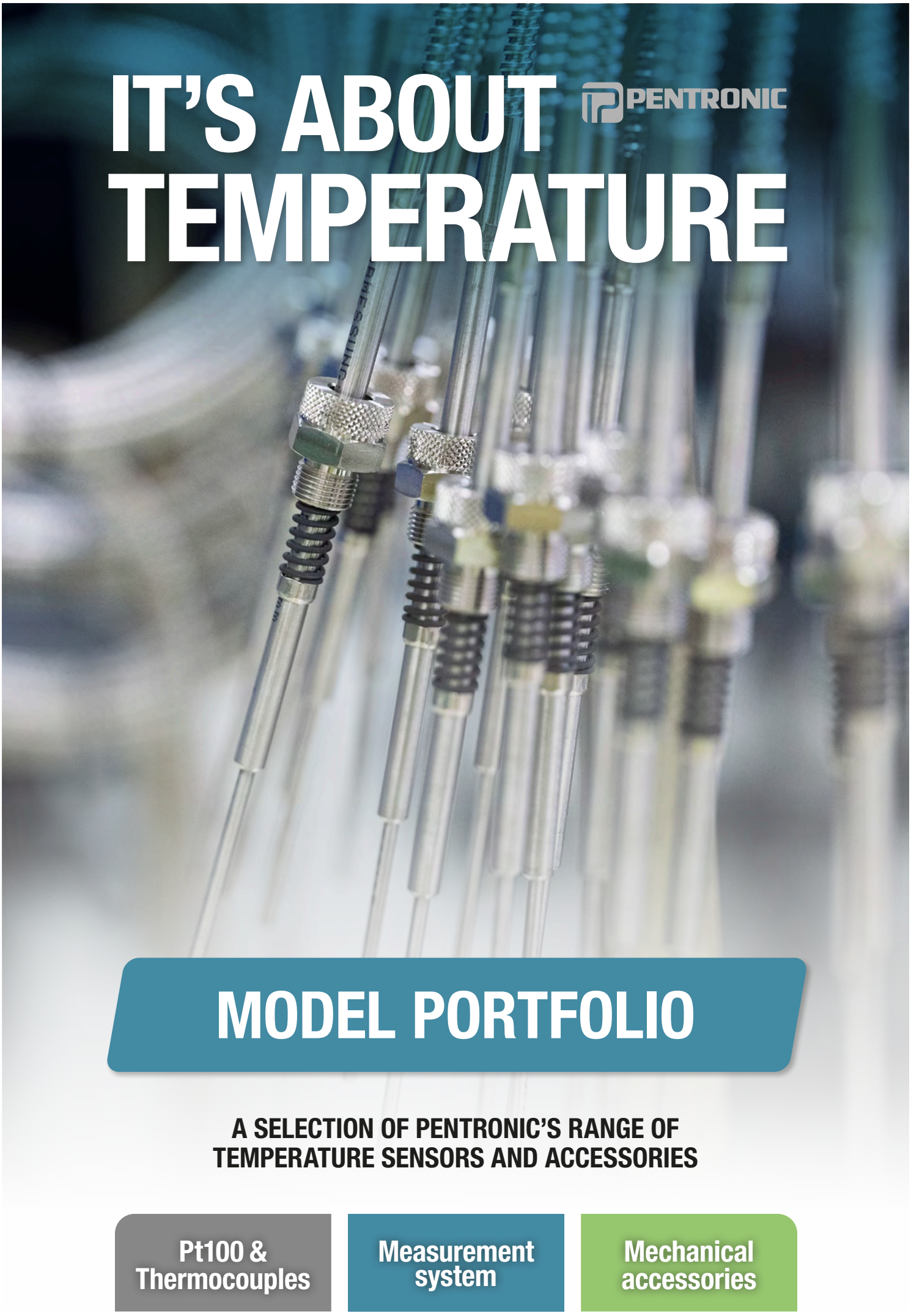


IT'S ABOUT TEMPERATURE

PENTRONIC

MODEL PORTFOLIO

A SELECTION OF PENTRONIC'S RANGE OF TEMPERATURE SENSORS AND ACCESSORIES

Pt100 & Thermocouples

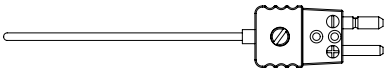
Measurement system

Mechanical accessories

Model portfolio

A selection of Pentronic's portfolio is presented below.

Please do not hesitate to contact us for more information or visit our webpage at www.pentronic.se



Mineral insulated thermocouples

Design: Large variety of designs, optional process connections and contacts.

Advantages: Very robust and versatile sensors with a wide area of application. Recommended for high temperature applications.

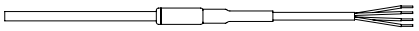
Model examples: 8102000, 8103000, 8105000, 11-00204.

Wire thermocouples

Design: Large variety of designs, optional process connections and contacts.

Advantages: Robust and flexible. Short respons time. Low cost.

Model examples: 6206000, 6101000, 6201000.

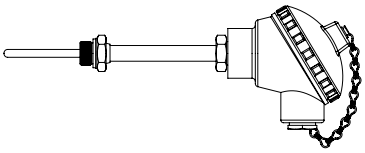


Resistance thermometers

Design: Large variety of designs, optional process connections and contacts.

Advantages: High accuracy, very versatile design options.

Model examples: 740000, 7917000, 7905100, 7913101.

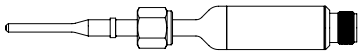


Process thermometers

Design: Large variety of designs. Available both as thermocouple or resistance thermometer. Several standardised process connections can be prepared. Connection head can be fitted with signal converter and several different contact options available.

Advantages: Proven and robust design. High degree of standarisation and interchangeability. Several designs have spare parts such as insertion probes and signal converters. Available in explosion-proof design.

Model examples: 8109600, 811000, 7941000, 7810900.

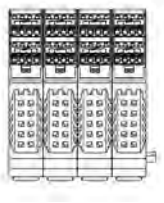


Integrated signal conversion

Design: Available as resistance or thermocouple thermometers. Multiple choice of digital communication protocol or 4...20mA signal available.

Advantages: Extremely good accuracy can be achieved. Minimal cabling and significantly simplified installation as well as service.

Model examples: PAT1101, PLT1101, PIO1101.



Measurement systems

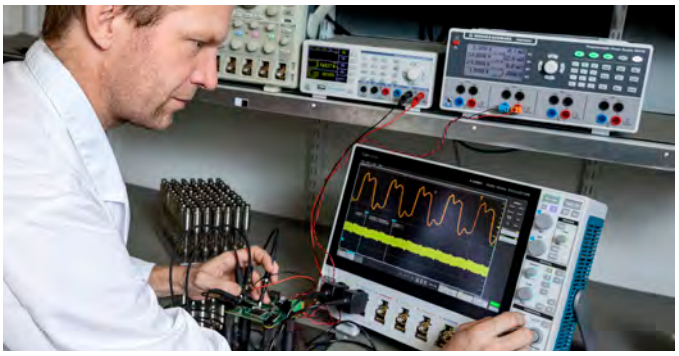
Design: Complete measuring system for thermocouples and resistance thermometers as well as pressure. Signal conversion and low energy field bus protocol for demanding applications.

Advantages: Extremely good measurement accuracy. High safety level (SIL).

Model examples: PLB1000 and PLB5000.

www.pentronic.se/products

Temperature measurement



A fundamental factor in controlling various processes is accurate temperature measurement, both in research and development and in large-scale production. In this brochure, we present a selection of Pentronic's different products.

Pentronic is Europe's leading manufacturer of industrial temperature sensors. We develop, manufacture and sell thermocouples and Pt100 resistance thermometers. We offer complete measurement systems as well as a wide range of complementary equipment.

Precise temperature measurements often require sensors to be adapted to the specific application to be measured. We therefore build Pentronic's standard models on a modular system. This allows us to create custom solutions using different combinations and components, which provides great flexibility and a wide range of options. Our goal is always short lead times for a broad selection of sensors to meet various needs.

Pentronic's strength also lies in offering uniquely tailored sensors and measurement systems in addition to standard models, further enhancing measurement accuracy and safety.

Pentronic also offers our customers training in temperature measurement and accredited calibration, both in our laboratories and in the field. If you have any questions about temperature measurement, please feel free to contact one of our sales engineers.

Reliable deliveries

At Pentronic, we adapt our production and processes to our customers' wishes and needs, which requires major flexibility when it comes to product changes or production volumes. We also provide fast and secure deliveries.

OTHER DIMENSIONS

By maintaining a large standard product range, Pentronic can promptly deliver a wide range of temperature sensors. If a requested product is not available in our standard range, we will assist you in quickly developing the product. We achieve this by manufacturing and stocking a vast assortment of subcomponents.

Reliable products

To ensure high product quality for all equipment, temperature sensors are always inspected before delivery. The individual measured value of each temperature sensor is documented in a test certificate, according to EN 10204 3.1. A tag with a unique serial number also guarantees that the sensor has been tested and approved. Pentronic electronically archives all test certificates.

You can access test certificates at: www.pentronic.se/en > Services > Test certificate.

At the time of delivery, we perform quality control using equipment that is traceable calibrated at our accredited laboratory. Testing methods are developed and monitored by our staff in accredited labs.

If you need to use a product that doesn't conform to test certificates, Pentronic offers accredited calibration services according to ISO/IEC 17025.

SWEDAC ACKREDITERING
Accred. no. 0076
Calibration
ISO/IEC 17025

Intertek
Pentronic is certified according to ISO 9001 and ISO 14001

Knowledge

Pentronic is a Swedish company with its own production facilities. All development and manufacturing take place in Västervik. We have been designing and producing industrial temperature sensors since the mid-1960s. This means that we have acquired extensive experience and knowledge in temperature measurement, and naturally, we share this expertise with our customers. This may involve specific industry requirements for measurement execution or sensor design, for example.

We transform your preferences and requirements for safely measuring temperature into sensors, which we either have in stock or manufacture based on your needs.

Pentronic's training in "traceable temperature measurement" will provide you with practical and theoretical knowledge in measurement and calibration. Through skills development, we help you create favourable conditions to strengthen and streamline your operations.

Product and industry approvals

HYGIENE APPROVAL 3A
Pentronic has obtained approval for a number of models of hygienic thermowells according to the American Sanitary Standard 3A 74-07.

The approval applies to designs for welded and Tri-Clamp (TC) connections.

Approved products will have the approval symbol on the respective datasheet.

IECEx/Ex
Pentronic is a certified manufacturer of explosion-proof temperature sensors. Our product range includes several models of Pt100 sensors and thermocouples for explosive atmospheres. You can find these products in our product listing.

NORDIC ENERGY MARKET
Pentronic is an Achilles-approved supplier to the Nordic energy market.

MARINE APPROVALS
Pentronic has classified a number of thermocouples and Pt100 sensors for marine applications.

NUCLEAR POWER
Pentronic supplies the nuclear power industry, which conducts its own supplier audits.

Well-known international suppliers to the nuclear power industry have also audited and approved Pentronic as a supplier.

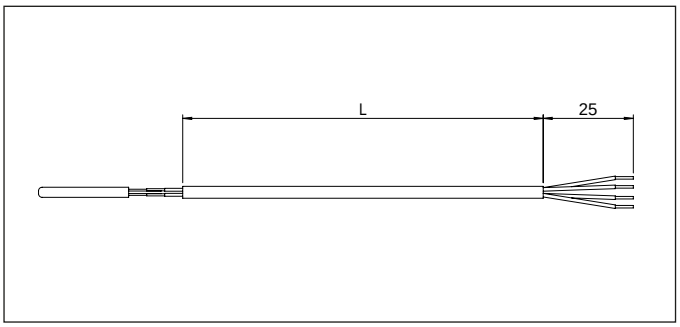
REACH and RoHS

REACH
Pentronic is not a manufacturer or importer of chemical substances. We are well aware of:

- The requirements of Regulation (EC) 1907/2006
- The candidate list
- Our obligations regarding material safety data sheets and customer information.

