

Cable thermocouple Model TC40

WIKA data sheet TE 65.40



for further approvals
see page 2

Applications

- For direct installation into the process
- Machine building
- Motors
- Bearing
- Pipelines and vessels

Special features

- Application ranges from 0 ... +1,200 °C (32 ... 2,192 °F)
- For insertion, screw-in with optional process connection
- Cable from PVC, silicone, PTFE or glass fibre
- High mechanical strength
- Explosion-protected versions



Cable thermocouples, model TC40

Description

Cable thermocouples are particularly suited to those applications in which the metallic sensor tip is mounted directly into bored holes (e.g. in machine components) or directly into the process for any application with no chemically aggressive media or abrasion.

For mounting into a thermowell, a spring-loaded compression fitting should be provided, since only this can press the sensor tip into the bottom of the thermowell. Otherwise a potentially critical force could be exerted on the measuring tip.

In the standard version the cable probe are manufactured without process connections. Fastening elements such as threaded fittings, union nuts, etc. can also be used.

Explosion protection (option)





TC40 series cable thermocouples are available with an EC-type examination certificate for “intrinsically safe”, Ex i, ignition protection.







These instruments comply with the requirements of the ATEX directive for gases and dusts.

The permissible power P_{max} as well as the permissible ambient temperature for the respective category can be seen on the EC-type examination certificate and in the operating instructions.

The internal inductance (L_i) and capacitance (C_i) for cable probes are found on the product label and they should be taken into account when connecting to an intrinsically safe power supply.

Approvals (explosion protection, further approvals)

Logo	Description	Country
	EU declaration of conformity ATEX directive (option) Hazardous areas - Ex i Zone 0 gas [II 1G Ex ia IIC T3 ... T6 Ga] Zone 1 mounting to zone 0 gas [II 1/2G Ex ia IIC T3 ... T6 Ga/Gb] Zone 1 gas [II 2G Ex ia IIC T3 ... T6 Gb] Zone 20 dust [II 1D Ex ia IIIC T125 ... T65 °C Da] Zone 21 mounting to zone 20 dust [II 1/2D Ex ia IIIC T125 ... T65 °C Da/Db] Zone 21 dust [II 2D Ex ia IIIC T125 ... T65 °C Db] - Ex n Zone 2 gas [II 3G Ex nA IIC T1 ... T6 Gc X] Zone 22 dust [II 3D Ex tc IIIC T440 ... T80 °C Dc X]	European Union
	IECEx (option) (in conjunction with ATEX) Hazardous areas - Ex i Zone 0 gas [Ex ia IIC T3 ... T6 Ga] Zone 1 mounting to zone 0 gas [Ex ia IIC T3 ... T6 Ga/Gb] Zone 1 gas [Ex ia IIC T3 ... T6 Gb] Zone 20 dust [Ex ia IIIC T125 ... T65 °C Da] Zone 21 mounting to zone 20 dust [Ex ia IIIC T125 ... T65 °C Da/Db] Zone 21 dust [Ex ia IIIC T125 ... T65 °C Db]	International
	EAC (option) Hazardous areas - Ex i Zone 0 gas [0 Ex ia IIC T3/T4/T5/T6] Zone 1 gas [1 Ex ib IIC T3/T4/T5/T6] Zone 20 dust [DIP A20 Ta 65 °C/Ta 95 °C/Ta 125 °C] Zone 21 dust [DIP A21 Ta 65 °C/Ta 95 °C/Ta 125 °C] - Ex n Zone 2 gas [Ex nA IIC T6 ... T1] Zone 22 dust [DIP A22 Ta 80 ... 440 °C]	Eurasian Economic Community
	INMETRO (option) Hazardous areas - Ex i Zone 0 gas [Ex ia IIC T3 ... T6 Ga] Zone 1 mounting to zone 0 gas [Ex ib IIC T3 ... T6 Ga/Gb] Zone 1 gas [Ex ib IIC T3 ... T6 Gb] Zone 20 dust [Ex ia IIIC T125 ... T65 °C Da] Zone 21 mounting to zone 20 dust [Ex ib IIIC T125 ... T65 °C Da/Db] Zone 21 dust [Ex ib IIIC T125 ... T65 °C Db]	Brazil

