

## Surface Thermocouples Model TC50

WIKA Data Sheet TE 65.50



### Applications

- To measure surface temperatures on flat surfaces or pipes in laboratories and industrial applications

### Special Features

- Application ranges up to max. 400 °C (option: 600 °C)
- Easily interchanged, no thermowell necessary
- For screwing, welding or with worm drive hose clip
- Cable made of PVC, silicon, Teflon® or fibreglass
- Explosion-protected versions Ex-i, Ex-n and NAMUR NE24



#### Thermocouples

Fig. top: Model TC50-O for surfaces

Fig. bottom: Model TC50-Q for pipes

## Description

### Probe

In the case of thermocouples for flat surfaces, the probe is installed into a contact block, which can be screwed or welded to the vessel surface. Thermometer designs for pipes will simply be fixed with a worm drive hose clip.

### Cable

There are various insulating materials available to match different environmental conditions. The free end of the cable is made up ready for connection, optional fitted with plugs or with connected fieldcase.

## Sensor

### Sensor type

Type	Recommended max. operating temperature
<b>K (NiCr-Ni)</b>	400 °C <sup>1)</sup>
<b>J (Fe-CuNi)</b>	400 °C <sup>1)</sup>
<b>E (NiCr-CuNi)</b>	400 °C <sup>1)</sup>
<b>T (Cu-CuNi)</b>	300 °C
<b>N (NiCrSi-NiSi)</b>	400 °C <sup>1)</sup>

1) higher temperatures on request

The application range of these thermometers is limited by the permissible max. temperature of the thermocouple, of the sheath material/pipe material, as well as the max. temperature of the process connection. If the temperature under measurement is higher than the permissible temperature at the cable access point, the distance between the cable transition and the critical temperature has to be adapted accordingly by an increased sensor length.

Listed sensor types are available both as single or dual thermocouples. The measuring point (hot junction) of the probe is supplied as ungrounded unless specified otherwise.

### Sensor limiting error

A cold junction temperature of 0 °C is taken as the basis for the definition of the sensor limiting error of thermocouples.

### Type K

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +375 °C	± 1.5 °C
<b>1</b>	+375 °C ... +1000 °C	± 0.0040 •   t   <sup>1)</sup>
<b>2</b>	-40 °C ... +333 °C	± 2.5 °C
<b>2</b>	+333 °C ... +1200 °C	± 0.0075 •   t   <sup>1)</sup>
<b>ISA (ANSI) MC96.1-1982</b>		
<b>Standard</b>	0 °C ... +1250 °C	± 2.2 °C or <sup>2)</sup> ± 0.75 %
<b>Special</b>	0 °C ... +1250 °C	± 1.1 °C or <sup>2)</sup> ± 0.4 %

### Type J

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +375 °C	± 1.5 °C
<b>1</b>	+375 °C ... +750 °C	± 0.0040 •   t   <sup>1)</sup>
<b>2</b>	-40 °C ... +333 °C	± 2.5 °C
<b>2</b>	+333 °C ... +750 °C	± 0.0075 •   t   <sup>1)</sup>
<b>ISA (ANSI) MC96.1-1982</b>		
<b>Standard</b>	0 °C ... +750 °C	± 2.2 °C or <sup>2)</sup> ± 0.75 %
<b>Special</b>	0 °C ... +750 °C	± 1.1 °C or <sup>2)</sup> ± 0.4 %

### Type E

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +375 °C	± 1.5 °C
<b>1</b>	+375 °C ... +800 °C	± 0.0040 •   t   <sup>1)</sup>
<b>2</b>	-40 °C ... +333 °C	± 2.5 °C
<b>2</b>	+333 °C ... +900 °C	± 0.0075 •   t   <sup>1)</sup>

### Type T

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +125 °C	± 0.5 °C
<b>1</b>	+125 °C ... +350 °C	± 0.0040 •   t   <sup>1)</sup>
<b>2</b>	-40 °C ... +133 °C	± 1.0 °C
<b>2</b>	+133 °C ... +350 °C	± 0.0075 •   t   <sup>1)</sup>

### Type N

Class	Temperature range	Limiting error
<b>DIN EN 60 584 part 2</b>		
<b>1</b>	-40 °C ... +375 °C	± 1.5 °C
<b>1</b>	+375 °C ... +1000 °C	± 0.0040 •   t   <sup>1)</sup>
<b>2</b>	-40 °C ... +333 °C	± 2.5 °C
<b>2</b>	+333 °C ... +1200 °C	± 0.0075 •   t   <sup>1)</sup>

1) | t | is the value of the temperature in °C without consideration of the sign

2) Whichever is larger.