RoHS
Pentronic aims to minimise the presence of harmful substances. We comply with the RoHS Directive, EU 2015/863, for products such as cables, in-house manufactured temperature sensors and our own electronics.

Products which we sell as agents on behalf of other brands, such as measurement and calibration instruments, are continuously replaced with RoHS-compliant products as they become available.

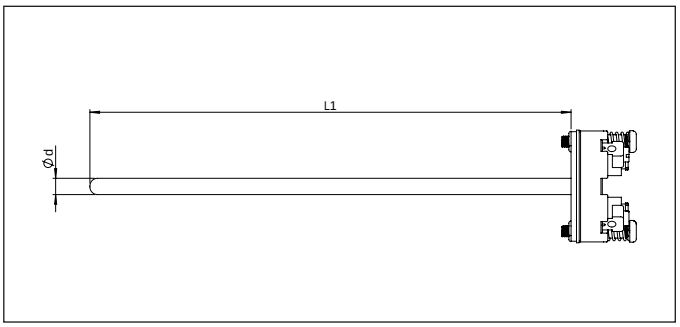


7100000
Sensor with extension cable

Design
Pt100 sensor soldered with cable. No protection tube.

Example area of use
Measuring air temperature in clean environments.

Max. temp.
Depends on the choice of cable.

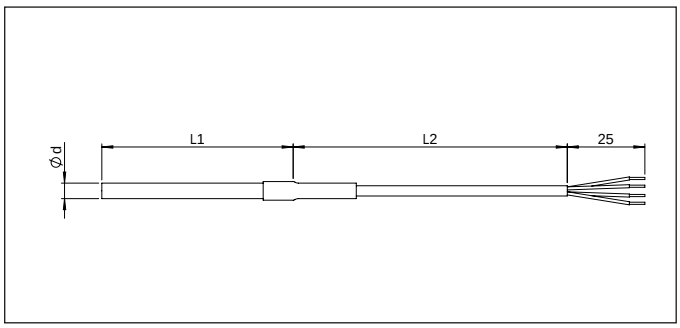


7260000 & 7264000
Insertion probe

Design
Spring loaded insertion probe.

Example area of use
Replaceable insertion probe for sensors type “DIN form B” and “DIN form D”

Max. temp.
Measuring probe: 250 or 600 °C depending on the design of the insertion probe.

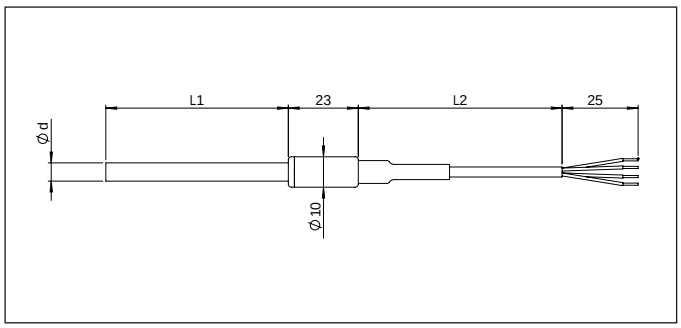


7300000
Sensor with protective tube and extension cable

Design
Pt100 detector built into protective tube extension cable.

Example area of use
Temperature measurements of gases and liquids. Only the protective tube may come into contact with liquids.

Max. temp.
Depends on the choice of cable.

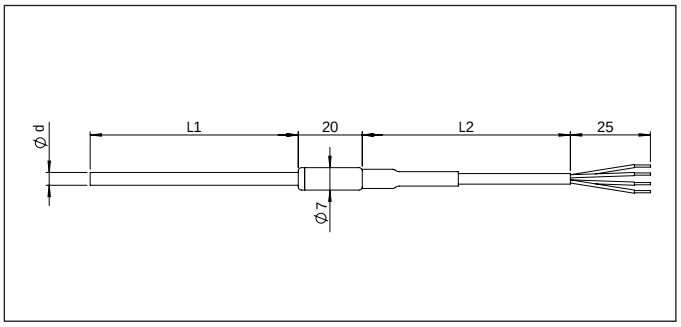


7400000
Sensor with protective tube, transition junction Ø 10 mm, with extension cable

Design
Pt100 detector built into protective tube or metal-sheathed mineral insulated cable. Transition junction Ø 10 mm with extension cable.

Example area of use
Temperature measurements of gases and liquids.

Max. temp.
Measuring probe: 250 °C with protective tube. 600 °C with metal-sheathed mineral insulated cable.
Transition junction: 100 °C.

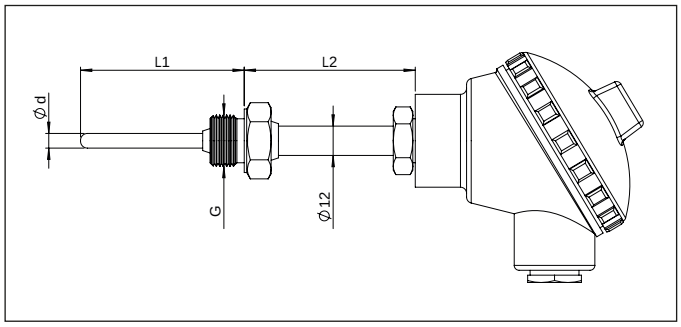


7410000
Sensor with protective tube, transition junction Ø 7 mm, with extension cable

Design
Pt100 detector built into protective tube or metal-sheathed mineral insulated cable. Transition junction Ø 7 mm with extension cable.

Example area of use
Temperature measurements of gases and liquids.

Max. temp.
Measuring probe: 250 or 600 °C depending on the design.

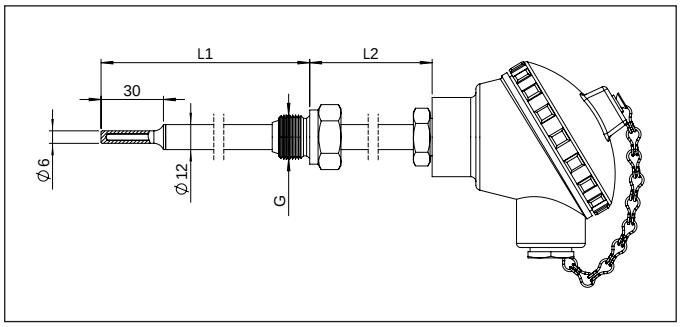


7610000 & 7614001
Sensor with process thread and terminal head without outer protective tube

Design
Process thread and terminal head. For mounting in protective thermowell.

Example area of use
Temperature measurement of gas and liquid in the process industry.

Max. temp.
Measuring probe: 250 or 600 °C depending on the design of the insertion probe.

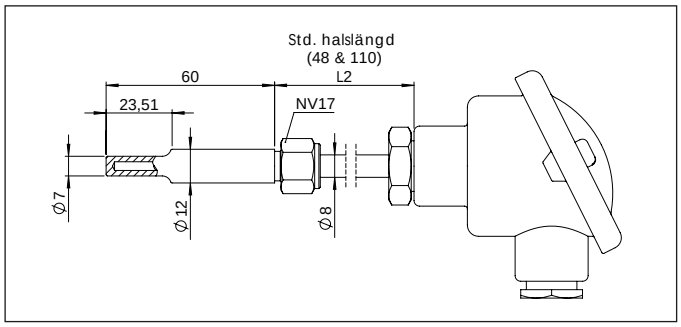


7820000
Sensor with outer protective tube and reduced tip diameter

Design
Outer protective tube and process thread. Reduced tip diameter for shorter response time. Replaceable insertion probe.

Example area of use
Temperature measurement of gas and liquid in the process industry.

Max. temp.
Measuring probe: 250 or 600 °C depending on the design of the insertion probe.

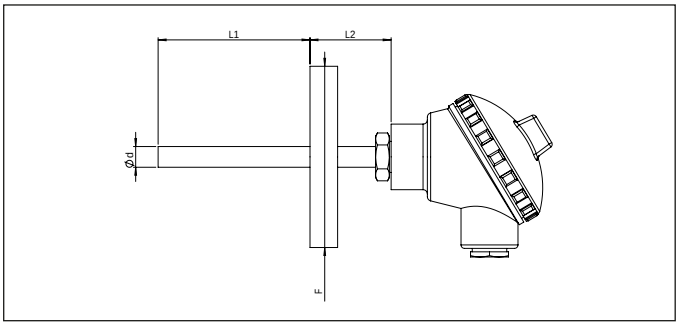


7830000
Sensor and thermowell with reduced tip diameter

Design
Machined thermowell with reduced tip diameter for faster response and more accurate measurements with replaceable insertion probe.

Example area of use
Temperature measurement of gas and liquid in the process industry. The thermowell is adapted for small-pipe welding, suitable for dimensions up to DN 100

Max. temp.
Measuring probe: 250 or 450 °C depending on the design of the insertion probe.

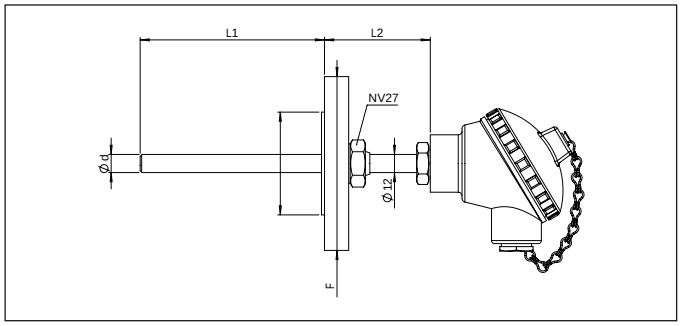


7850000
Sensor with protective tube, flange and terminal head

Design
Outer protective tube, flange and terminal head, replaceable insertion probe.

Example area of use
Temperature measurement of gas and liquid in the process industry.

Max. temp.
Measuring probe: 250 or 600 °C depending on the design of the insertion probe.

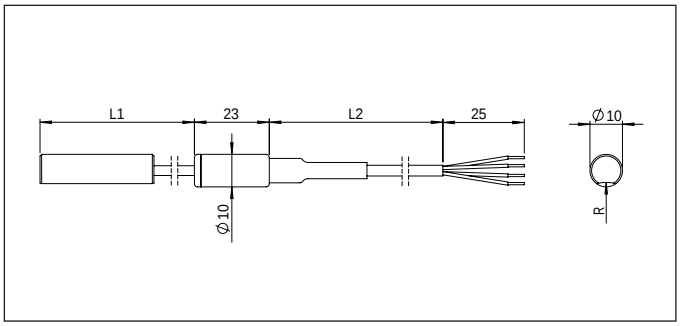


7860000
Sensor with thermowell, flange and terminal head

Design
The measurement insert consists of a flange and terminal head and is intended to be used with a Y thermowell. The thin flange of the thermowell is to be squeezed between the sensor's flange and the flange of the process vessel. Replaceable insertion probe.

Example area of use
Measuring temperatures in chemically aggressive environments.

Max. temp.
Measuring probe: 250 or 600 °C depending on the design of the insertion probe.

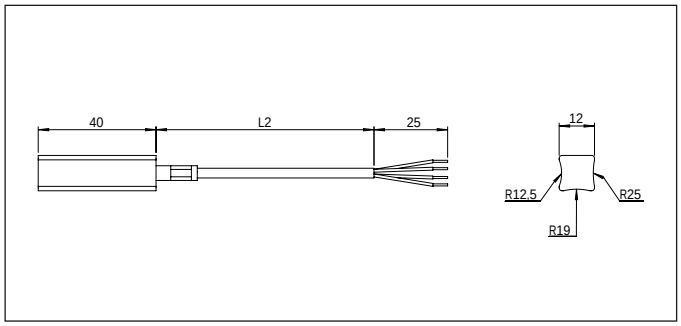


7905100
Surface temperature sensor

Design
Pt100 detector mounted in metal-sheathed mineral insulated cable with a brass cylinder.

Example area of use
Temperature measuring on flat surfaces and on tubes.

Max. temp.
Measuring probe: 400 °C.

