

# Mechanical temperature measuring instruments



**WIKA**

Part of your business

## Contents

WIKA product lines	3
Bimetal thermometers	4
Gas actuated thermometers	6
Expansion thermometers	7
Special products, types of connections	7
Thermowells	8
Technical information	10
Further products for temperature measurement	14
WIKA worldwide	16



Fully automatic production of measuring instruments



The modern high-bay warehouse ensures efficient logistics

# Ability to meet any challenge

## Our knowledge for your success

In the course of the last six decades the name WIKA has become a symbol for sophisticated solutions in the field of pressure and temperature measurement.

Our ever increasing ability is the basis for implementation of innovative technologies in the form of reliable products and efficient system solutions.

We owe our leading position in the world market to the consistent dedication towards premium quality, to which, today, 7,000 employees of the WIKA group of companies are committed. More than 500 experienced sales staff ensure that our customers are individually and competently advised and looked after from the outset.

Anywhere and any time.

## Certified quality

The WIKA quality assurance management system has been certified in accordance with ISO 9001 since 1994. The quality and safety standards of our company meet the standard systems of several countries.

## Made by WIKA

The development and high-tech production in our owned modern production facilities (Germany, Brazil, China, India, Canada, Poland, Switzerland, South Africa and U.S.A.) is the best warranty for our flexibility.

Whether SMD automatic insertion machines, CNC automatic machining centres, welding robots, laser welding, sputterers, thermotransfer printing or thin film production - we exploit all possibilities to achieve above-average results. And the end result: More than 43 million quality products are delivered year in, year out, in more than 100 countries. Worldwide, approximately 350 million WIKA measuring instruments are in use.



DKD/DAkkS accredited calibration laboratories for pressure and temperature

# WIKA product lines

The WIKA programme covers the following product lines for various fields of application.

## Electronic pressure measurement

WIKA offers a complete range of electronic pressure measuring instruments: pressure sensors, pressure switches, pressure transmitters and process transmitters for the measurement of gauge, absolute and differential pressure. Our pressure measuring instruments are available in the measuring ranges 0 ... 0.6 mbar to 0 ... 15,000 bar. These instruments come supplied with standardised current or voltage output signals (also intrinsically safe per ATEX or with flameproof enclosure), interfaces and protocols for various field buses. Whether ceramic thick film, metal thin film or piezo-resistive, WIKA is the leading manufacturer worldwide that develops and produces the full range of today's leading sensor technologies.

## Mechatronic pressure measurement

As a result of the almost unlimited options for different combinations of mechanical and electrical connections, an extraordinary range of instrument variants is possible. Various digital and analogue output signals are also available for these measuring instruments. For our measuring instruments we use latest sensors, tested in automotive applications millions of times over. They work without any kind of mechanical contact, consequently they are wear-resistant, and there's absolutely no retroaction to the mechanics.

## Mechanical pressure measurement

Indicating instruments for gauge, absolute and differential pressure with Bourdon tube, diaphragm or capsule pressure element have been tested millions of times over. These instruments cover scale ranges from 0 ... 0.5 mbar to 0 ... 7,000 bar and accuracies of up to 0.1 %.

## Diaphragm seals

WIKA diaphragm seals, fitted with pressure gauges, pressure transducers, pressure transmitters etc., are recognised and valued internationally for the most difficult of measuring tasks. The measuring instruments can therefore be used at extreme temperatures (- 90 ... +400 °C), and with aggressive, corrosive, heterogeneous, abrasive, highly viscous or toxic media. The optimal diaphragm seal designs, materials and filling media are available for each application.

## Electrical temperature measurement

Our range of products includes thermocouples, resistance thermometers (also with on-site display), temperature switches as well as analogue and digital temperature transmitters for all industrial applications, covering measuring ranges from -200 ... +1,600 °C.

## Mechatronic temperature measurement

As a result of the integration of switch contacts and output signals into our mechanical temperature measuring instruments, we can offer a wide variety of combined instruments. With switch contacts the pointer position triggers a change-over. Electrical output signals are realised via an additional, independent sensor circuit (resistance thermometer or thermocouple).

## Mechanical temperature measurement

The mechanical temperature measuring instruments work on the bimetal, expansion or gas actuation principle and cover scale ranges from -200 ... +700 °C. All thermometers are suited for operation in a thermowell as required.