Limiting error with selected temperature in °C for thermocouples type K and type J

Temperature (ITS 90) °C	Limiting error Class 1 °C	Limiting error Class 2 °C
<b>0</b>	± 1.5	± 2.5
<b>100</b>	± 1.5	± 2.5
<b>200</b>	± 1.5	± 2.5
<b>300</b>	± 1.5	± 2.5
<b>400</b>	± 1.6	± 3.0
<b>500</b>	± 2.0	± 3.75
<b>600</b>	± 2.4	± 4.5

## Process connection

### TC50-O: with metal contact block

Design: contact block for screwing or welding to flat surface  
Material: stainless steel  
Dimensions: see drawing  
other versions on request

### TC50-P: with weld on sheet

Design: weld on sheet  
Material: stainless steel  
Dimensions: see drawing  
other versions on request

### TC50-Q: with worm drive hose clip

Design: worm drive hose clip  
Material: stainless steel  
Dimensions: see drawing  
other versions on request

### TC50-T: with washer

Design: centric drilled washer  
Material: stainless steel  
Dimensions: see drawing  
other versions on request

### TC50-U: with magnet

Versions on request

## Metallic sensor

Material: stainless steel  
Diameter: 3 mm or 6 mm  
Length: selectable

**Surface thermocouples can be constructed in two different ways:**

### ■ Tubular design

The tubular design is characterised by a rigid construction of the metal sensor tip, therefore tubular designs must not be bent.

The inner part of the resistance sensor is connected directly to an insulated lead, therefore tubular cable thermocouples can only be used up to the temperatures specified for the cable (see operating temperatures).

### ■ Sheathed design

In sheathed thermocouples the flexible part of the sensor is a mineral-insulated cable (MI-cable).

This consists of a stainless steel outer sheath with a lead forced into it, insulated with a highly-compressed ceramic powder.

Sheathed thermocouples may be flexed with a radius 3-times of the sheath diameter – except for the transition sheath.

Due to this flexibility, sheathed thermocouples can be applied even at points that are difficult to access.

## Transitions

The junction between the metal part of the thermocouple and the connecting cable or wire is either crimped, rolled or cast, depending on the design. This area must not be submerged into the process and must not be bent. Compression fittings should not be attached to the transition. The type and dimensions of the transition depend largely on the combination between input leads and metal sensor and the sealing requirements.

Dimension T denominates the length of the transition.

Criterion	Dimension T in mm	Ø transition in mm
Probe Ø = transition Ø	not applicable	identical to probe
Ø 3 mm with crimped transition	45	6
Ø 6 mm with crimped transition	45	7
Ø 8 mm with crimped transition	45	10

## Connection cable

Numerous insulating materials are available to adapt to different prevailing conditions.  
The cable end can be supplied ready for connection, fitted with a plug as an option, also with connected fieldcase.

### Connection cable (standard)

- Thermocouple, adapted to the sensor
- Cross-section: approx. 0.22 mm<sup>2</sup> (standard version)
- Number of wire: according to number of sensor
- Insulation material: PVC, silicon, Teflon® or fibreglass
- Shielding (option)

### Sheath material

- Ni-alloy 2.4816 (Inconel 600)
- Stainless steel
- Others on request

## Operating Temperatures maximum

### ■ Connection cable and single lead wires

The maximum temperature permissible at each point of the connecting cable is that specified for the connecting cable. The sensor itself could, possibly, be subjected to higher temperatures.

The following temperature limits apply to conventional connecting cables:

PVC	-20 °C ... +100 °C
Silicon	-50 °C ... +200 °C
Teflon®	-50 °C ... +250 °C
Fibreglass	-50 °C ... +400 °C

Since an isolated cable is also fitted inside the metallic probe of the tubular design, the operating limits of the connection wire apply.

### ■ Transition

The temperature at the transition is further limited by the use of potted sealing compound.

