicator type A / AS - AGS: Stainless steel, with screw-on cover - AGSH: Stainless steel, with upper screw-on cover - AGSD: Stainless steel, with screw-on cover and LCD indicator type A / AS – Transmitter in connection head (4...20 mA HART, FF, PA) – Suited to explosion protection, intrinsic safety and flameproof enclosure		
Measuring ranges	– Resistance thermometers: -196...600 °C (-320.8...1112 °F) – Thermocouples: -40...1100 °C (-40...2012 °F)		
Measuring insets	In accordance with DIN 43735, replaceable		
Display (optional)	Transmitter-controlled graphic (alphanumeric) LCD indicator type A / AS with dual function – Transmitter configuration via button (HMI) – Process-, sensor- or current value display		
Functional safety	SIL2 in accordance with IEC 61508		
Approvals for explosion protection	IECEx, ATEX, FM, CSA, GOST, other approvals are pending		
Connection heads	 AGL / AGLH / AGLD Display type A / AS / AGS / AGSH / AGSD Display type A / AS		
Data sheet	DS/TSP3x1		

SensyTemp TSH series 200
High temperature up to 1800 °C (3272 °F)

Product series	**TSH210** 	**TSH220** 
Process connections	Metal thermowell	Ceramic thermowell
	Stop flange with counterflange, threaded socket, welded standard flange	
Modular design	– Supports numerous applications - In accordance with EN 50446 and also available in accordance with ABB standard – Connection heads - AUZ: Aluminum, with hinged cover - AUZH: Aluminum with upper hinged cover - BUZ: Aluminum, with hinged cover - BUZH: Aluminum, with upper hinged cover - Other heads in various forms and materials – Transmitter in connection head (4...20 mA HART, FF, PA)	
Max. operating temperature	1300 °C (2372 °F)	1800 °C (3272 °F)
Connection heads (selection)	 AUZ	 AUZH
	 BUZ	 BUZH
Data sheet	DS/TSH2x0	

Wireless made easy
Truly autonomous with Energy Harvester

Product series	TSP3xx-W	TSP3xx-W	TTF3xx-W
			
Communication protocol	WirelessHART	WirelessHART	WirelessHART
Device type	Battery supply without Energy Harvester	Battery supply with Energy Harvester	Battery supply without Energy Harvester
Input	– Two sensors inputs - Resistance thermometers, resistance-type remote sensor (0…5000 Ohm) - Thermocouples, voltages, mV voltages (-125…1100 mV)		
Sensor connection	– Pt100 2-, 3-, 4 wire, thermocouple with internal reference junction – 2x Pt100 2- and 3 wire, 2x thermocouple or 1x Pt100 2-, 3-, 4 wire and 1x thermocouple		
Technical features	– Continuous sensor monitoring and self-monitoring - Supply voltage, wire break and corrosion monitoring – Sensor error adjustment – Electrical isolation – Specific linearization - Callendar-Van Dusen coefficients, table of value pairs / 32 points – Innovative energy management		
Indicator (optional)	Transmitter-controlled graphic (alphanumeric) LCD indicator type B with dual function: – Transmitter configuration via push button – Process-, sensor- or current-value display		
Configuration	Via HART handheld (DTM, EDD, HMI)		
Approvals for explosion protection	IECEx, ATEX, other approvals are pending		
Data sheet	DS/TSP3x1-W		DS/TTF300-W

The WirelessHART temperature sensor TSP300-W with Energy Harvester is the world's first self-powered wireless measurement devices requiring no wiring, no external power supply and ideally no battery replacement.

Oil and gas temperature measurement
Safe tough and reliable

Temperature measurement systems for the oil and gas industry are engineered, manufactured and documented by ABB engineers. Traceability is maintained at all times for both materials and processes. All wetted material can be traced from the mill to the finished product.

Wake frequency design assurance

In high flow installations, unsupported thermowells can produce wake vibrations that could approach their resonant frequency leading to serious cracking and even destruction of the thermowell. ABB engineers know where potential problems could occur and recommend available options.