## Level measurement

WIKA has a comprehensive range of level measuring instruments available for temperatures up to 450 °C, specific gravity from 400 kg/m<sup>3</sup> and pressure ranges up to 420 bar. This includes standard instruments and customised products.

## Calibration technology

WIKA offers a broad product spectrum of calibration instruments for the physical measured values of pressure and temperature, and for electrical measured values. A multitude of specific patents ensure unmatched performance characteristics with many of our calibration instruments. The range of services comprises the calibration of pressure and temperature measuring instruments in our accredited DKD/DAkkS calibration laboratories and a mobile service to calibrate your instruments on site.

# Bimetal thermometers

**46**

**Industrial heating**



Nominal size: 50, 63, 80, 100 mm  
Scale range: 0 ... 120 °C  
Permissible operating pressure at thermowell/stem: Max. 6 bar  
Wetted parts: Copper alloy  
Data sheet: TM 46.02

**48**

**Refrigeration and air conditioning**



Nominal size: 63, 80, 100, 160 mm  
Scale range: -30 ... +120 °C  
Wetted parts: Copper alloy  
Data sheet: TM 48.01

**50**

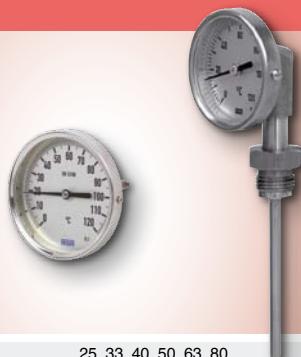
**Standard version**



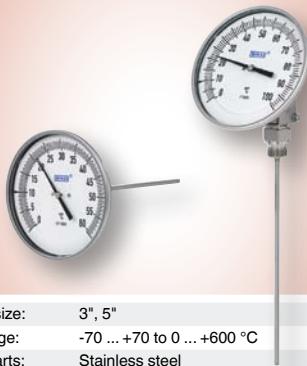
Nominal size: 63, 80, 100, 160 mm  
Scale range: -30 ... +200 °C  
Permissible operating pressure at thermowell/stem: Max. 6 bar  
Wetted parts: Copper alloy  
Data sheet: TM 50.03

**52**

**Industrial series, axial and radial**



Nominal size: 25, 33, 40, 50, 63, 80, 100, 160 mm  
Scale range: -30 ... +50 to 0 ... +500 °C  
Permissible operating pressure at thermowell/stem: Max. 25 bar  
Wetted parts: Stainless steel  
Data sheet: TM 52.01

**53****Industrial series, axial, adjustable stem dial**

Nominal size: 3", 5"

Scale range: -70 ... +70 to 0 ... +600 °C

Wetted parts: Stainless steel

Option: Liquid damping to max. 250 °C  
(case and sensor)

Data sheet: TM 53.01

**54****Heavy duty series, axial and radial, adjustable stem and dial**

Nominal size: 63, 80, 100, 160 mm

Scale range: -70 ... +70 to 0 ... +600 °C

Wetted parts: Stainless steel

Option: Liquid damping to max. 250 °C  
(case and sensor)

Data sheet: TM 54.01

**55****Stainless steel series, axial and radial, adjustable stem and dial**

Nominal size: 63, 100, 160 mm

Scale range: -70 ... +70 °C to 0 ... +600 °C

Wetted parts: Stainless steel

Option: Liquid damping to max. 250 °C  
(case and sensor)

Data sheet: TM 55.01

# Gas-actuated thermometers

## R73, S73, A73

Axial and radial, adjustable stem and dial



Nominal size: 100, 160 mm  
Scale range: -200 ... +50 to 0 ... +700 °C  
Wetted parts: Stainless steel  
Option: ■ Liquid damping (case)  
■ Contact bulb

Data sheet: TM 73.01

## Q73, F73

With capillary



Nominal size: 100, 160, 144 x 144 mm  
Scale range: -200 ... +50 to 0 ... +700 °C  
Wetted parts: Stainless steel  
Option: ■ Armoured or coated capillary (PVC coating)  
■ Liquid damping (case)  
■ Contact bulb

Data sheet: TM 73.01

## 74

For sanitary applications



Nominal size: 100 mm  
Scale range: ■ 0 ... 120 or 0 ... 160 °C  
■ -20 ... +100 and -30 ... +50 °C  
Wetted parts: Stainless steel 1.4435  
Option: ■ Liquid damping (case)  
■ Wetted parts with electropolished surface