Maximum temperature of the compound: 120 °C

Option: 250 °C

(Other versions on request)

### ■ Plugs

For optionally-fitted connecting plugs the maximum permissible temperature at the plug is 85 °C

### ■ Operating temperature

If the temperature to be measured is higher than the permissible temperatures at the cable, plug or transition, the metal part of the sensor must be long enough to protrude from the hot zone. Care must be taken that the lowest of the maximum operating temperatures of cable, transition or plug are not exceeded.

## Ingress protections

### ■ IP protection

Surface thermocouples can be delivered up to an ingress protection of IP 65 (depending on the cable-sheath material and the number of wires). In a special design, IP 67 is also possible on request.

For connectors with sheathed glass fibre the combination with an explosion-protected design is excluded.

### ■ Explosionsschutz (Option)

Surface thermocouples of the TC50 product range are available with a type-examination certificate for protection classes Ex-i and Ex-n (Directive 94/9/EG).

The devices comply with the requirements of the directive 94/9/EG (ATEX), EEx-i, for gases and dust. The classification or suitability of the device (approved power P<sub>max</sub>, minimum clearances from hot surfaces as well as the permissible ambient temperature) for the appropriate category should be taken from the type-examination certificate or operating instructions.

### Note:

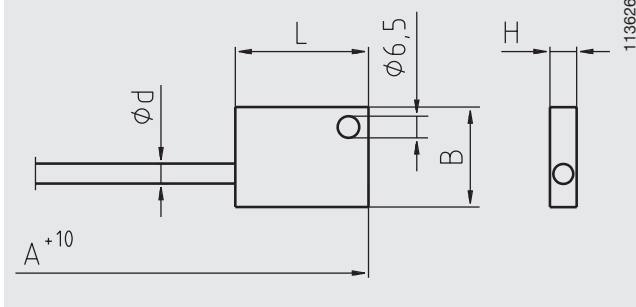
When mounting thermometers with flying leads, the personnel fitting them must ensure that the connection is carried out properly and in compliance with the appropriate regulations. When the thermometer cables are terminated within the hazardous area, suitable adapters / connectors should be used.

Flying leads must be connected outside of the hazardous area or, when operated in dust explosive atmospheres, within an enclosure which is certified according to the 94/9/EC and EN 50 281-1-1 directives, and provides an ingress protection of at least IP 65.

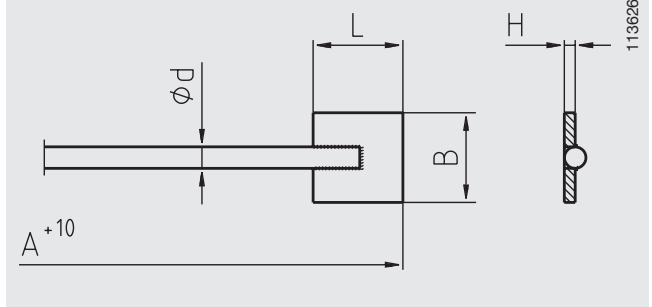
A minimum air and creepage distance of 2 mm must be ensured.

## Dimensions in mm

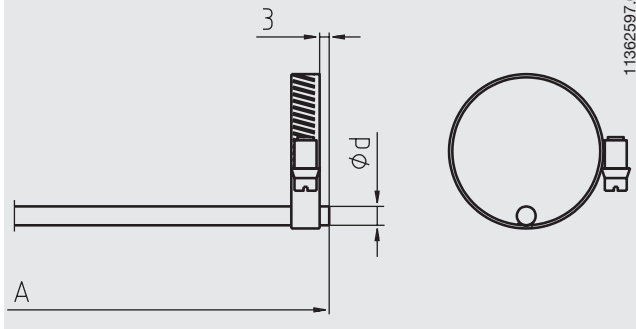
**TC50-O** contact block with bore



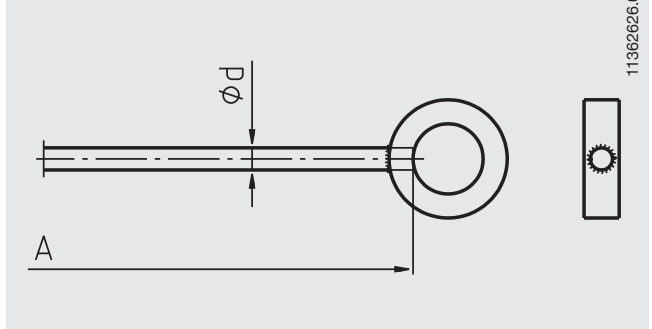
**TC50-P** weld on sheet



**TC50-Q** worm drive hose clip



**TC50-T** washer



### Please note:

The complete A length must always be seen in connection with the drawings on page 6 and 7.