Thermowells, sensors, cables and transmitters – all manufactured by ABB

A key component of ABB's quality confidence comes from the use of own cables, components, thermowells and transmitters. The control of quality and materials is maintained at every critical stage. From sensors that are laser welded to thermowells manufactured on dedicated machines, temperature solutions from ABB are safe, tough and reliable.

Solutions for the full oil and gas production cycle

- Exploration
- Production (on shore, off shore and sub-sea)
- Transportation
- Refining

Standard qualifications

- ISO 9001
- ISO 14001
- OHAS 18001
- PED

Products qualifications

- X-ray PMI
- Dye Penetration
- X-ray Weld verification
- Ultrasonic Weld verification
- Full material traceability
- Thermowell concentricity and dimensional reporting
- Full design and third party approved welding procedures
- Fully forged flanges to ANSI standards
- RTD and TC calibration traceable to NAMAS
- NACE
- NORSOK

Hazardous area applications

- Explosion proof
- Intrinsic safety
- Non-sparking
- Non-incendive

Multipoint temperature measurement
Unique solutions for specific tasks

ABB's multipoint temperature solutions allow plant operators to monitor more than one temperature measurement point through a single vessel entry. Typically the sensors are distributed along the length of a large diameter pipe type thermowell, touching the surface at the point the measurement needs to be made. Some designs allow for the extraction and replacement of the temperature measuring elements whilst the plant is still operating.

Multipoints are by their very nature highly specific to their intended operation. They are usually designed to the exact requirements of the customer. ABB engineers bring their extensive knowledge of temperature measurement techniques and pressure vessel design and materials together, to provide unique solutions to customer specific measurement tasks. ABB has got a large installed base of multipoint temperature measurement devices in several industries.

Applications for Multipoints vary considerably. They are used in vessels rather than pipes. Multipoints have been mounted both vertically and horizontally to give a cross sectional view of the temperature distribution within the vessel. Both RTD based instruments and thermocouple based instruments are available from ABB, depending on the application requirements of the customer.

Temperature sensor solutions
First choice for any application

Intrinsic safety at chemical plants

Many processes and products in chemical plants are potentially explosive. Electrical equipment needs to be prevented from igniting. The best way this can be done is by using intrinsically safe products. These make sure that the electrical equipment does not develop the energy needed to cause an explosion, even under fault conditions.

The safe solution

ABB's TSP range of temperature sensors can be fitted with the head mounting transmitters TTH200 and TTH300. Both product lines are available with the intrinsic safety option. Due to this electrical protection standard, the reliable and durable TSP sensor will never produce the amount of energy required to cause an explosion. The building of intrinsically safe circuits is a highly specialized engineering discipline. To support these engineers, ABB provides all the information needed in well-structured, easy to read TSP documentation and certification material.

Functional safety according to IEC 61508

ABB offers temperature sensors and transmitters with SIL certification for safety relevant applications.

Thermowells for oil and gas

For the Oil and Gas industry, the specification of a thermowell is the most demanding aspect of temperature instrumentation. An LNG (Liquid Natural Gas) plant takes natural gas and processes it into a liquid at very low temperatures of up to -163 °C (-261.4 °F). Ordinary stainless steel thermowells are not advised for cryogenic temperatures.

ABB worked together closely with Oil and Gas plant engineers and developed a solution which uses a high Chromium Molybdenum alloy (F44, 1.4547), known as 6% Mo and is suited for this particular measuring task.

In case given process conditions might lead to wake vibrations close to the thermowells' resonant frequency, the product is subjected to a wake frequency assessment. This helps to preserve product quality of customized products even in very specific situations.

The finished design of ABB's thermowell products is manufactured and documented to the most exacting standards and can be confidently fitted into the customers plant.

Temperature measurement of a process gas with temperature sensor TSP131

Specifically designed thermowells

Reliable temperature measurement Solutions for your industry

Cement plant measurement tasks

The production of cement from raw meal involves intensive and finely controlled heating. Temperatures that are too low result in a poor finished product yield, temperatures that are too high cause excessive energy consumption. Only an accurate and robust high temperature measurement solution will satisfy the need for balance between quality and cost.