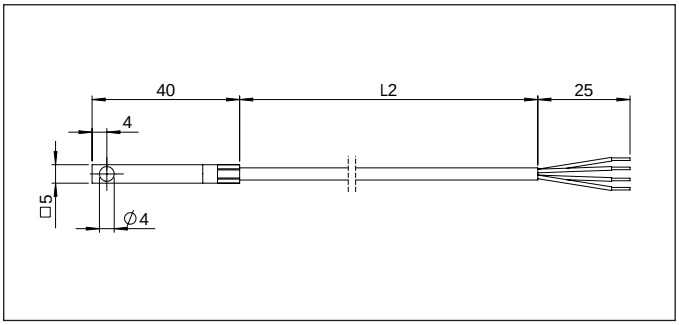


7906000
Surface temperature sensor with multiple radiuses

Design
Pt100 detector mounted in brass body with one flat contact surface and three contact surfaces with radiuses.

Example area of use
Temperature measuring on flat surfaces and on tubes.

Max. temp.
Measuring probe: 150 °C, Cable: 200 °C.

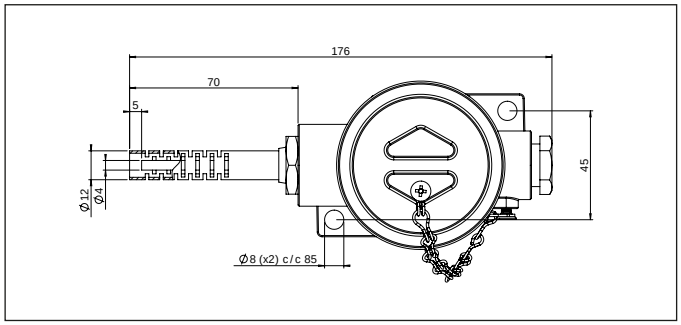


7907000
Surface probe with mounting hole

Design
Pt100 detector mounted in brass body with Ø 4 mm mounting hole.

Example area of use
Temperature measuring on flat surfaces and on tubes.

Max. temp.
Measuring probe: 150 °C. Cable: 200 °C.

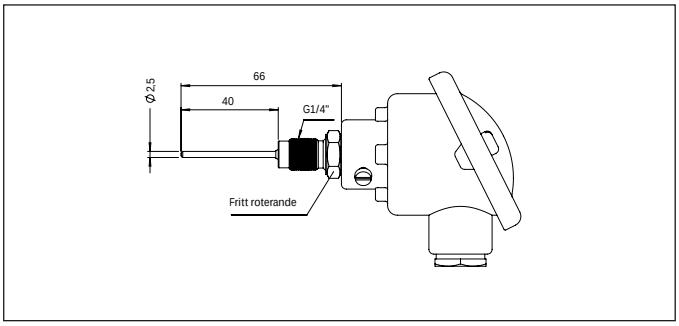


7910005
Outdoor air temperature sensor

Design
Pt100 detector mounted in a 4 mm diameter tube Inside an outer perforated protective tube reducing radiation heat. Terminal junction box for wall installation.

Example area of use
Outdoor and indoor air temperature measurements.

Max. temp.
Measuring probe: 250 °C. Terminal junction box: 100 °C.

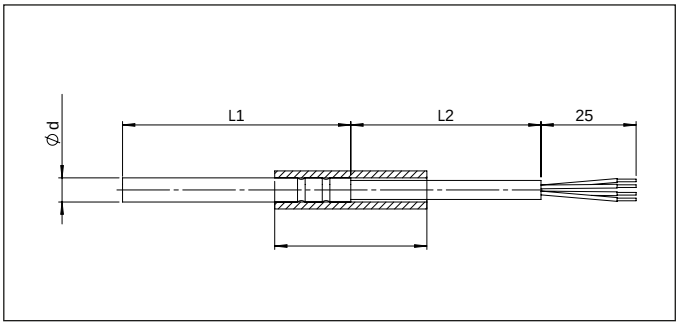


7911000
Thin sensor with process thread and terminal head

Design
Pt100 detector mounted in Ø 2.5 mm protective tube. For mounting in protective thermowell.

Example area of use
Temperature measurement of gas and liquid in the process industry. To be used when short response time is needed and/or at small tube dimensions.

Max. temp.
Measuring probe: 250 °C.

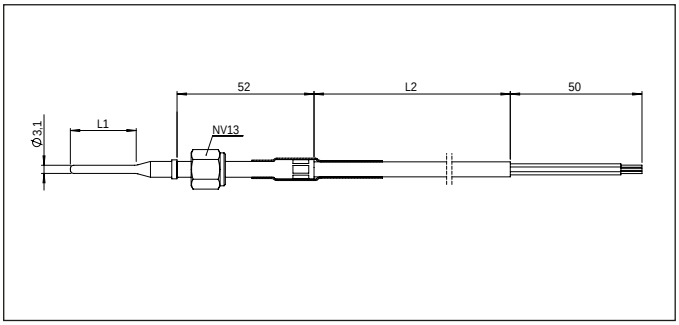


7912000
Sensor with moisture-proof sealed protective tube

Design
Pt100 detector mounted in protective tube. Sealed with silicon gel and silicon hose.

Example area of use
Measuring temperature in the surface layer of paved roads and in other moist environments, such as timber dryers.

Max. temp.
Measuring probe: 180 °C. Cable: 180 °C.

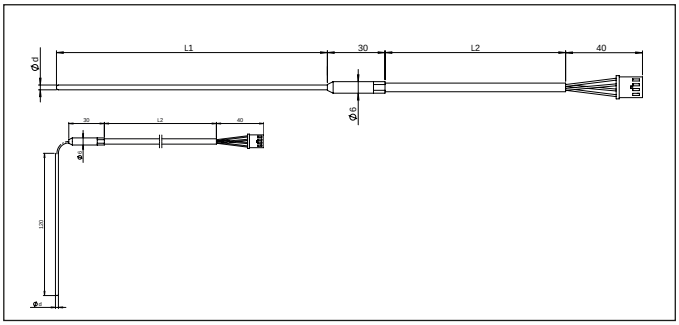


7913101 & 7914101
Hygienic sensor for weld-in boss or thermowell. American Sanitary Standard 3A

Design
Pt100 detector mounted in protective tube. 3-wire connection. Mounted on weld-in boss or in thermowell. Hygienic seal between sensor and weld-in boss.

Example area of use
Temperature measurements in tubes with hygiene requirements, e. g. in the food industry.

Max. temp.
Measuring probe: 200 °C. Cable: 80 °C.

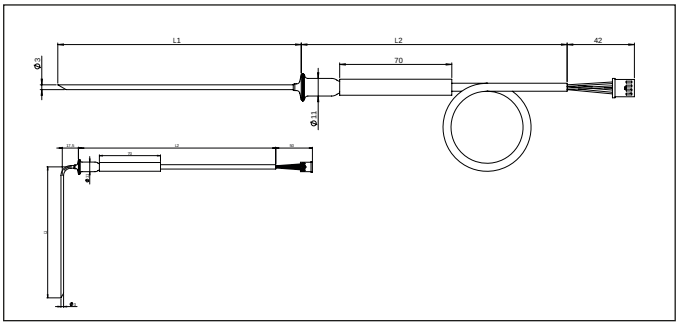


7915000
Sensor for autoclaves

Design
Pt100 detector mounted in protective tube.

Example area of use
Temperature measurement of process media in the service space of autoclaves.

Max. temp.
Measuring probe: 250 °C. Cable: 80 °C.

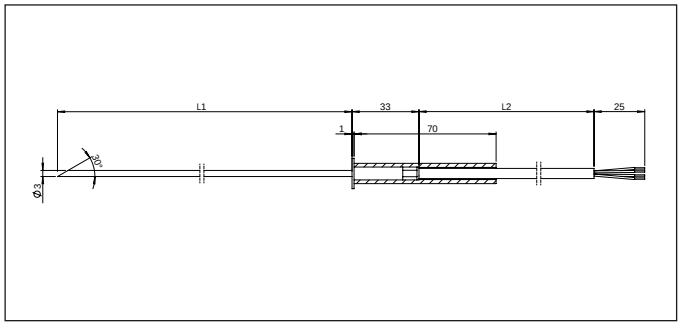


7917000
Sensor for steam chambers (autoclaves)

Design
Pt100 detector mounted in protective tube with cannula-like (injection needle) probe tip. Sealed with silicon gel and silicon hose.

Example area of use
Temperature measurements of goods and atmosphere in steam chambers (autoclaves).

Max. temp.
Measuring probe: 180 °C. Cable: 180 °C.

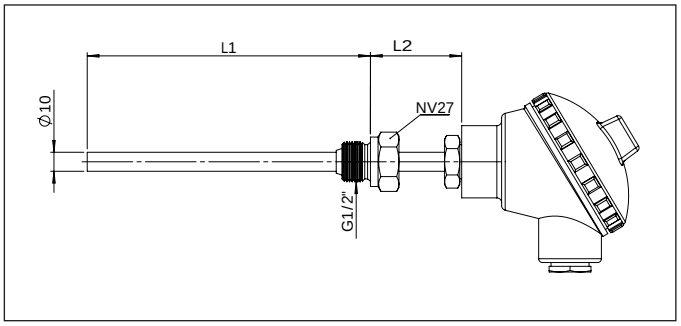


7919000
Food sensor

Design
Pt100 detector mounted in protective tube with cannula-like (injection needle) probe tip. Sealed with silicon gel and silicon hose.

Example area of use
Temperature measurement of food e.g. in smoke-house processes.

Max. temp.
Measuring probe: 200 °C, Cable: 200 °C.

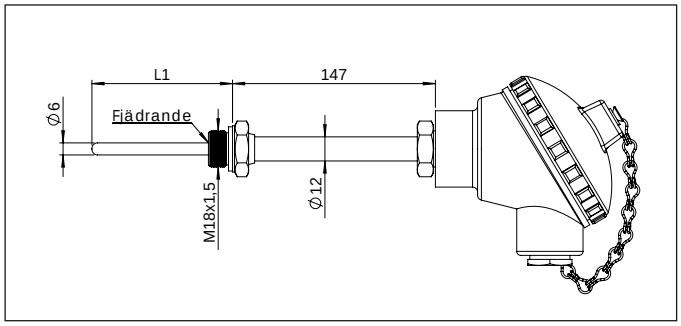


7931000 & 7932000
Sensor that fits “DIN form B” terminal head

Design
Outer protective tube and process thread. Replaceable insertion probe.

Example area of use
Temperature measurement of gas and liquid in the process industry. Neck length suited for insulated pipes.

Max. temp.
Measuring probe: 250 or 600 °C depending on the design of the insertion probe.

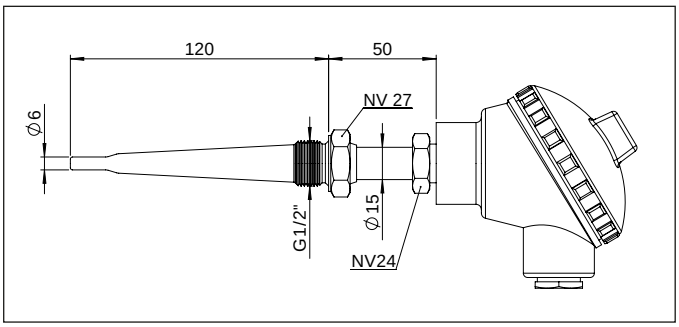


7941000
Thermocouple for thermowells DIN form D

Design
Neck with spring-loaded mounting for mounting in protective thermowell. Replaceable insertion probe.

Example area of use
Temperature measurement of gas and liquid in the process industry.

Max. temp.
Measuring probe: 250 or 600 °C depending on the design of the insertion probe.