Process connection	Dimensions in mm		
	width x length x height (W x L x H)	for pipe diameter	outer-Ø x inner-Ø x thickness (AD x ID x d)
Metal contact block with bore d = 6.5 mm	30 x 40 x 8	-	-
Weld on sheet	25 x 25 x 3.0	-	-
Worm drive hose clip	-	7 ... 17	-
Worm drive hose clip	-	14 ... 34	-
Worm drive hose clip	-	17 ... 57	-
Worm drive hose clip	-	60 ... 75	-
Worm drive hose clip	-	78 ... 93	-
Worm drive hose clip	-	97 ... 112	-
Washer	-	-	38.1 x 19.1 x 9.5

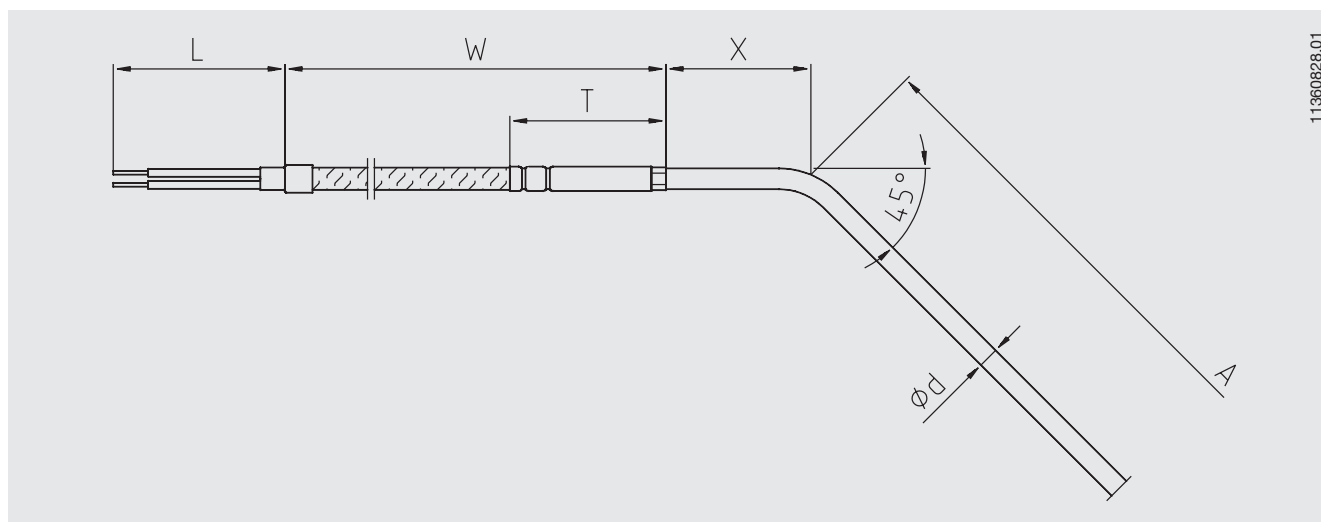
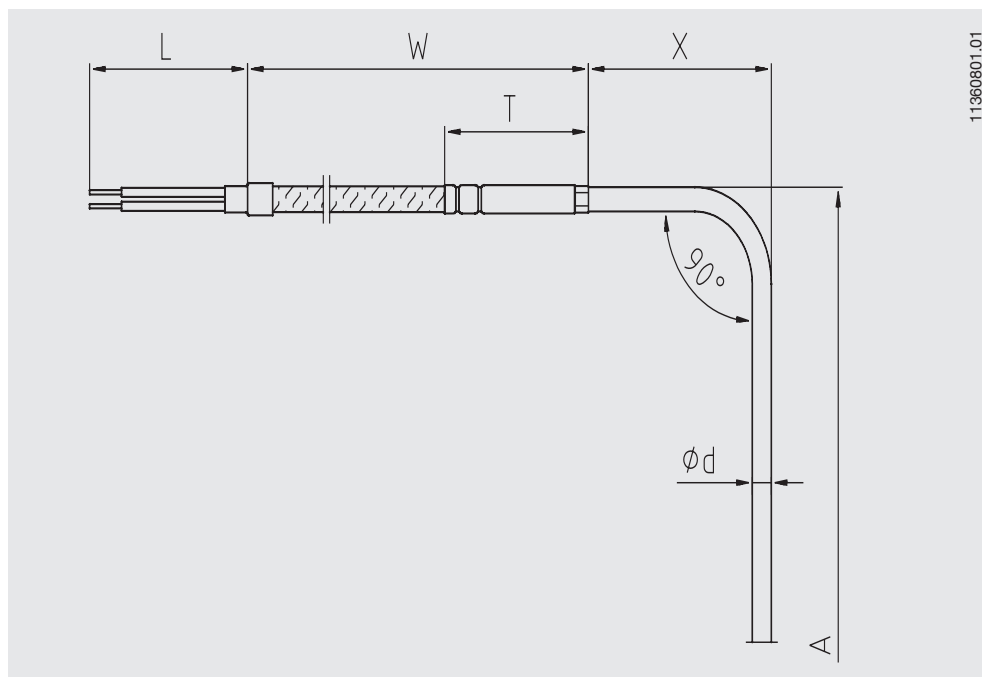
## Angled probes