Logo	Description	Country
	NEPSI (option) Hazardous areas - Ex i Zone 0 gas [Ex ia IIC T3 ~ T6] Zone 1 mounting to zone 0 gas [Ex ia/ib IIC T3 ~ T6] Zone 1 gas [Ex ib IIC T3 ~ T6] Zone 20 dust [Ex iaD 20 T65 ~ T125] Zone 21 mounting to zone 20 dust [Ex ibD 20/21 T65 ~ T125] Zone 21 dust [Ex ibD 21 T65 ~ T125] - Ex n Zone 2 gas [Ex nA IIC T1 ~ T6 Gc]	China
	KCs - KOSHA (option) Hazardous areas - Ex i Zone 0 gas [Ex ia IIC T4 ... T6] Zone 1 gas [Ex ib IIC T4 ... T6]	South Korea
-	PESO (option) Hazardous areas - Ex i Zone 0 gas [Ex ia IIC T1 ... T6 Ga] Zone 1 mounting to zone 0 gas [Ex ib IIC T3 ... T6 Ga/Gb] Zone 1 gas [Ex ib IIC T3 ... T6 Gb]	India
	GOST (option) Metrology, measurement technology	Russia
	KazInMetr (option) Metrology, measurement technology	Kazakhstan
-	MTSCHS (option) Permission for commissioning	Kazakhstan
	BelGIM (option) Metrology, measurement technology	Belarus
	Uzstandard (option) Metrology, measurement technology	Uzbekistan

Instruments marked with "ia" may also be used in areas only requiring instruments marked with "ib" or "ic".
 If an instrument with "ia" marking has been used in an area with requirements in accordance with "ib" or "ic", it can no longer be operated in areas with requirements in accordance with "ia" afterwards.

Approvals and certificates, see website

Sensor

Sensor types

Model	Operating temperatures per			
	IEC 60584-1		ASTM E230	
	Class 2	Class 1	Standard	Special
K	-40 ... +1,200 °C	-40 ... +1,000 °C	0 ... 1,260 °C	
J	-40 ... +750 °C	-40 ... +750 °C	0 ... 760 °C	
E	-40 ... +900 °C	-40 ... +800 °C	0 ... 870 °C	
N	-40 ... +1,200 °C	-40 ... +1,000 °C	0 ... 1,260 °C	
T	-40 ... +350 °C		0 ... 370 °C	

The actual operating temperature of the thermometers is limited both by the maximum permissible working temperature and the diameter of the thermocouple and the MI cable, as well as by the maximum permissible working temperature of the thermowell material.

If the temperature to be measured is higher than the permissible temperature at the cable transition, the distance between the cable transition and the critical temperature must be adjusted accordingly by an increased probe length.

For detailed specifications for thermocouples, see IEC 60584-1 or ASTM E230 and Technical information IN 00.23 at www.wika.com.

Tolerance value

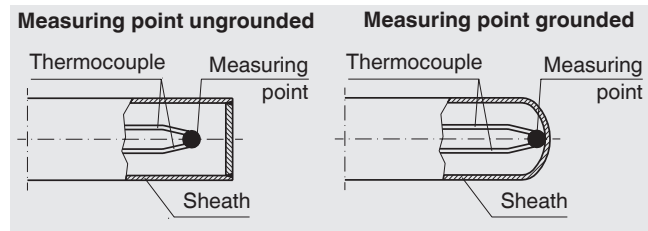
For the tolerance value of thermocouples, a cold junction temperature of 0 °C has been taken as the basis.

Listed models are available both as single or dual thermocouples. The thermocouple will be delivered with an ungrounded measuring point, unless explicitly specified otherwise.

IP ingress protection

Cable thermocouples can be delivered with up to IP65 (dependent on cable sheath material and number of wires). With a special design, IP67 is also possible on request. Connection leads with a glass-fibre sheath cannot be combined with an explosion-proof version.