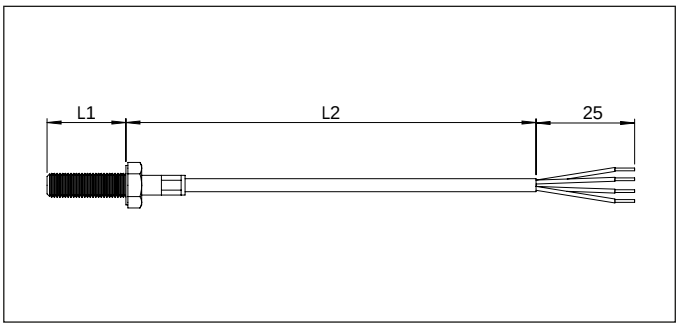


7945000
Sensor with terminal block and thermowell with reduced tip diameter

Design
Machined thermowell with reduced tip diameter for faster response and more accurate measurements. G1/2” process thread. Replaceable insertion probe.

Example area of use
Temperature measurement of gas and liquid in the process industry.

Max. temp.
Measuring probe: 250 or 450 °C depending on the design of the insertion probe.



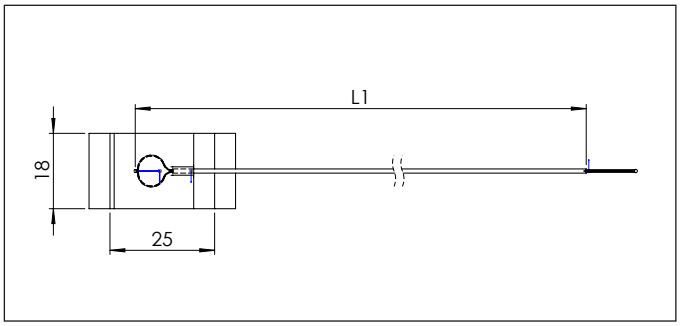
7950000
Sensor with threaded measuring junction

Design
Pt100 detector mounted into M6-screw which is stainless and acid-proof. Different threading options available.

Example area of use
Temperature measurement of goods, e. g. bearings.

Max. temp.
Measuring probe: 150 °C. Cable: 200 °C.

Thermocouple

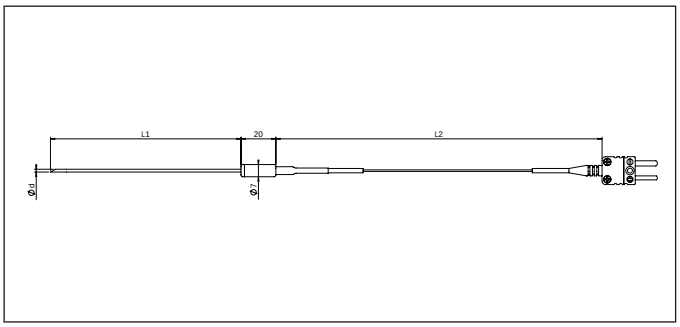


6206000
Surface temperature sensor with self-adhesive backing

Design
Wire thermocouple with welded measuring junction. The junction is provided with self-adhesive backing.

Example area of use
Temperature measuring on flat surfaces and on tubes. The exposed measuring junction offers very fast response time.

Max. temp.
Complete pad: 180 °C. Wire: 205 °C.

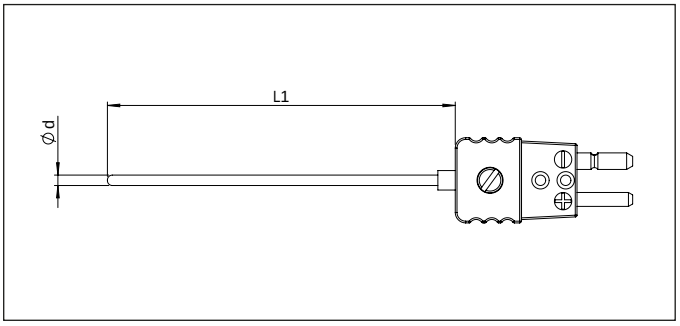


6305000
Cannula probe

Design
Thermocouple wire in protective tube with cannula probe and Kapton-insulated cable.

Example area of use
Temperature measurements in food.

Max. temp.
Measuring probe: 260 °C.

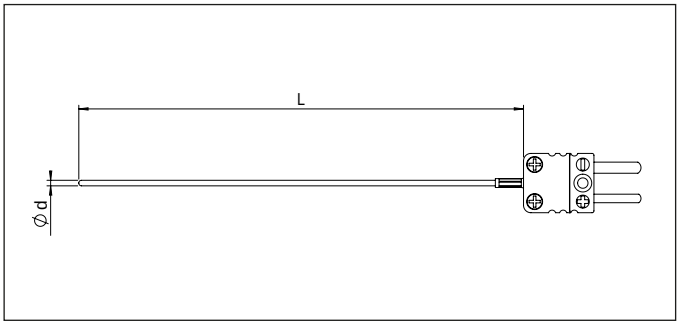


8102000
Metal-sheathed probe with moulded standard connector

Design
Mineral-insulated metal-sheathed thermocouple with a standard connector, available with standard male connector.

Example area of use
Temperature measurements of gases and liquids.

Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.



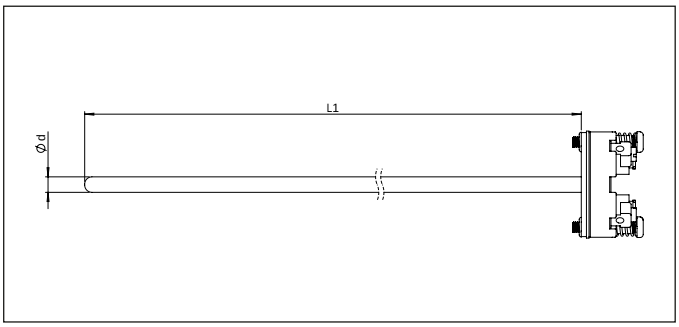
8103000
Metal-sheathed probe with miniature connector

Design
Metal-sheathed thermocouple cable (MIMS) with miniature male connector.

Example area of use
Temperature measurements of gases and liquids.

Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.

Thermocouple

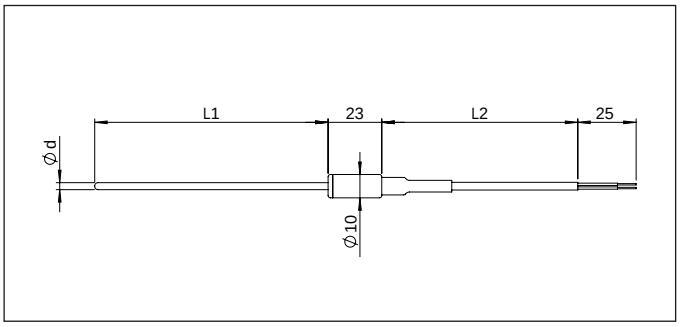


8104000
Insertion probe

Design
Spring loaded insertion probe.

Example area of use
Replacement insertion probe for process sensors.

Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.

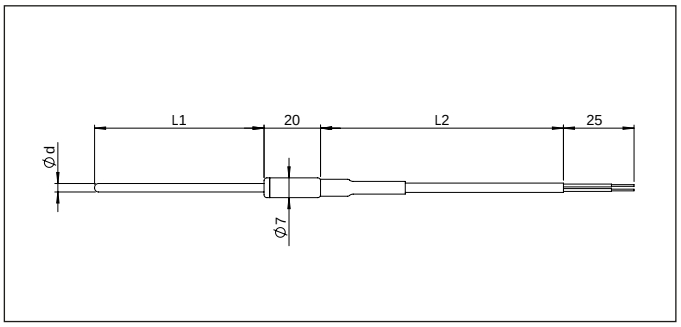


8105000
Metal-sheathed probe with Ø 10 mm transition junction, with extension cable

Design
Metal-sheathed thermocouple cable with extension cable and Ø 10 mm transition junction.

Example area of use
Temperature measurements of gases and liquids.

Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.

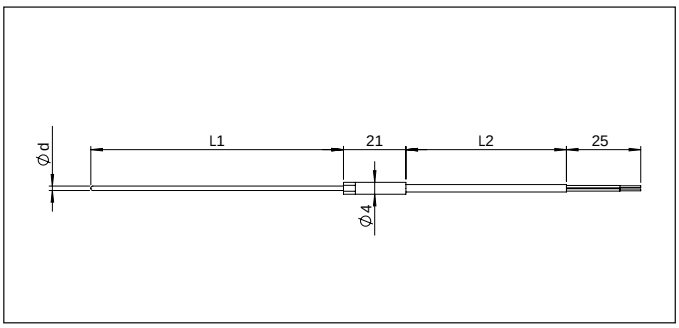


8106000
Metal-sheathed probe with Ø 7 mm transition junction, with extension cable

Design
Metal-sheathed thermocouple cable with extension cable and Ø 7 mm transition junction.

Example area of use
Temperature measurements of gases and liquids.

Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.



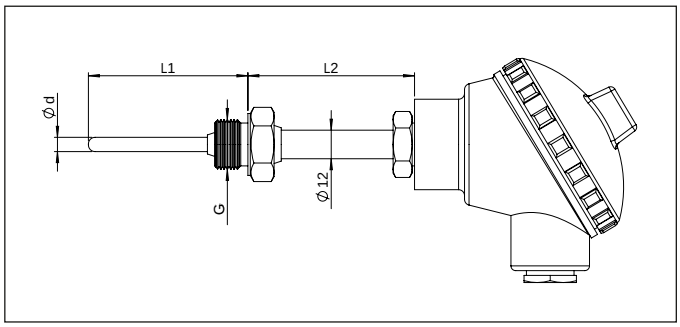
8107000
Metal-sheathed probe with Ø 4 mm transition junction, with extension cable

Design
Metal-sheathed thermocouple cable with extension cable and Ø 4 mm transition junction.

Example area of use
Temperature measurements of gases and liquids.

Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.

Thermocouple

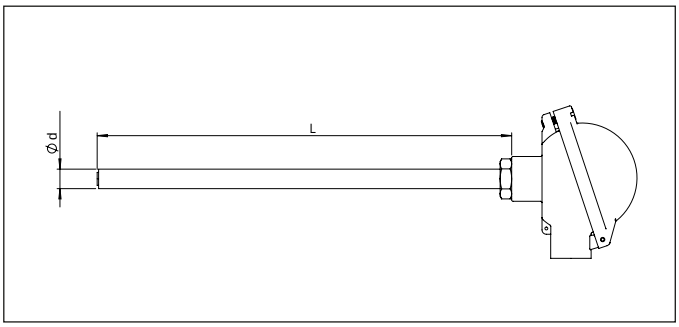


8108300
Thermocouple for thermowells DIN form D

Design
Neck with spring-loaded mounting for mounting in protective thermowell.
Replaceable insertion probe.

Example area of use
Temperature measurement of gas and liquid in the process industry.

Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.

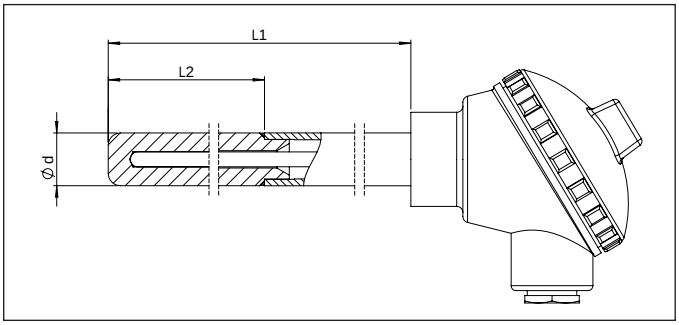


8109000
Sensor with protective tube and terminal head

Design
Housing in stainless steel or high temperature resistant steel.
Replaceable insertion probe.

Example area of use
Temperature measurements in combustion boilers and heat treatment furnaces.

Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.