Sheathed surface thermocouples can be supplied in pre-bent shapes. In this case the position of the bend is indicated by a further dimension.

Dimension X denominates the distance of the bend from the lower edge of the transition.

Other bend angles on request.

Equalisation loops are also possible on request.



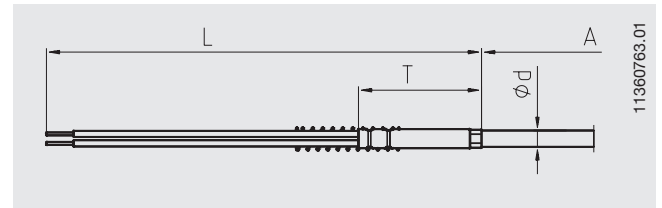
## Cable end design

Dimension A defines the probe length, dimension W the length of the connection lead, L the length of the free single strands and dimension T the transition (if present).

T is always a part of lengths W and L respectively. (see table on page 3).

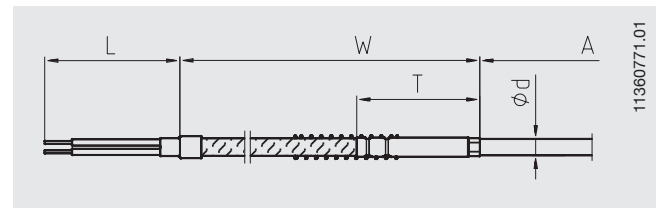
### Connection with single lead wires

Lead length 150 mm, other length on request,  
Thermo wire Ø 0.5 mm,  
type of compensating cable according to type of sensor,  
Teflon® insulated, number of conductor wire couples  
according to number of sensors, stripped lead wires, other  
versions on request.



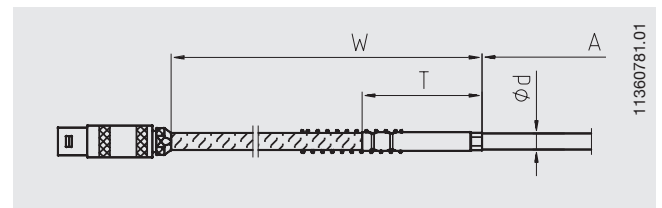
### With connection cable

Cable and probe are firmly connected to each other.  
Cable length to customer specification  
Compensating cable, leads 0.22 mm², type of compensat-  
ing cable according to type of sensor, number of cores  
according to number of sensors, stripped lead wires.



### With connector fitted on connection cable

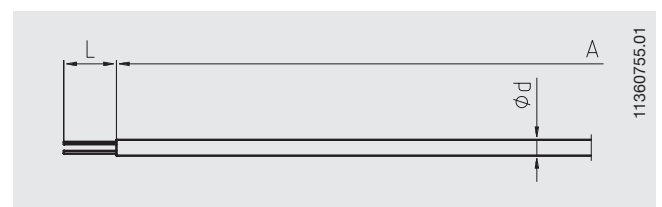
The optional connection plug is fitted to the flexible  
connecting cable.