Sensor tip designs



For temperature measurement in a solid body, the diameter of the bore into which the sensor should be inserted, should be no more than 1 mm larger than the sensor diameter.

Cable thermocouples can be designed in two different ways:

■ Tubular design

The tubular design features a rigid construction to the metal sensor tip; therefore tubular designs must not be bent. Within the pipe, the connection cable extends almost to the sensor tip. Therefore tubular cable thermocouples can only be used up to the temperature specified for the cables (see operating temperature).

Tube diameter:

- 4.0 mm
- 4.5 mm
- 6.0 mm
- 8.0 mm
- Others on request

■ Sheathed design

In sheathed thermocouples the flexible part of the sensor is a mineral-insulated cable (sheathed cable). It consists of a stainless steel outer sheath, which contains the insulated internal leads, embedded within a high-density ceramic compound.

Sheathed thermocouples - with the exception of the transition sleeve - may be bent to a radius of 3-times the sheath diameter. Due to this flexibility, the sensor can be used in areas that are difficult to access.

Sheath diameter:

- 0.5 mm
- 1.0 mm
- 1.5 mm
- 3.0 mm
- 4.5 mm
- 6.0 mm
- 8.0 mm
- Others on request

Please note:

The flexibility of the sheathed thermocouple must be considered, especially when the flow rates are relatively high. Designs in which the process connection is not located directly at the cable transition should be considered critical in applications where vibratory or oscillating stresses occur.

Sheath material

- Ni alloy 2.4816 (Inconel 600)
 - up to 1,200 °C (air)
 - standard material for applications which require specific corrosion resistance properties under exposure to high temperatures, resistant to induced stress corrosion cracking and pitting in media containing chloride
 - resistant to corrosion caused by aqueous ammonia in all temperatures and concentrations
 - highly resistant to halogens, chlorine, hydrogen chloride
- Stainless steel
 - up to 850 °C (air)
 - good corrosion resistance with aggressive media as well as steam and flue gases in chemical media

Others on request

Transition

The junction between the metal part of the sensor and the connecting cable or bare wire should not be immersed within the process and must not be bent. Compression fittings should not be attached to the transition sleeve.

The dimension T describes the length of the transition sleeve.

Criterion	Dimension T ¹⁾ in mm	Ø transition sleeve in mm
Probe Ø = transition sleeve Ø	40	Identical to probe
Ø 2 ... 4.5 mm with crimped transition sleeve	45	6
Ø 6 mm with crimped transition sleeve	45	7
Ø 8 mm with crimped transition sleeve	45	10

For operating temperatures < -40 °C the transition sleeve is designed as follows:

Criterion	Dimension T in mm	Ø transition sleeve in mm
Probe Ø = transition sleeve Ø	60	Identical to probe
Ø 2 ... 4.5 mm with crimped transition sleeve	60	8
Ø 6 mm with crimped transition sleeve	60	8
Ø 8 mm with crimped transition sleeve	60	10

1) The transition sleeve is generally 60 mm long for 2 x 4-wire sensor connection method.

Connecting cable

There are various insulating materials available to suit any particular environmental conditions. The cable ends can be prepared ready for connection, or as an option, can be fitted with connectors.

Connection cable (standard)

- Thermocouple, adapted to the sensor
- Cross-section: min. 0.22 mm²
- Number of thermocouples: dependent on the connection method
- Insulation material: PVC, silicone, PTFE or fibreglass
- Screen (option): Recommendation for connection to transmitter

Operating temperatures

■ Connection cable and single wires

At any point on the connection cable, the maximum temperature that may be attained is that for which the connection cable is specified. The thermocouple itself can potentially withstand higher temperatures.