Data sheet: TM 74.01

## 75

Highly vibration resistant



Nominal size: 100 mm  
Scale range: 0 ... +700 or -50 ... +650 °C  
Wetted parts: Stainless steel  
Option: Various neck-tube and insertion lengths  
Data sheet: TM 75.01

# Expansion thermometers

70

High-quality version



Nominal size: 63, 100, 160 mm

Wetted parts: Stainless steel

Option: ■ Liquid damping (case)  
■ Indication accuracy class 1  
■ With micro switch

Data sheet: TM 81.01

IFC

Standard version



Nominal size: 60, 80, 100 mm

Wetted parts: Copper alloy

Option: ■ Square case version  
■ Other case materials  
■ With micro switch

Data sheet: TM 80.01

TF58, TF59

Standard version



Nominal size: 58 x 25 mm, 62 x 11 mm

Wetted parts: Copper alloy

Option: ■ Vertical arrangement  
■ Special scales  
■ Other case materials

Data sheet: TM 80.02

## Special products, types of connections

32

Machine glass thermometer,  
V-form



Nominal size: 110, 150, 200 mm

Wetted parts: Copper alloy

Option: ■ Dual scale °F/°C  
■ Other types of connections

Data sheet: TM 32.02

Compression fittings



Application: Suitable for thermometers with plain stem  
(design of connection 1)

Material: Stainless steel

Operating range: Max. 600 °C

Double nipple version



Application: Suitable for thermometers with union nut  
(design of connection 3)

Material: Stainless steel

Operating range: Max. 600 °C

Neck tubes



Material: Stainless steel

Operating range: Max. 600 °C

# Thermowells

## TW10

### Flanged (solid-machined)



Thermowell form: Tapered, straight or stepped

Nominal size: ASME 1 to 4 inch

(DIN/EN DN 25 to DN 100)

Pressure rating: ASME to 2,500 psig (DIN/EN to PN 100)

Data sheet: TW 95.10, TW 95.11, TW 95.12

## TW15

### Screw-in (solid machined)



Thermowell form: Tapered, straight or stepped

Head version: Hexagon, round with hexagon, or round

with spanner flats

Process connection: 1/2, 3/4 or 1 NPT

Data sheet: TW 95.15

## TW20

### Socket weld (solid machined)



Thermowell form: Tapered, straight or stepped

Welding collar: 1.050, 1.315 or 1.900 inch

diameter: (26.7, 33.4 or 48.3 mm)

Pressure rating: 3,000 or 6,000 psig

Data sheet: TW 95.20

## TW22

### Fabricated with flange connection for sanitary applications



Aseptic connection: ■ DIN 11851

■ DIN 32676

■ Tri-clamp

■ VARIVENT®

■ BioControl®

Thermowell material: Stainless steel 1.4435

Data sheet: TW 95.22

## TW25

### Weld-in (solid-machined)



Thermowell form: Tapered, straight or stepped

Head diameter: Up to 2 inch (50.8 mm)

Data sheet: TW 95.25

## TW30

### Vanstone (solid-machined) for lap flanges



Thermowell form: Tapered, straight or stepped

Nominal size: ASME 1, 1½ or 2 inch

Pressure rating: ASME up to 2,500 psig

Data sheet: TW 95.30

**TW35****Threaded (fabricated)  
(DIN 43772 form 2, 2G, 3, 3G)**

Thermowell form: Form 2, 2G, 3 or 3G

Material: Stainless steel

Instrument connection: M24 x 1.5 rotatable

Data sheet: TW 95.35

**TW40****Flanged (fabricated)  
(DIN 43772 form 2F, 3F)**

Thermowell form: Form 2F or 3F

Nominal size: DIN/EN DN 25 to DN 50 (ASME 1 to 2 inch)

Pressure rating: DIN/EN up to PN 100  
(ASME up to 1,500 psig)

Data sheet: TW 95.40

**TW45****Screw-in (fabricated)  
(DIN 43772 form 5, 8)**

Thermowell form: Form 5 or 8

Material: Stainless steel or copper alloy

Data sheet: TW 95.45

**TW50****Screw-in (solid-machined)  
(DIN 43772 form 6, 7, 9)**

Thermowell form: Form 6, 7 or 9

Data sheet: TW 95.50

**TW55****Weld-in or flanged (solid-machined)  
(DIN 43772 form 4, 4F)**

Thermowell form: Form 4 or 4F

Nominal size: DIN/EN DN 25 to DN 50 (ASME 1 to 2 inch)