### Designs with bare connecting wires

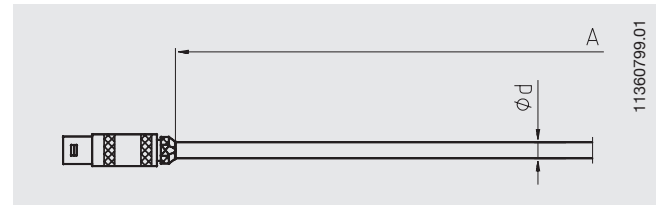
The inner leads of the mineral-insulated cable protrude.  
L = 20 mm (standard).

The length of the flying leads can be adapted to customer  
requirements. These blank internal leads are made of solid  
wire and thus are not suitable for longer distances.



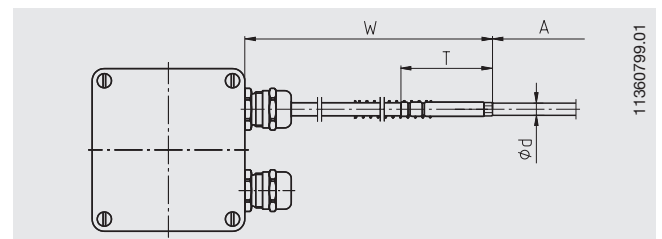
### Version with plug fitted directly to the sensor

These versions are based on the design with bare connect-  
ing wires. The plug is fitted directly to the metal sensor.



### Version with connected fieldcase

The cable gland (plastic) connects the connection cable  
with the fieldcase (plastic, ABS).  
A second cable gland is mounted for the flying lead.  
An aluminium case is available as an option.



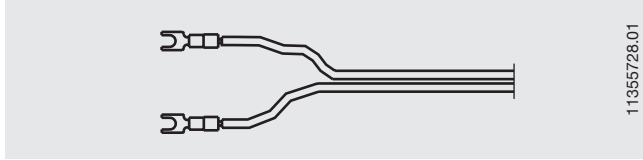
## Plug (option)

Surface thermocouples can be supplied with plugs fitted.

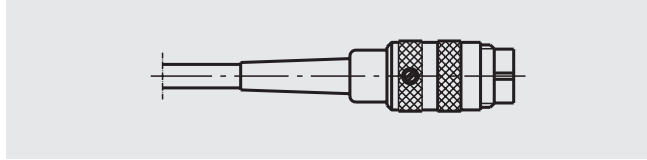
The following options are available:

### ■ Spade lugs

(not suitable for versions with bare connecting wires)

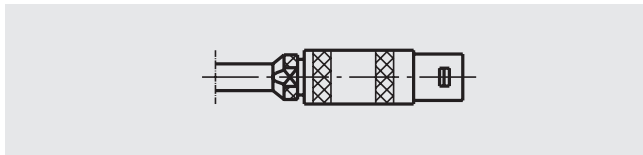


### ■ Screw-in-plug, Binder (male)

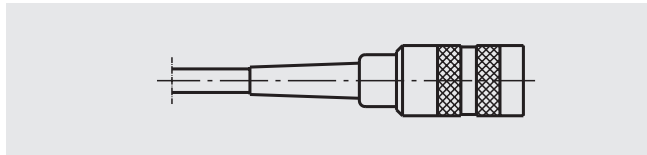


### ■ Lemosa plug size 1 S (male)

### ■ Lemosa plug size 2 S (male)

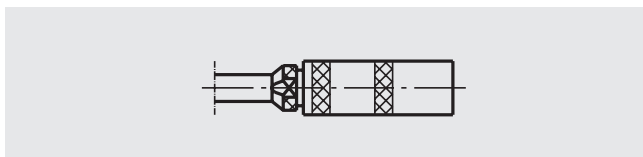


### ■ Screw-in-plug, Binder (female)



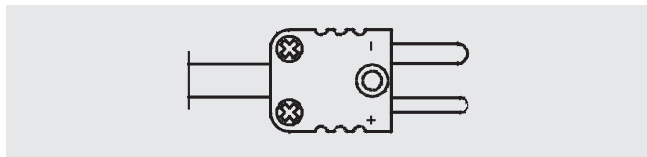
### ■ Lemosa plug size 1 S (female)

### ■ Lemosa plug size 2 S (female)



### ■ Standard thermo plug 2-pin (male)

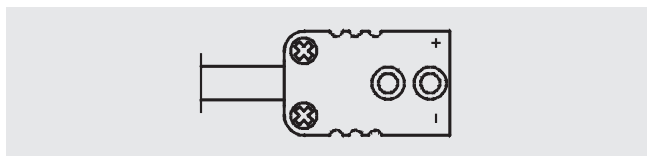
### ■ Miniature thermo plug 2-pin (male)



Other plug versions (sizes) on request.