For the common connection wires the following temperature limits apply:

PVC	-20 ... +100 °C
Silicone	-50 ... +200 °C
PTFE	-50 ... +250 °C
Fibreglass	-50 ... +400 °C

■ Transition

The temperature at the transition is further limited by the use of a potted sealing compound. Temperature range of the potting compound: -40 ... +150 °C
Option: 250 °C
(other variants on request)

Temperature range of the special low-temperature version: -60 ... +120 °C ²⁾

²⁾ only available with selected approvals

■ Connector

With the option of a coupler connector fitted the maximum permissible temperature range is:

Lemosa: -55 ... +250 °C
Binder: -40 ... +85 °C

■ Working temperature

If the temperature to be measured is higher than the permissible temperature at the cable, connector or transition, the metallic part of the probe must be long enough to be outside of the hot zone. It should be noted that the lowest of the max. operating temperatures for the cable, transition or connector must not be exceeded.

Designs

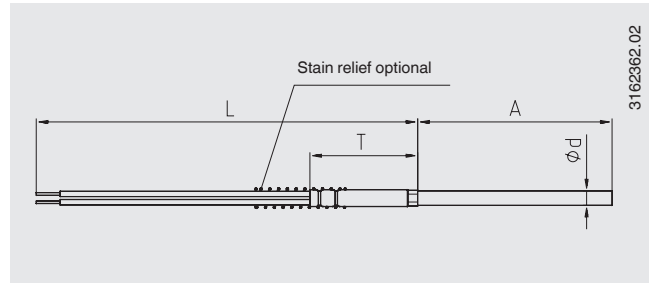
Cable thermocouples are classified into the following variants, depending on the nature of their electrical connections:

- With single wires
- With connection cable
- With connector
- With bare connecting wires

Connection with single wires

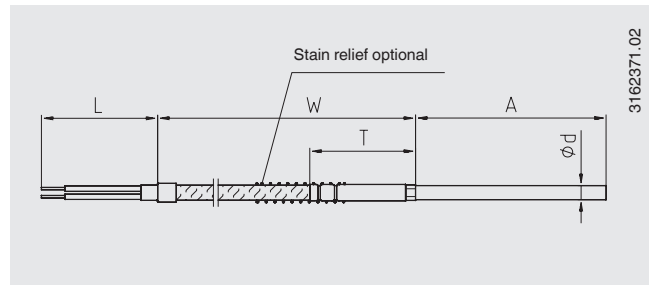
Cable length 150 mm, other lengths on request, thermo wire \varnothing 0.5 mm, compensating cable type according to the sensor type, PTFE-insulated, number of cable end pairs according to the number of sensors, bare wire ends other versions on request

The dimension A describes the insertion length into the process. The dimension W describes the length of the connecting wire. L is the length of the single wires. The dimension T describes the transition sleeve (if present), T is always a constituent of the length W or L (see table on page 5).



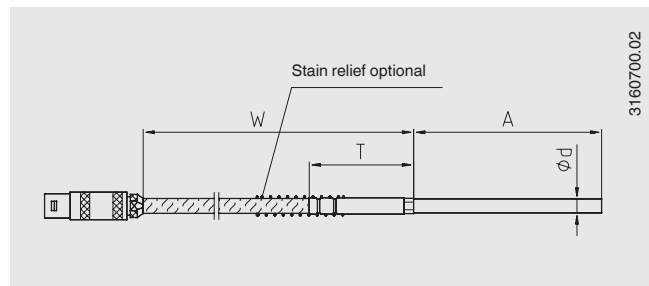
With connection cable

Cable and probe are permanently connected to each other. Cable length to customer specification. Compensating cable, leads 0.22 mm², compensating cable type depending on the sensor type, number of wires according to number of sensors, bare wire ends



With connector fitted to connection cable

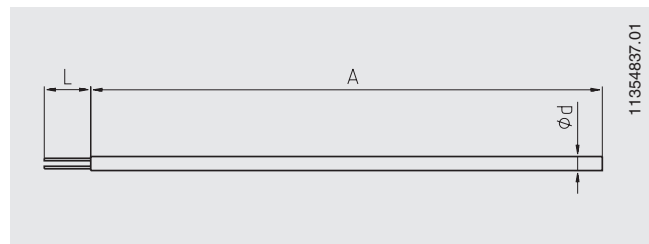
The optional coupler connector is fitted to a flexible connection cable.