Erosive and explosive environment – the challenge

The kiln operates between 1400 and 1500 °C (2552 and 2732 °F), with preheaters operating between 1100 and 1300 °C (2012 and 2372 °F). Cement products are extremely erosive. A plant atmosphere which could contain hot powder presents a potentially explosive atmosphere.

The high temperature solution

ABB's TSH high temperature measurement products offer a range of solutions all engineered to the highest degree. For measurements of up to 1100 °C (2012 °F) simple thermocouples and metal protection tubes are the cost effective choice. For higher temperature applications precious metal thermocouples and ceramic protection tubes offer reliable measurement and erosion resistance. Standard copper based thermocouples begin to melt at higher temperatures. ABB combines precious metal thermocouples and ceramic tubes to resist temperatures up to 1800 °C (3272 °F) with reasonable life expectancy.

Specialized temperature measurement

Pressurized Water Reactors (PWR) use high pressure water in their primary loop. It transfers its energy through a system of heat exchangers which raise the steam for the turbines. One of the most critical measurements in this kind of reactor is the temperature of the primary loop. This measurement is needed to enable the efficient running of the system and as a safety feature to shut the reactor down, if the loop temperature exceeds a certain limit.

The solution to control primary loop temperature

Specialized ABB temperature products have been developed for this demanding role. Using the highest integrity stainless steel for the thermowell and an ultra fast design of tip and sensor, the ABB nuclear temperature sensor has been passed fit for service by both KTA in Germany and IEEE in the USA. Using a PT200 platinum resistance sensor as the basis of the measurement enables a very good signal to noise ratio over the long four wire connection. No head mounting transmitter is used as semiconductors are very sensitive to ionizing radiation. The sensors have been rated at up to 2.3 MGy radiation resistance for 40 years. ABB also supplies non-critical equipment into the nuclear power industry to monitor such diverse tasks as pump bearing temperatures and turbine temperatures. ABB temperature measurement products supplied to the nuclear power industries are certified to withstand high levels of shock of up to 5 g, that might be caused by natural or man made hazardous causes.

ABB high temperature sensor installed in a kiln

Temperature transmitter series 200
For demanding applications

Product series	TTH200	TTR200
		
Communication protocol	HART	
Device type	Head mounted temperature transmitter	Rail mounted temperature transmitter
Input	– One sensor - Resistance thermometers, resistance-type transmitters (0…5000 Ohm) - Thermocouples, voltages, mV transmitter (-125…1100 mV)	
Sensor connection	Pt100 2-, 3-, 4 wire, thermocouple with internal cold junction	
Technical features	– Continuous sensor monitoring and self-monitoring - Supply voltage monitoring - Wire break and corrosion monitoring – Sensor error adjustment – Electrical isolation	
Display (optional)	Transmitter-controlled graphic (alphanumeric) LCD display type AS for process-, sensor- or current-value display	
Configuration	DTM, EDD	
Functional safety	SIL2, SIL3 in Dual Configuration in accordance with IEC 61508	
Approvals for explosion protection	IECEx, ATEX, FM, CSA, GOST, other approvals are pending	
Data sheet for detailed information	DS/TTH200	DS/TTR200