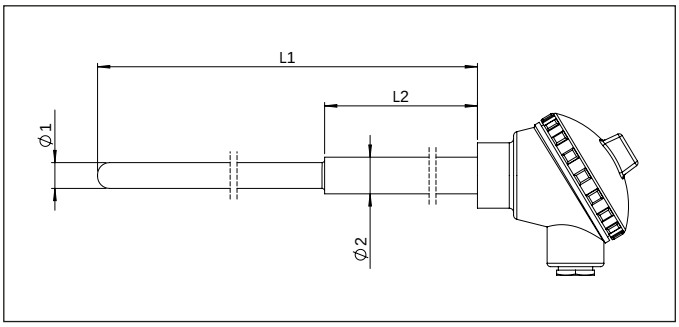


8109400
Sensor with wear-resistant tip, protective tube and terminal head

Design
The probe tip consists of a machined thermowell which can take normal Ø 6 mm inserts. Material 253MA.

Example area of use
Temperature measurement in incinerators in district heating networks, e.g. furnaces with sandbeds.

Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.



8110000
Sensor with ceramic protective tube and terminal head

Design
Housing with highly refined ceramic (C799) protective tube with neck of stainless steel. Replaceable insertion probe.

Example area of use
Temperature measurements in combustion boilers and heat treatment furnaces.

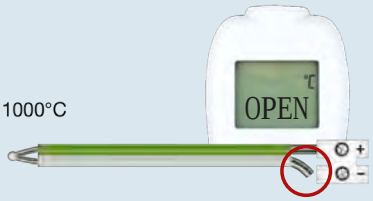
Max. temp.
Depends on the type of thermocouple and material properties.
See tables on page 21.

Faulty connections of thermocouples and Pt100

Keep this in mind when connecting thermocouples

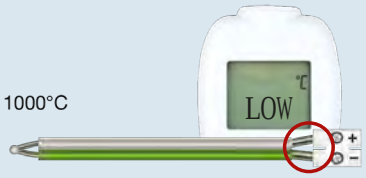
Circuit break (open circuit)

A sensor wire has become detached, loosened or is in poor contact with the instrument. The instrument triggers an alarm, e.g. by displaying the word “Open”.



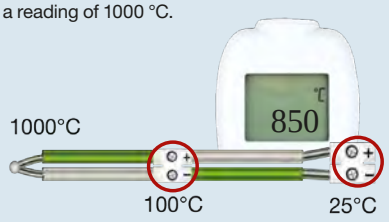
Reversed polarity of entire measuring circuit

If the polarity has been reversed, the instrument will operate “in reverse”. A temperature increase will be recorded as a temperature decrease.



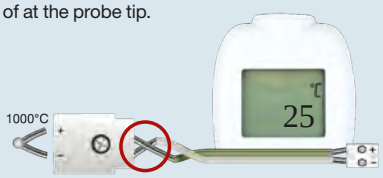
Double reversed polarity

If the polarity of the extension cable has been reversed at both ends, the temperature at the ends will affect the output signal. The reading will be the temperature at the measuring junction minus twice the temperature difference between the terminal head and the reference junction. Keep in mind that if a temperature controller having a set-point value of 1000 °C is connected, the power will be stepped up, thereby giving a true value approximately 150 °C higher than the set-point value. However, the instrument will still display a reading of 1000 °C.



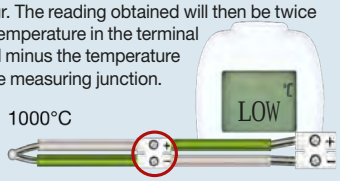
Short circuit

If the insulation wears off and the wires are short circuited, a measuring junction is created. The instrument will then display the temperature at the short-circuit point instead of at the probe tip.



Reversed polarity within the measuring circuit

The extension cable must have the same polarity as the thermocouple wires. If the polarity of the thermocouple is reversed, opposing voltages occur. The reading obtained will then be twice the temperature in the terminal head minus the temperature at the measuring junction.



Keep these in mind when connecting Pt100s to avoid misleading measurement results

4-wire Pt100 to 3-wire indicator

Be careful of false 4-wire connections. It can be tempting to connect two wires in the same terminal of an instrument built for 3-wire measurement.

The result will be a 50 percent difference in resistance between the different branches of the 3-wire indicator, where equal resistance is necessary for zero error. See the adjacent figure for the correct way to connect a 4-wire Pt100.

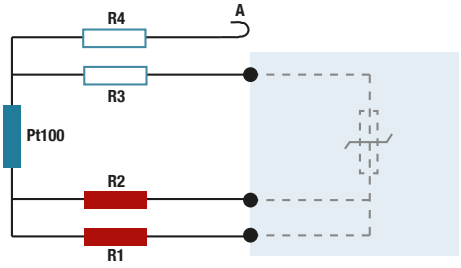
With a 10 m 4 x 0.25 mm² extension cable the measurement error is approx. 0.9 °C.

3-wire Pt100 to a 4-wire indicator

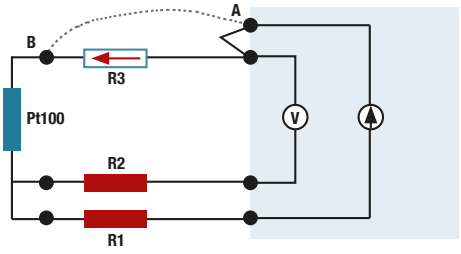
A Pt 100 with 3 wires plus an instrument for 4-wire connection. The changeover from 4 wires to 3 is done as close to the sensor as possible. In the adjacent figure this is done at B, as shown by the dotted line.

If you connect at A instead, the measuring current must pass through the wire with R3. The indicator then shows the resistance for the Pt100 plus the resistance R3. The error can then be approx. 1.8 °C (for a 10 m 3 x 0.25 mm² wire).

When the connection is correctly made at B, the measuring current encounters less resistance en route to the Pt100. For a short process sensor, the increase can lead to a measurement error of approx. 0.1 °C.

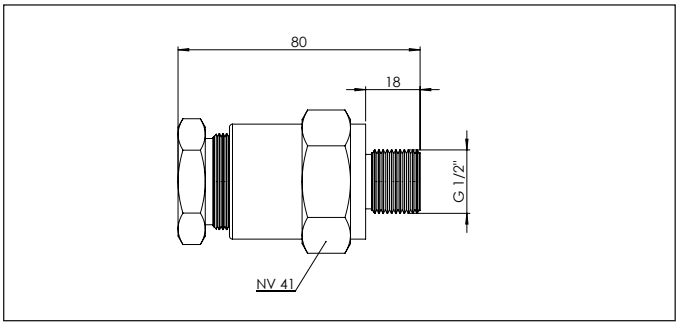


The correct connection of a 4-wire Pt100 to a 3-wire indicator. One of the wires (any will do) must be left unconnected. See A.



The correct connection of a 3-wire Pt100 to a 4-wire indicator involves transitioning to the 3-wire configuration as close to the sensor as possible to achieve the lowest measurement error. Connecting at B gives a lower error reading than connecting at A. The reason is that the power generating loop must be separated from the volt-meter circuit (R3) except in the Pt100 sensor itself.

Mechanical accessories

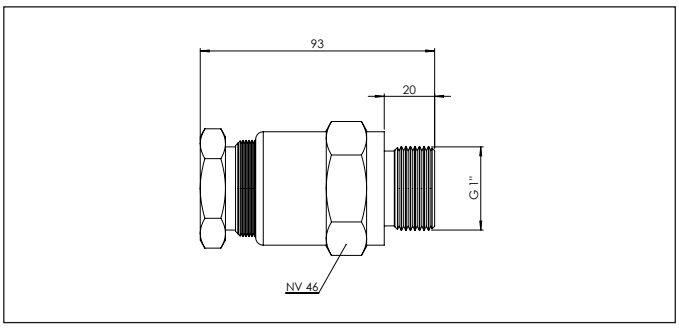


23-04055
Feedthrough with locking and sealing with packing ring of graphite, model UG 2-15-G1/2

Design
15 mm feedthrough with locking and sealing ring of graphite and G1/2” connection thread.

Example area of use
Positioning of temperature sensor neck.

Max. temp.
450 °C.

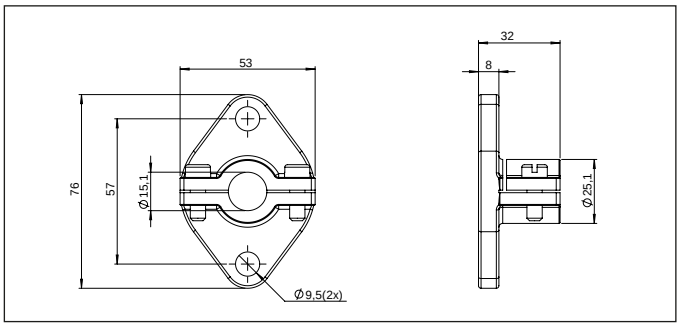


23-05050
Feedthrough with locking and sealing with packing ring of graphite, model UG 2-22-G1

Design
22 mm feedthrough with locking and sealing ring of graphite and G1” connection thread.

Example area of use
Positioning of temperature sensor neck.

Max. temp.
450 °C.

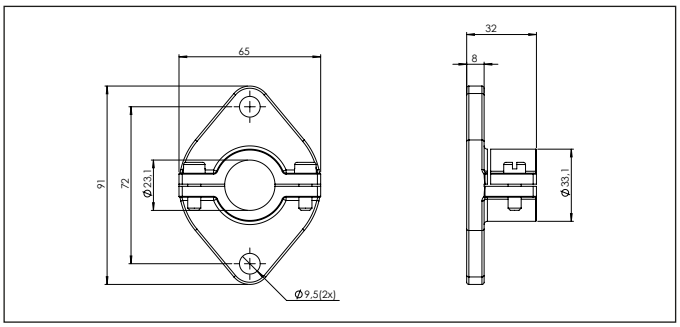


23-04030
Mounting flange UZ 21-15

Design
15 mm mounting flange with clamp.

Example area of use
Positioning of temperature sensor neck.

Max. temp.
300 °C.



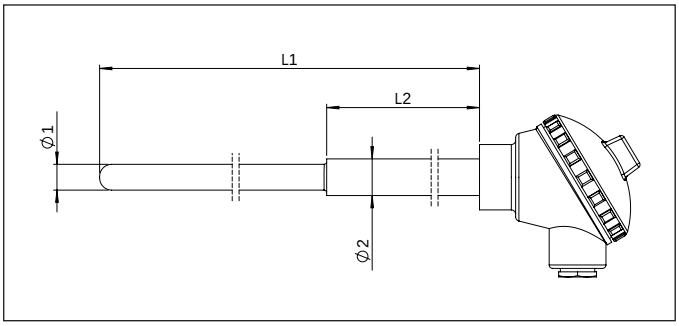
23-04040
Mounting flange UZ 21-22

Design
22 mm mounting flange with clamp.

Example area of use
Positioning of temperature sensor neck.

Max. temp.
300 °C.

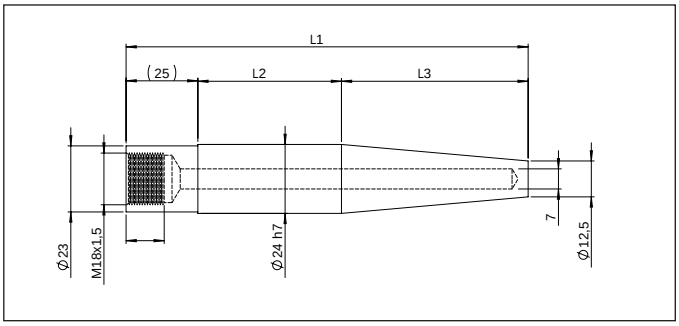
Mechanical accessories



8115000
Ceramic protective tube

Design
Protective tube of high purity ceramics (C799) with one end closed. Neck with G1/2" thread.

Example area of use
As a protective tube for temperature measurements in combustion boilers as well as heat treatment furnaces.