Pressure rating: DIN/EN up to PN 100  
(ASME up to 2,500 psig)

Data sheet: TW 95.55

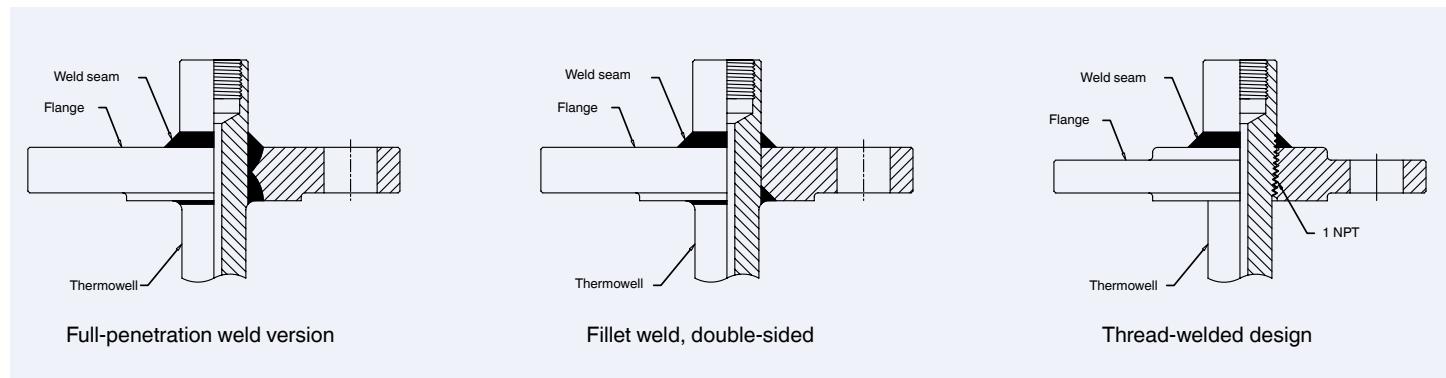
# Thermowells

WIKA thermowells are available both in solid machined and fabricated designs. The variants offered include designs with flanges, with threads and for welding. Furthermore, thermowells are available in Vanstone design and with sterile process engineering connections. The choice of material and manufacturing to customer requirements ensure optimal protection of the sensor and accurate measurements. Thermowells with flanges can be manufactured with double fillet weld, penetration weld or in threaded weld designs. A full-penetration weld seam guarantees a complete joining of the flange and the thermowell, and thus the strongest welded joint. The double

fillet weld offers a good alternative with its excellent stability.

Thermowells in threaded weld design consist of a thermowell with a 1-NPT thread, which is screwed into a threaded flange. In addition, the thermowell is secured on one or both sides by a weld seam.

## Welding options

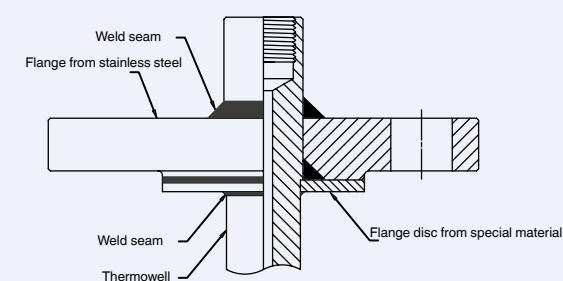


## Flange disc option for special materials

The design with a flange disc is available for solid machined or fabricated flanged thermowells. In this design, the flange disc material is matched to the material of the thermowell shaft; the non-wetted flange is manufactured from stainless steel. The flange disc is welded to the thermowell and the stainless steel flange, so that all the parts form a single unit. After welding, the sealing face of the flange disc is turned to the required surface roughness.

The flange disc design is used when chemically aggressive process media require the use of special materials, while the flange, for cost considerations, can be manufactured from stainless steel.

Usually 316/316L stainless steel is used as flange material. The weld seam used is a double fillet weld between all components.



**Note:** The main advantage of this design is the cost-saving over a complete construction from special materials. However, due to the design, an air gap exists between the stainless steel flange and the flange disc, which could be detrimental in critical processes.