Temperature transmitter series 300
For most demanding applications

Product series	TTH300	TTF300
		
Communication protocol	HART, FF, PA	HART, FF, PA
Device type	Head-mounted temperature transmitter	Field-mounted temperature transmitter, single compartment technology, 2 cable glands
Input	– Two sensors - Resistance thermometers, resistance-type remote sensor (0…5000 Ohm) - Thermocouples, voltages, mV voltages (-125…1100 mV)	
Sensor connection	– Pt100, 2-, 3-, 4 wire, thermocouple with internal reference junction – 2x Pt100 2- and 3-wire, 2x thermocouple or 1x Pt100 2-, 3-, 4 wire and 1x thermocouple	
Technical features	– Continuous sensor monitoring and self-monitoring - Supply voltage, wire break and corrosion monitoring – Sensor error adjustment – Electrical isolation – Specific linearization - Callendar-Van Dusen coefficients, table of value pairs / 32 points	
Indicator (optional)	Transmitter-controlled graphic (alphanumeric) LCD indicator type A (TTH300) or type B (TTF300) with dual function: – Transmitter configuration via push button – Process-, sensor- or current-value display	
Configuration	Via HART (DTM, EDD, HMI), FF (EDD, HMI), PA (DTM, EDD, HMI, GSD)	
Functional safety	HART, SIL2/SIL3 in dual configuration in accordance with IEC 61508	
Approvals for explosion protection	IECEx, ATEX, FM, CSA, GOST, other approvals are pending	
Data sheet	DS/TTH300	DS/TTF300

Temperature transmitter solutions
First choice for any application

Reliable temperature measurement

A typical power plant has hundreds of temperature measurements. Most of them are concerned with the burning of fuel to raise steam for the massive turbines which power the generators. A wide range of operation is demanded from a temperature sensor used in this application. The majority of these measurements are therefore made using thermocouples, which are ideally suited due to their wide temperature range.

The intelligent temperature measurement solution

ABB's TTR200 rail mounted temperature transmitter converts the voltage signal of the thermocouple to a robust communication protocol such as 4…20 mA or HART. Nevertheless thermocouple signals are very small, with the correct compensation cable they can run over relatively long distances without any significant loss in accuracy. The thermocouple sensors themselves are very quick to respond to temperature changes and extremely robust. The TTR200 is a rail mounting version of the TTH200 transmitter with the addition of two indicator LED(s). A green LED indicates that the transmitter is powered. A red LED would indicate a fault in either the unit or the sensor. TTR200 units can be placed in cabinet racks.

TTR200 benefits

- Universal sensor input for reduced spares holding
- Mechanical configuration lock to prevent unintended tampering

Comfortable temperature measurement

In certain process conditions it is not possible to install head mounted transmitters directly on top of temperature sensors. Excessively high or low temperatures would influence the life time of the electronics. Vibrations or placement close to an electromagnetic source can change measurements significantly. In other installations it is not possible to see the display or easily reach the transmitter for further configuration.

The solution

ABB's field mounted temperature transmitters TTF300 are the cost effective solution to this challenge. For measurements in harsh operating conditions, a transmitter with a stainless steel housing is available, withstanding temperatures of -50 °C (-58 °F). The TTF300 can be supplied with a display that allows for making configuration without using a handheld terminal. In addition, sensor redundancy check, sensor drift detection and customer specific characteristic curves are available.

With their completely sealed electronic unit, the influence from outside is reduced to a minimum, resulting in a reliable solution with long term stability. Full certification complying with different plant environments are provided, as well as SIL2, fulfilling today's standards for the process industry.

TTR200 rail mounted temperature transmitters installed in cabinet rack

Temperature transmitter TTF300 for field mounting

Temperature measurement under control
The LCD indicator

Operating concept

ABB offers an optional LCD indicator for temperature sensors, which provides for convenient parameter reading directly at the device. Two LCD indicator variants are available: The indicator type AS provides a pure display function, whereas type A / B additionally allows configuration options via four keys. The intuitively operable menu is very user-friendly. The keys and the LCD indicator are protected by a housing cover with window.

Configuration options of the type A indicator

- Sensor configuration
- Measuring range
- Failure mode (HART)
- Software write protection for configuration data
- Device address for FOUNDATION Fieldbus, PROFIBUS PA and WirelessHART

LCD indicator type A and type B	LCD indicator type AS
	
Function keys 1 Exit/cancel 2 Previous 3 Next 4 Select	

Contact us

To find your local ABB contact visit:
www.abb.com/contacts

For more product information visit:
www.abb.com/temperature

Note:

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PB/TEMPERATURE-EN Rev. A 03.2015

Power and productivity
for a better world™