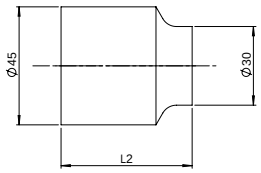


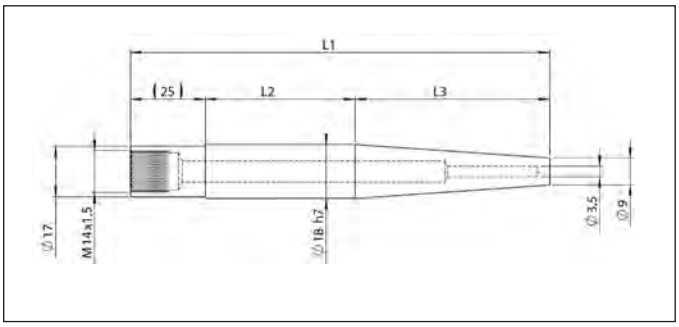
9055020
Thermowell and mounting boss for weld-in, DIN 43772 form 4

Design
Machined thermowell according to DIN 43772, form 4 D.
Mounting boss for weld-in.

Example area of use
Temperature measurements in critical pressure applications.
Insertion probe models 7941000 and 8108300 fit to this thermowell.

9055040
Mounting boss for weld-in



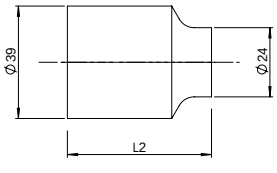


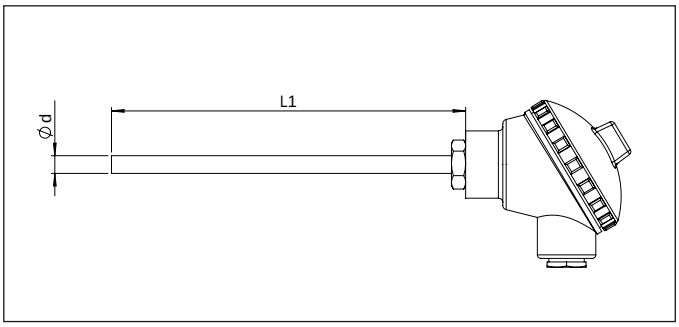
9055025
Thermowell and mounting boss for weld-in, DIN 43772 form 4 DS

Design
Machined thermowell according to DIN 43772, form 4 DS.
Mounting boss for weld-in.

Example area of use
Temperature measurements in critical pressure applications.
Insertion probe models 7614000 and 8108300 fit to this thermowell.

9055045
Mounting boss for weld-in



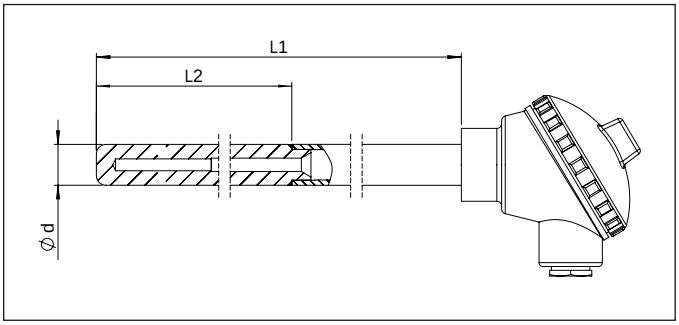


9061500
Protective tube of high temperature steel

Design
Protective tube of high temperature steel with one end closed.

Example area of use
As a protective tube for temperature measurements in combustion boilers as well as heat treatment furnaces.

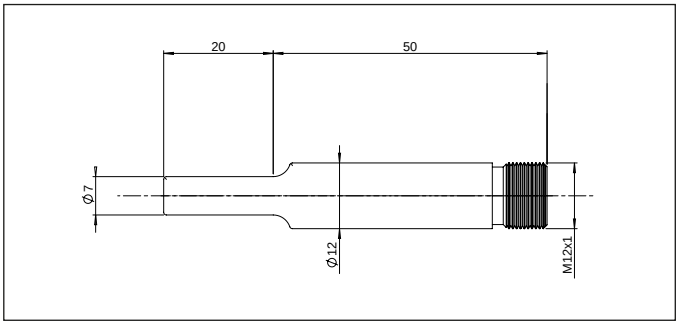
Mechanical accessories



9061504
Protective tube with wear-resistant tip

Design
Machined thermowell with increased wall thickness in the 250 mm long tip. Adapted for Ø 6 mm inserts. The terminal head can be threaded onto the open end of the protective tube.

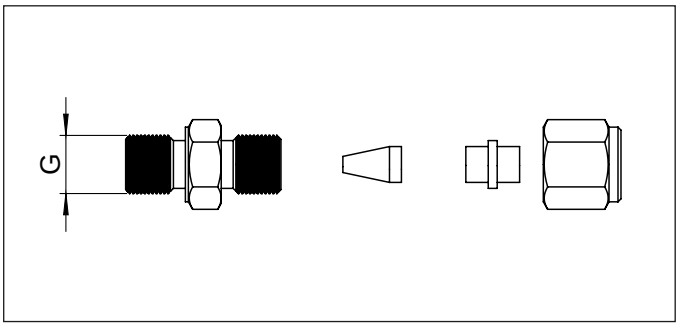
Example area of use
Spare part for sensor model 8109400. This sensor is used for measurements where increased abrasion is to be expected.



9062050
Thermowell, machined

Design
Machined thermowell with reduced tip diameter.

Example area of use
When installing sensor 7830000.



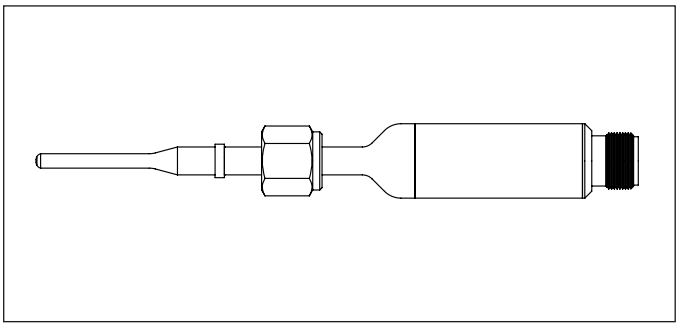
9040000
Compression fittings for pipes and metal-sheathed probes

Pentronic's range of compression fittings covers temperature sensor diameters from 0.5 to 22 mm. With a compression nut, a cone is pressed into the feedthrough hole, securing the sensor in place. Using a steel cone slightly deforms the pipe or metal-clad cable, causing the cone to grip firmly, ensuring a tight feedthrough.

The PTFE material in the cone prevents sensor deformation. The primary purpose of the cone is to hold the sensor in place, and the sensor insertion length can be adjusted when the compression nut is loosened.

A slotted steel cone's sole purpose is to allow adjustments of sensor insertion at temperatures higher than the approximately 200 °C that PTFE material can withstand.

Integrated signal conversion



Pentronic's integrated signal converters are known for their very high system accuracy, down to ±0.2 °C depending on the choice of signal conversion and design. Its compact design and high protective level (IP67/IP69) make it suitable for demanding applications, such as in food production.

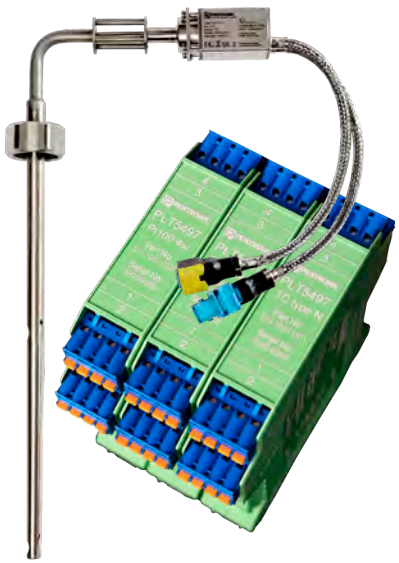
The probe and neck length can be varied, and the sensor can be designed with a wide range of process connections. Pentronic also manufactures associated cables and gateways for communication.

	PAT	PLT	PIO
Output signal	4–20 mA	PLB® Bus	IO-Link
Measuring junction	4w Pt100	4w Pt100	4w Pt100/ Thermocouple
Process connections	Multiple options are available, including qualified hygienic process connections, TC flanges, bayonet, but can also be designed with M12, miniature or standard process connectors. Alternatively loose conductors.		
Recommended max. process temperatures	600 °C*	600 °C*	Pt100: 600 °C*/ Thermocouple: 1,200 °C*
Recommended max ambient temperatures	80 °C	80 °C	80 °C
Recommendations	Highly versatile analogue sensor based on proven technology and communication.	A flexible digital system with very high measurement accuracy. Recommended for installations with multiple measurement points. Minimised cable installation thanks to cost-effective and energy-efficient digital bus communication.	IO-Link A digital and highly versatile system based on standardised communication. Very high accuracy and the possibility of integration into existing systems.
Configuration**	Pentronic UPI1611***	Pentronic UPI1611***	IO-Link standard, other alternatives available
Accessories	Customised cables	Gateway for Profinet, EthernetIP communication Customised cables	Customised cables

** Depends on requirements for measurement accuracy, mechanical design, and signal converter configuration.*
*** All integrated sensors are delivered configured according to specifications.*
**** UPI1611 configuration tool for PAT- and PLT systems.*

Digital measuring systems

The Pentronic PLB5000 system
– A digital temperature measuring system for demanding environments



- Cost-effective, compact and robust measurement system
- Up to 120 measuring positions with high accuracy via digital bus
- Simple installation with minimal cabling
- Safety integrity level: SIL 2 IEC61508
- Intrinsic safety systems IECEx and ATEX
- Integrated signal converter for 1, 2 or 3 sensors, or DIN rail-mounted model for up to 4 sensors
- Inputs for Pt100/1000 or thermocouple Type K, N, R, S
- Gateway with PROFIBUS DP/PROFIsafe connection
  Gateway for IECEx/ATEX Zone 1 with PROFINET over APL connection will be launched in 2026
- High availability through redundancy

The PLB5000 system is designed for accurate temperature measurement in demanding environments. The system provides superior measurement and stability in small and robust casings. The signal converter delivers digital measurements, has a uniquely low power consumption and is easy to install with a minimum of cabling. Designed for applications where a high degree of flexibility, accuracy and safety is required.

Cables

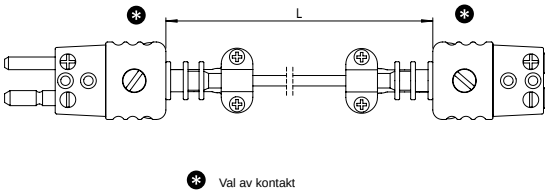
CABLES
We offer a wide range of connection cables for both Pt100 and thermocouples. Yellow Type K according to ANSI standard. Otherwise, the IEC standard applies.

For Pt100

4-leaders 3-leaders

For thermocouples

K K T



6901000
Thermocouple extension cable

Design
Extension cable with connectors.

Example area of use
When you want to connect a thermocouple to an instrument.

Advice for handling temperature sensors and connection cables

Advice for handling temperature sensors

There are basically two different types of temperature sensor – resistance thermometers (often called Pt100 or Pt1000) and thermocouples:

Resistance thermometers (Pt100/Pt1000):

- Do not exceed the resistance thermometer's measurement range
- High temperatures together with thin sensors can shorten service life
- Do not expose the sensors to sudden impacts or vibrations
- Avoid thermal shocks
- Do not bend sensors made of sheath material (MI cable) too tightly. Minimum bending radius equals twice the diameter
- Tube/pipe sensors must not be bent at all
- The measurement environment can shorten service life. You should therefore regularly check the sensor's mechanisms and output signal

Functional testing of resistance thermometers (Pt100/Pt1000):

If the sensor has been exposed to mechanical shock or been bent, you should perform the following tests to determine whether it has been damaged:

- Measure the resistance between red and white, or yellow and blue, with e.g. a multimeter. At room temperature (23°C ± 4°C), the resistance should be between 106 Ω and 111 Ω.
- Using an insulation tester, measure the insulation between the inner conductor and the outer sheath. (see the extract from IEC 60751:2022 below).

Test voltage (Vdc)	Minimum approved insulation (MΩ)
100	100

- Low insulation resistance is an indicator that the sensor should be replaced.