### ■ Standard thermo plug 2-pin (female)

### ■ Miniature thermo plug 2-pin (female)



## Further options

### Bend protection


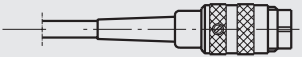
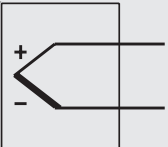
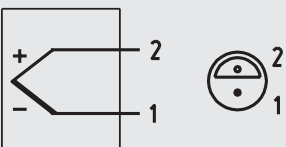
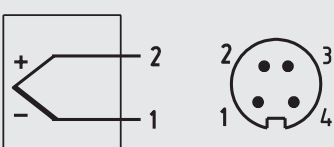
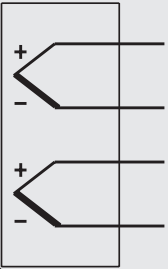
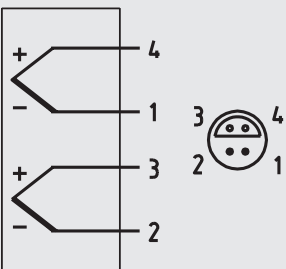
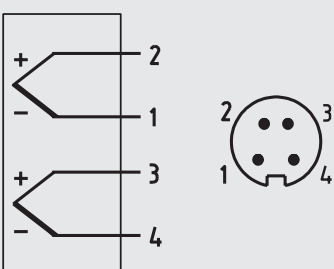
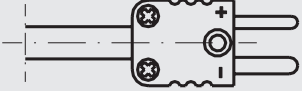
Bend protection (strain relief spring or shrink tubing) serves to protect the transition where the rigid probe and the flexible connection cable join. This should always be used when any movement of the connection cable relative to the thermometer mounting point is expected.

For installation in accordance with Ex-n, bend protection is obligatory.

The standard length of the strain relief spring is 60 mm.



## Electrical connection

Cable		Lemosa plug, (male) on cable		Binder plug (series 680), (male) on cable (screw-in-plug)	
		3171 966.01		3374 896.01	3374900.02
Colour coding of the wire ends see table					
single thermocouple					
dual thermocouple					
Thermo plug		Positive and negative terminal are marked. Two thermo connectors are used with dual thermo-couples.			

Other connector plugs and other PIN assignments on request.

## Colour code of cable

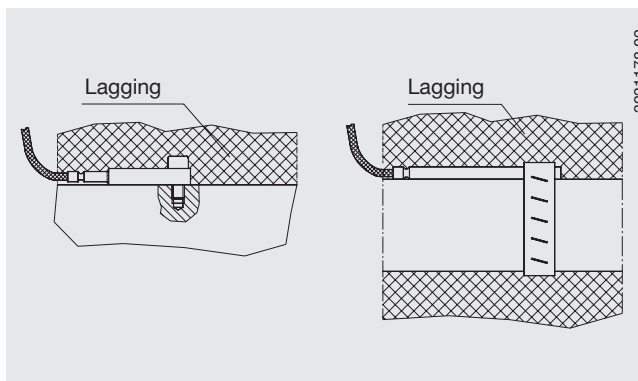
Sensor type	Standard	Positive terminal	Negative terminal
K	DIN EN 60 584	green	white
J	DIN EN 60 584	black	white
E	DIN EN 60 584	violet	white
T	DIN EN 60 584	brown	white
N	DIN EN 60 584	pink	white

## Mounting instructions

The basic requirements to ensure perfect measurement results is to retain good thermal contact between the probe and the outside wall of the tank or pipe. Minimal heat loss to the ambient from the probe and measuring point is imperative.

The probe should have direct metallic contact with the measuring point and have firm contact with the measuring point.

Lagging must be applied where the probe has been mounted to avoid error due to heat loss. This lagging must have sufficient temperature resistance and is not provided with the probe.



Modifications may take place and materials specified may be replaced by others without prior notice.  
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.



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