## Non-destructive test/evaluation

**Non-destructive testing (NDT)** and non-destructive evaluation (NDE). A number of different tests are carried out by WIKA to determine deficiencies or defects in or on the surface of materials.

**Liquid penetrant inspection (LPI)** is used to locate surface defects on relatively smooth and non-porous materials. This test method is normally used for welded parts to guarantee a good quality of the weld surface. Typical weld defects that can be discovered are cracks, porous spots, overlaps and laminations.

**X-ray testing (RT)** is used extensively on weld seams of pipes, fittings, etc. The method is based on the differing absorptions of penetrating radiation and thus detects differences in density due to material composition, thickenings and flaws. Defects are found internally and may typically be present in raw materials, castings, and forgings, as well as in welded and soldered joints. X-ray tests are normally used for components that must fulfil critical requirements. Irregularities or flaws that can be detected include: surface and internal cracks, voids, laminations, thickenings, lack of fusion, lack of penetration, excessive penetration, porosity, inclusions, misassembly and misalignments.

**Hydrostatic and pneumatic pressure** and strength tests are used to (statically) test thermowells, piping systems, vessels, pressure seals, mineral insulated cable and associated fittings or bushings under their working pressure.

The hydrostatic pressure and strength test is conducted with water at ambient temperatures. For pneumatic pressure testing, dry air, helium, argon or nitrogen are usually used.

**Ultrasonic testing** is used as an independent test or in conjunction with X-ray testing. It is a method in which high frequency sound waves are introduced into a material. Any surface or subsurface discontinuities or flaws that are detected interrupt the sound waves and reflect a proportion of them. The level of the reflected waves depends on the size of the discontinuity or flaw. The defects that can be detected are similar to those that can be found through X-ray testing. Ultrasonic testing often replaces X-ray methods when there is difficulty in positioning the X-ray film or where the required distance from the radiation source cannot be maintained, and this can introduce safety risks.

**Positive material identification (PMI):** A common method is spectroscopy with X-ray fluorescence analyses (RFA). With this method the analysing instrument has a low radioactive source. The basic principle is based upon the fact that each material has a different electron energy level and the instrument determines the required energy to remove an electron and thus, for example, to cause an ionisation. The analyser can only identify a limited number of metallic elements. This testing of material composition is fast, easy and effective when determining the accuracy of material certificates, of identifying material that has lost its marking, or when a large quantity of material must be checked.

An alternative system for determining material composition is Optical emission spectrometry (OES). This method uses a laser beam or an electric arc to excite the electrons in the material sample, which causes them to emit light. The wavelengths of the light emitted are related to the composition of the tested material.

# Flange sealing faces on thermowells

For flanges in accordance with the standards ASME B16.5, EN 1092-1 and DIN 2527 there are different sealing face forms and surface finishes in use. The most commonly-used sealing face of all the standards is the version with offset sealing tongue with spiral phonographic grooves in the sealing face. The form and depth of the grooves is defined in the corresponding flange standards.

Less common in thermowells are flanges with smooth sealing faces without detectable grooves or designs with concentric, continuous grooves.

## Flange form

### Standard flange sealing faces per ASME B16.5

	AARH (μinch)	Ra (μm)
Stock finish	125 ... 250	3.2 ... 6.3
Smooth finish	< 125	< 3.2
RTJ (Ring joint groove)	< 63	< 1.6
Tongue/groove	< 125	< 3.2

### Standard flange sealing faces to DIN 2527

	Ra (μm)	Rz (μm)
Form C	-	40 ... 160
Form E	-	< 16

### Standard flange sealing faces to EN 1092-1

	Ra (μm)	Rz (μm)
Form B1	3.2 ... 12.5	12.5 ... 50
Form B2	0.8 ... 3.2	3.2 ... 12.5

## Thermowell design

To assist in the design of the thermowell, a separate spreadsheet is provided. This enables the dimensions to be determined for tapered and straight thermowells on which the process medium flow in the pipeline causes vibration or stress. Invalid value inputs or results that are outside the permissible limits can thus be identified. The calculation includes a wide range of standard and special materials.