Thermocouples:

- Do not exceed the resistance thermometer's measurement range
- High temperatures together with thin sensors can shorten service life
- Avoid thermal shocks
- Do not bend sensors made of sheath material (MI cable) too tightly. Minimum bending radius equals twice the diameter
- The measurement environment can shorten service life. You should therefore regularly check the sensor's mechanisms and output signal

Functional testing of thermocouples:

If the sensor has been exposed to mechanical shock or been bent, you should perform the following tests to determine whether it has been damaged:

- With a multimeter, measure the resistance between the conductors.
- The resistance on a healthy sensor should be 0 Ω.
- An open input indicates a broken circuit
- Using an insulation tester, measure the insulation between the inner conductor and the outer sheath (see the extract from IEC 61515:2016 below).

Outer diameter D (mm)	Test voltage (Vdc)	Minimum approved insulation (MΩ)
0,5 < D ≤ 1,6	100	20
1,6 < D	50 till 100	1000

- Low insulation resistance is an indicator that the sensor should be replaced.

Contact us if you are unsure about the operation of your temperature sensor. Want to know more about temperature sensors?

Visit www.pentronic.se

Download your test certificate at www.pentronic.se

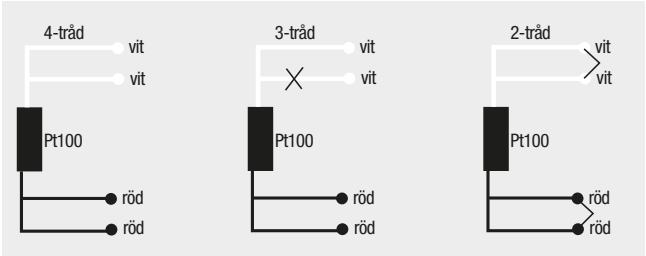
Pt100 connection

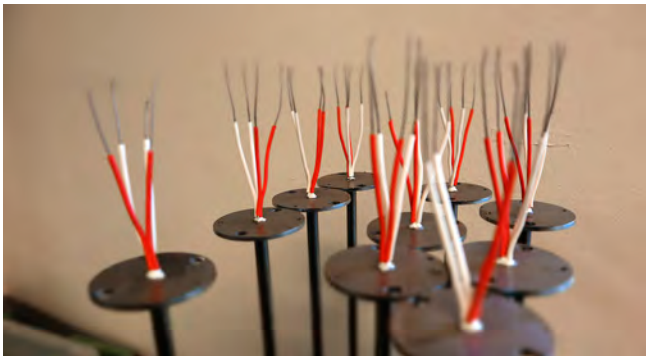
CHANGE FROM 4-WIRE CONNECTION TO 3-WIRE OR 2-WIRE

Our stocked Pt100 sensors use a 4-wire connection unless otherwise specified. Here's how you can change to other connection options.

3-wire: Exclude any arbitrary conductor or terminal. Do not parallel-connect the excluded one with the remaining conductors.

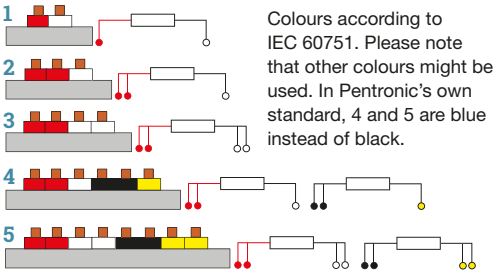
2-wire: Parallel-connect the conductors or terminals in pairs on both sides of the Pt100 detector.





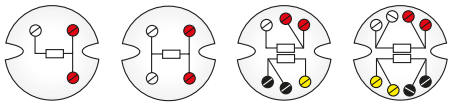
TECHNICAL ARTICLE

Extension cable for Pt100s



Colours according to IEC 60751. Please note that other colours might be used. In Pentronic's own standard, 4 and 5 are blue instead of black.

Terminal block connector for Pt100s



Note that other colours may be used.

Max. recommended working temperatures for thermocouples with sheath material Iconel 600 (EN 2.4816), type K and N according to IEC 61515:2016

Ø mm	K and N
1 and less	700 °C
1,5	920 °C
2	920 °C
3	1070 °C
4,5	1150 °C
6 and more	1150 °C

Pentronic also manufactures sensors in specialised sheath alloys for thermocouples, designed for working temperatures up to 1250 °C (e.g. Nicrobel).

With regard to ceramic protection tubes: the Al03 tubes C799 and C610 are kept in stock. Recommended for thermocouples and working temperatures up to 1700 °C.

Other options for special applications are available on request.

Types of thermocouples

Type	IEC Color	Ansi MC 96.1 Color	Working-range in °C	Atmosphere
E			-200 - 900	Good in oxidising environments
J			-200 - 760	Not good in oxidising environments or acids
K			-200 - 1200	Good in oxidising environments
N			-200 - 1200	Like K but standardised to be better over 200 °C
T			-200 - 370	Not in oxidising environments
B			0 - 1700	Ceramic protection tubes, all environments
S/R			0 - 1480	Ceramic protection tubes, all environments
C/D			0 - 2315	Vacuum, not for oxidising environments
A			0 - 2500	Vacuum, not for oxidising environments

Properties of cable insulation materials

Type of material	T min	T max	Ex. of thermocouples	Ex. resistance-thermometers	Abrasion resistance	Chemical resistance	Moisture resistance	Solvent resistance	Fire test
PVC	-15	105	8105000	7914000	4	4	3	2	4
PUR	-50	150	NA	7400000	4	3	3	3	3
NYLON	-65	121	6101000	NA	5	5	2	3	1
FEP	-65	200	8105000	NA	5	5	5	5	5
SILICON	-100	200	6102000	7912000	3	3	4	2	5
PFA	-65	260	6101000	7300000	5	5	5	5	5
PTFE	-265	260	6101000	7300000	4	5	5	5	5
POLYIMIDE	-265	260	6101000	NA	5	5	5	4	4
GLASS FIBRE	NA	510	6102000	NA	1	3	3	5	5
CERAMIC FIBER	NA	1200	6101000	NA	2	3	2	5	5

1-5 where 1 is worst and 5 is best. Note that the table describes generalised properties of the insulation material; the properties of specific cables may differ. When selecting a cable always consult the relevant data sheet for the precise specification.

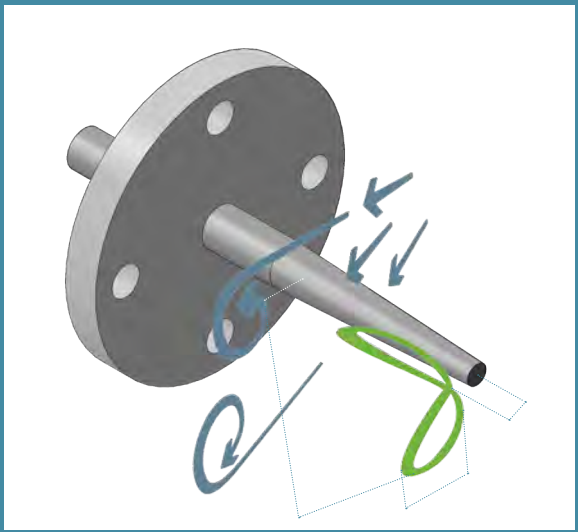
Material properties

Properties of common materials

We manufacture mechanical components, accessories, thermowells and tube necks from a variety of materials in our own precision tooling workshop. The table below lists a selection of our most common types of steel. We also do custom orders in titanium, copper, and a number of different plastics.

Type of material	Comment	EN 10027-2	EN 10027-1	AISI/SAE/ASTM	Other designation
Stainless steel	A highly versatile and common material suitable for moderate temperatures and environments.	1.4301 1.4307	X5CrNi 18-10 X2CrNi 18-9	304 304/304L	A2 stainless steel
Mo alloy stainless steel	The molybdenum alloy helps improve acid resistance suitable for the process industry. Also called acid-resistant steel.	1.4401 1.4436	X5CrNiMo 17-12-2 X3CrNiMo 17-13-3	316	A4 acid-resistant steel
Mo alloy stainless steel Low carbon content	Pentronic's standard material. The low carbon content helps improve properties in the temperature range 425–925 °C where steel with a higher carbon content can exhibit problems with carbide precipitation/ intergranular corrosion.	1.4404 1.4432 1.4435	X2CrNiMo 17-12-2 X2CrNiMo 17-12-3 X2CrNiMo 18-14-3	316L	
Mo alloy stainless steel titanium stablised	Excellent corrosion resistance.	1.4571	X6CrNiMoTi 17-12-2	316 Ti	Classic V4A
High temperature stainless steel	For temperature ranges up to 1150 °C. Excellent corrosion resistance. Abrasion resistant.	1.4749 1.4835 1.4854 1.4767	X18CrN28 X9CrNiSiNCe 21-11-2 X6NiCrSiNCe 35-25 CrAl 20 5	446 UNS S30815 UNS S35315	4C54 253MA 353MA Kanthal AF
Nickel-based alloys	Excellent corrosion properties, working temperatures up to 900 °C* Excellent properties in reducing environments.	2.4816 2.4819 2.4951/2.4630	NiCr15Fe NiMo16Cr15W NiCr20Ti	UNS N06600 UNS N10276	Inconel 600* Hastelloy C-276 Nimonic 75
Pressure vessel steel	Standardised material certified for use in industrial pressurised installations.	1.0460 1.5415 1.7335 1.7380	P250GH 16Mo3 / 15Mo3 13CrMo 4-5/13CrMo 4-4 10CrMo9-10	SA 105 A204 Gr.A A387 gr.12 A122 F22	C22.8

* Inconel 600 is designed for safe use over a very broad temperature range and is used as a sheath material in high quality sheathed thermocouples. Properly designed, an Inconel 600 sheathed thermocouple can withstand working temperatures up to 1150 °C.



Wake frequency calculations

The American standard ASME PTC 19.3 TW (2016) describes a method for calculating Kármán vortex streets. These oscillations influence fixed thermowells in pipe flows. In flows, there is a risk that the wake effect will cause the thermowell to oscillate violently, with the result that it can break apart or break free from its mounting. The standard describes calculation models for various basic types of thermowell: these calculations are generally termed wake frequency calculations. For the analysis, the thermowell's dimensional, material and shape data are needed, plus data on the relevant environment, such as flow and pressure. The calculations show the thermowell's safe levels in relation to its natural frequency.

Pentronic offers wake frequency calculations as an additional service.

Dimensions and resistance of various thermocouple wires

Dimensions			Conductor resistance in ohms per metre of wire					
AWG	Diam. mm	Area mm²	K	N	J	T	S	Cu/Cu
18	1.02	0.823	1.2	1.6	0.86	00	0.4	0.04
20	0.81	0.519	1.9	2.6	1.2	1.0	0.6	0.07
22	0.64	0.324	3.1	4.1	1.9	1.5	0.9	0.11
23	0.57	0.259	3.9	5.1	2.3	2.0	1.2	0.13
24	0.51	0.205	4.9	6.5	3.0	2.5	1.5	0.17
25	0.45	0.162	6.2	8.2	3.7	3.1	1.8	0.21
26	0.40	0.128	7.8	10.4	4.7	3.9	2.3	0.27
28	0.32	0.080	11.8	16.5	7.5	6.3	3.7	0.43
30	0.25	0.051	19.8	26.2	12.0	10.0	5.8	0.68
32	0.20	0.032	30.9	41.0	18.8	15.6	9.3	1.08
34	0.16	0.020	49.7	66.1	30.2	25.2	14.8	1.71
36	0.13	0.013	79.0	105.0	48.1	40.1	23.5	2.72
38	0.10	0.008	123.7	164.0	75.3	62.5	37.3	4.33
40	0.08	0.005	205.4	273.1	124.1	103.8	59.3	6.88

AWG = American Wire Gauge.

The conductor resistance in ohms per metre of wire means the total resistance of 1 metre of both wires in a single pair of wires. For Pt100 wire, the total resistance of 1 metre of two wires is given, which also corresponds to the resistance of 2 metres of one wire.