Designs with bare connecting wires

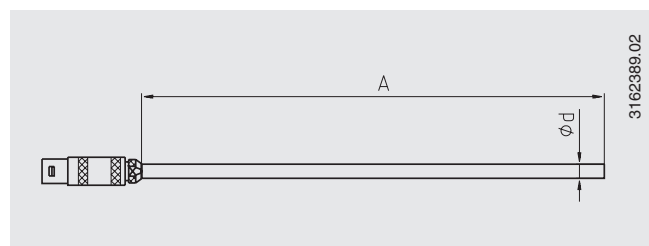
The internal leads of the mineral-insulated cable protrude. L = 20 mm (standard)

The length of the bare connecting wires can be matched to customer requirements. These bare internal leads are made from solid wire, and so are not suitable to be run over long distances.



Design with connector fitted directly to the probe

These designs are based on the design with bare connecting wires. The connector is fitted directly to the metallic probe.



Process connections for straight probes

The cable thermocouples can be fitted with an optional process connection. The dimension A describes the insertion length into the process.

To minimise heat dissipation errors via the threaded connection, the insertion length, A, should be at least 25 mm long. The position of the threaded connection is specified by the dimension X and is not dependent on the connection type.

Please note:

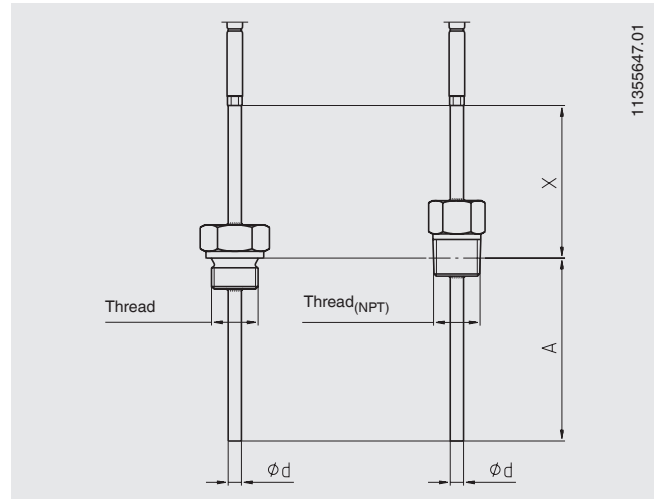
- For parallel threads (e.g. G 1/2) the dimensioning always refers to the sealing collar of the threaded connection nearest the process
- For tapered threads (e.g. NPT) the measurement plane is located approx. in the centre of the thread

Fixed threaded connections/threads

used to mount the probe into a threaded coupling with a female thread.

Insertion length A: in accordance with customer specification
Material: stainless steel, others on request

The probe must be rotated in order to screw it into the process. Therefore, this design must first be mounted mechanically and it can then be electrically connected.



Compression fitting

allows simple adjustment to the required insertion length at the installation point.

Since the compression fitting is adjustable on the probe, the dimensions A and X are stated as the values for the delivered item. The length of the compression fitting determines the smallest possible length, X, of approx. 40 mm.

Material: stainless steel

Ferrule material: stainless steel or PTFE

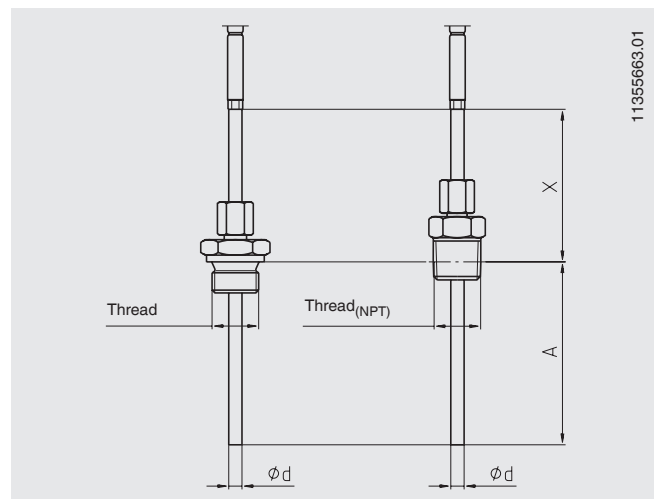
Stainless steel ferrules can be adjusted once; once they have been unscrewed, sliding along the sheath is no longer possible.