The screenshot shows a Microsoft Excel spreadsheet titled "Thermowells Questionnaire". The form is divided into several sections:

- Customer data:** Fields for Company, Name, Department, Address, Date, Phone, Fax, and Email.
- Process conditions:** Fields for Process medium (liquid, gaseous, vaporous), Density of medium (kg/m³), Flow rate (ml/s), and Max. working temperature (°C). It also includes a field for Max. working pressure (bar).
- Thermowell details:** Fields for Insertion point / SMD No., Model no., Body size, Insertion length, Thermowell diameter, and Total length. It includes checkboxes for: solid machined, flanged, threaded, female thread, male thread, female connector, male connector, flange connector, threaded connector, and weld diameter.
- Diagrams:** Three diagrams illustrating different thermowell configurations: "Example of version with flange", "Example of tapered connection version", and "Example of weld-in type version".
- Page footer:** WIKA logo and text: "WIKA - Your partner for measurement", "WIKA - Your partner for measurement", "WIKA - Your partner for measurement", and "Page 1 of 2".

# Mechanical temperature measuring instruments

Temperature is an indicator of the thermal condition of a homogenous material or body that expresses the energy of motion that is contained in the molecules of the material. A close thermal contact between two bodies is needed in order that these bodies adopt the same temperature (temperature equalisation). The body to be measured should be coupled as closely as possible to the temperature sensor system.

The most established temperature measurement methods are based on material or body properties that change depending on the temperature. We manufacture temperature measuring instruments to the following measuring principles:

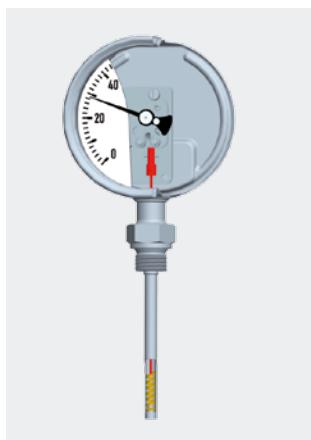
## Bimetal thermometers

### Operating principle

A strip, made from two securely laminated rolled sheets, with metals having different coefficients of expansion ("bimetal"), will bend on any temperature change.

This causes the strip to deflect in proportion to the temperature variation. The actual bimetal system consists of a bimetal strip that is either

- a helical bourdon tube or a
- spiral tube



Through mechanical deformation of the bimetal strip in the aforementioned spring forms, a rotational movement occurs when the temperature changes.

If one end of the bimetal measuring system is fixed securely, the other will rotate the pointer shaft.

The scale ranges are between -70 and +600 °C with an accuracy class 1 and 2 in accordance with EN 13190.

The internal pressure in the system changes with the adjacent temperature. This causes the pointer axis connected to the spring to turn and the temperature value to be displayed on the scale. The capillary, with lengths between 500 and 10,000 mm also enables measurements to be made on remote measuring points.

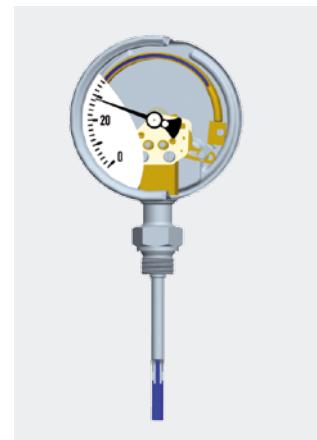
The scale ranges are between -40 and +400 °C with accuracy classes 1 and 2 in accordance with EN 13190.

## Gas-actuated thermometers with or without capillary

### Operating principle

The measuring system consists of a stem, capillary and Bourdon tube in the case. These parts are combined to form a single unit. The entire measuring system is filled with an inert gas under pressure.

Any change in temperature causes a change in internal pressure in the stem. The pressure deforms the Bourdon tube and the deflection is transferred to the pointer via a dial movement.



Variations in the ambient temperature acting on the case are compensated for by a bimetal element mounted between the movement and the Bourdon tube.

The scale ranges are between -200 and +700 °C with an accuracy class 1 in accordance with EN 13190.

## Expansion thermometers

### Operating principle

The measured value registration is made through the liquid-filled measuring system which consists of a temperature probe, capillary and Bourdon tube. All three components combine to form a closed tube system.

# Further products for temperature measurement

**Fittings**



**Electrical thermometers**



**Digital indicators & controllers**



**Temperature transmitters**



**Hand-held measuring instruments**



**Temperature calibrators**



**Infrared hand-held thermometers**



**Transmitter with digital display**



**Data collection and software**



**Longlife digital thermometer**



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