The stated measurements are rounded off and should be considered as guide-lines. Deviations may occur.

Compensation material – denoted by the letter C, e.g. KC – has a different resistance than that of the corresponding thermocouple material.

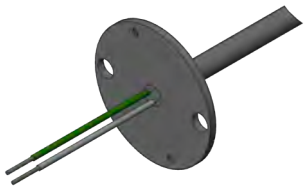
Cu/Cu stands for copper in both wires and has been included for comparison.

Common connection options for thermocouples and resistance thermometers

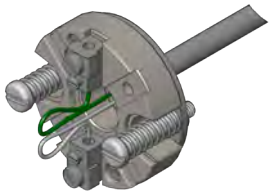
Connections are a critical part of your measurement chain and when choosing which one to use, it is important to consider not only the measurement uncertainty but also the accessibility, the surrounding environment and the ease of replacement. There is now a great variety of both connectors and casings, and in addition to choosing the type of connection it is also possible to choose between different versions of integrated signal converters. Various versions are available with 4 to 20mA or digital signal output.

Thermocouple cable with free wires

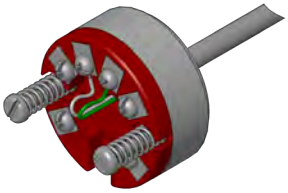
Pt100 cable with free wires



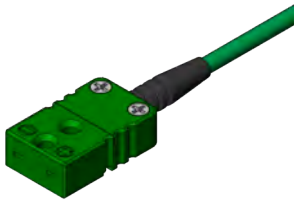
Measurement insert ready for mounting of a terminal head or transmitter (T/E or Pt100)



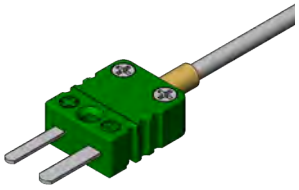
Measurement insert with terminal head (T/E or Pt100)



Measurement insert with transmitter (T/E or Pt100)

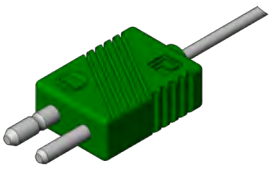


Miniature female connector mounted on a cable



Miniature male connector mounted on a sheath

Standard female connector mounted on a cable



Standard male connector mounted on a sheath

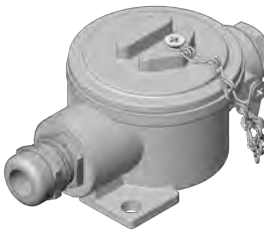
LEMO connector mounted on a cable

M12 connector with integrated electronics

M12 connector mounted on a cable or sensor

M12 connector mounted on a terminal head

Thermocouple connector mounted on a terminal head



Terminal box for terminal block or transmitter

Instrument portfolio

TEMPERATURE INDICATORS

Small mobile temperature gauges are required for tasks such as maintenance and control. Pentronic offers standard packages for the most common measurements. With a wide range of instruments, sensors and accessories, we can easily customise equipment to meet your specific requirements.

Temperature indicators can range from simple panel-mounted temperature meters to advanced measurement bridges for laboratory use. We will guide you in choosing the right equipment.

CONTACTLESS IR PYROMETERS

An IR pyrometer measures temperature without contact. All objects with a temperature above 0 K (Kelvin) emit infrared light that is proportional to the object's temperature. For optimal pyrometer measurements, knowledge of IR technology is required.

We can act as your advisor and offer a range of products from simple handheld devices to more advanced and industry-specific pyrometers and thermal cameras for various applications.

GFM – GLASS FLOW METERS

Pentronic's glass flow meter (GFM) is a contactless measurement system that optimises the manufacturing process.

By measuring and controlling the flow of molten glass to the spinner that forms glass wool during the production of glass wool insulation, the process can be significantly streamlined.

MOISTURE SENSORS AND NIR EQUIPMENT

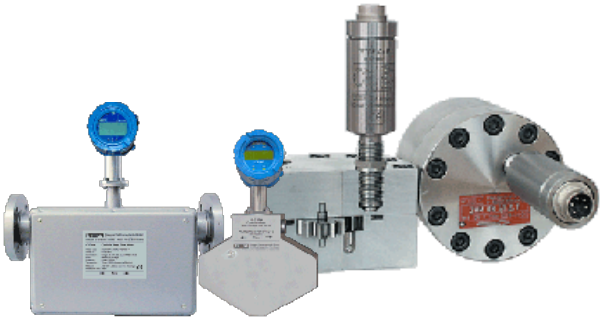
For many years, Pentronic has provided Swedish industry with equipment for continuous and contactless measurement of moisture content, fat content, protein and more. Coating and thickness can also be measured continuously using contactless equipment. We also offer meters for laboratory use or sampling in processes. Industries where this equipment is used include paper, cellulose, processing, forestry, bioenergy, food, pharmaceuticals and more.

FIBRE OPTIC TEMPERATURE SENSORS

Fibre optic temperature sensors from Rugged Monitoring can be a good solution when traditional sensors interfere with measurements or are themselves disturbed or ruined. Applications include high-voltage applications, the automotive industry and medical equipment. Measurements are made in strong magnetic fields, microwaves, high voltage, explosive environments – environments where normal sensors cannot be used. By using a wavelength-sensitive material at the tip of a glass fibre, you get a temperature sensor that is highly durable and can be made both small and flexible. The glass fibre and its insulation material create a temperature sensor that is completely free of metals yet still rugged. The measurement range is -200 to +300 °C.

Advantages of fibre optic systems include their high accuracy, small size and durability.

Instrument portfolio



FLOW METERS
We offer a range of precise flow meters designed for liquids of varying viscosity, from 1 to 106 mm²/s. Applications for flow meters include paint and coatings, PUR, adhesives, PVC, hydraulic oil, compressed air, as well as flows in the food and pharmaceutical industries. The meters use various measurement principles, including: gears, turbines, screws and mass flow (Coriolis).

DATA LOGGERS
Data loggers are a simple way to record documentation from production, experiments and troubleshooting. Our product range covers a wide spectrum, from simpler models with a few channels to more advanced units with a large number of channels for the most demanding applications. We also offer Datapaq temperature profiling and monitoring systems. Temperature datalogger systems used to measure product and process temperatures through industrial heat treatment and curing processes.

TRANSMITTERS
Signal transmission to higher-level measurement and control systems often occurs with the help of transmitters or signal converters, as they are also known. Our range includes transmitters for direct installation in sensors or control cabinets. A transmitter converts signals from the temperature sensor, for example, into 4–20 mA, 0–10 V, Profibus, IO-link or Hart, among other signal buses. In many cases, transmitters are used as Zener barriers in hazardous (Ex) environments.

CALIBRATION EQUIPMENT
Calibration equipment is needed to ensure high traceability within a company's entire flow up to process measurement. Thanks to the experience of our accredited laboratory, we have significant knowledge in this area. We offer calibration equipment from selected manufacturers, including instruments for ovens and baths.

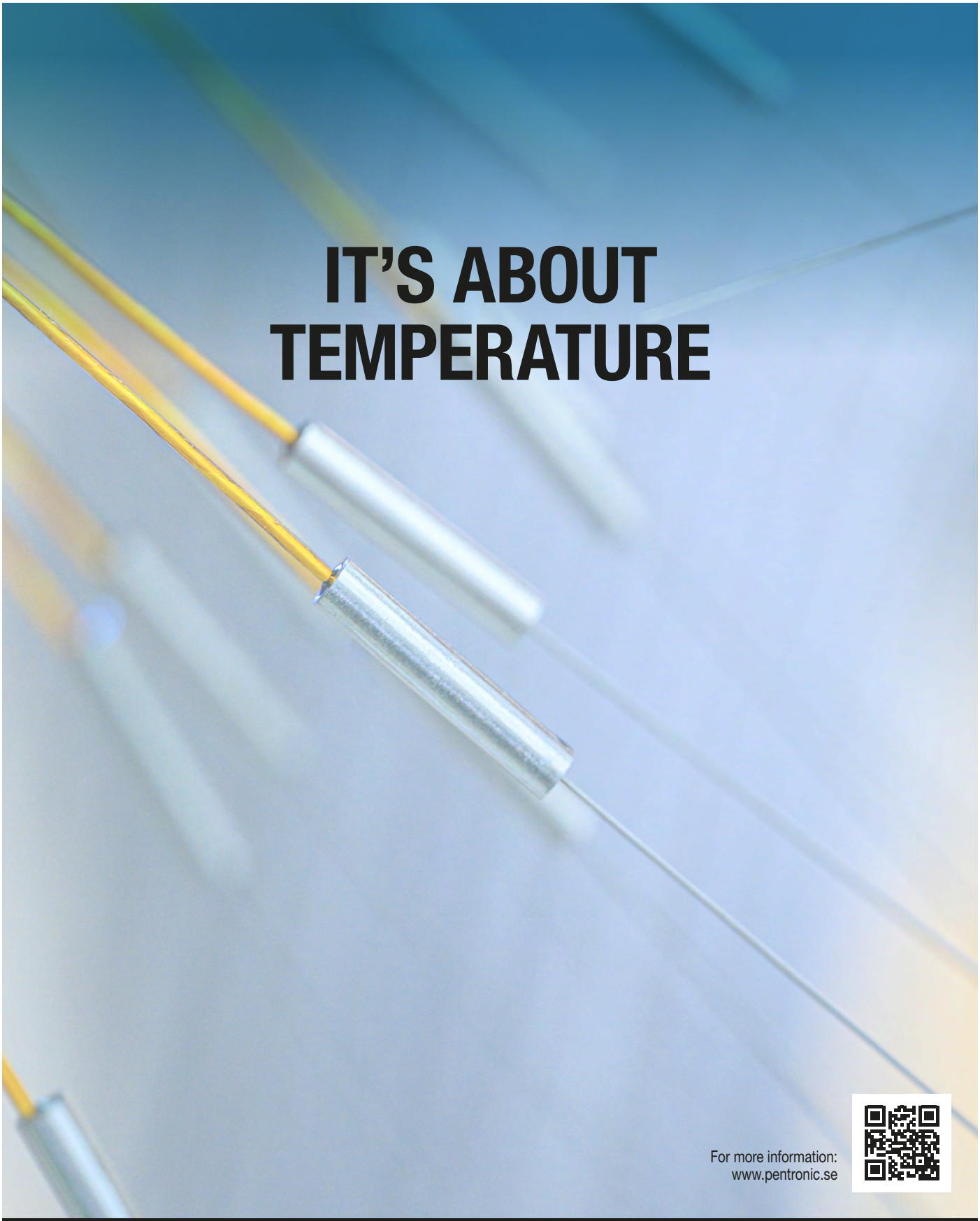
Calibration

To reduce the risk of measurement errors and disposal costs, it is becoming increasingly important to calibrate everything from sensors to measured value presentation to trace and address sources of error.
The safest way to achieve traceability to the temperature scale is through accredited calibration. We provide calibration services in our own laboratory or on-site at the customer's location. You can find details of our various accreditations at: www.pentronic.se or www.swedac.se.

EXTERNAL CERTIFICATION REQUIREMENTS

Accred. no. 0076
Calibration
ISO/IEC 17025

If your company is required to adhere to temperature measurement standards, we can assist you. Pentronic is at your service and can propose calibration methods to maintain traceability in temperature measurement. We offer calibration of temperature sensors in batches or individually, for one or multiple temperatures. Calibration is conducted by our accredited calibration laboratory, AKL 0076.



For more information:
www.pentronic.se

PENTRONICS PRODUCT RANGE

- Temperature sensors
- Temperature indicators
- Handheld temperature meters
- Control equipment
- Calibration services & equipment
- Moisture & thickness meters
- Training in temperature measurement & calibration
- Temperature transmitters
- Cables – connectors – panels
- IR pyrometers
- Data loggers and printers
- Fiber optics
- GFM glass flow meters
- Electro-optical testing systems

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