- Max. temperature at process connection 500 °C
- Max. pressure load 40 bar

PTFE ferrules can be adjusted several times, after unscrewing, repeated sliding along the sheath is still possible.

- Max. temperature at process connection 150 °C
- For use without pressure

For sheathed thermocouples with a \varnothing of 2 mm, only PTFE ferrules are approved.



Spring-loaded compression fitting

allows easy adjustment to the desired insertion length at the mounting point, while at the same time maintaining the spring pre-tension

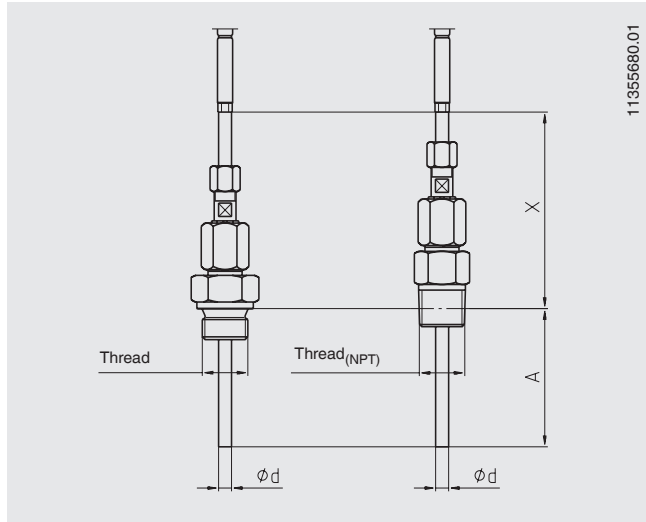
Since the compression fitting is adjustable on the probe, the dimensions A and X are stated as the values for the delivered item. The length of the compression fitting determines the smallest possible length, X, of approx. 80 mm.

Material: stainless steel
Ferrule material: stainless steel

Stainless steel ferrules can be adjusted once; once they have been unscrewed, sliding along the sheath is no longer possible.

Max. temperature at process connection 500 °C

A pressure load on the compression fitting is not intended.



Spring-loaded compression fitting, can work with pressures up to max. 8 bar

allows easy adjustment to the desired insertion length at the mounting point, while at the same time maintaining the spring pre-tension, intended for use with hydraulic oil

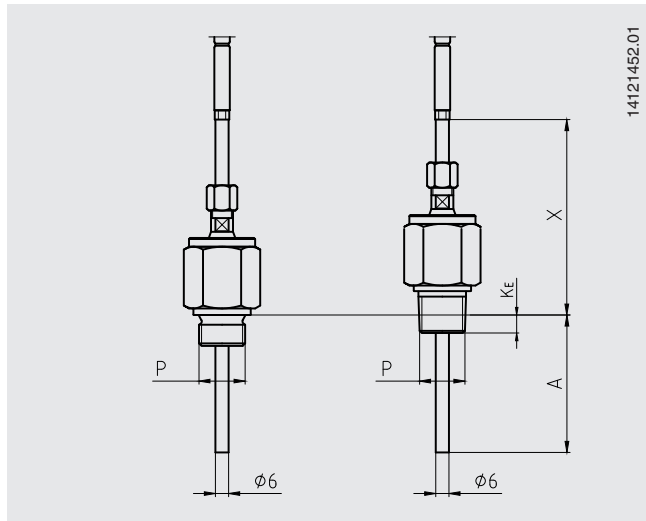
Since the compression fitting is adjustable on the probe, the dimensions A and X are stated as the values for the delivered item. The length of the compression fitting determines the smallest possible length, X, of approx. 80 mm.

Material: stainless steel
Ferrule material: stainless steel

Stainless steel ferrules can be adjusted once; once they have been unscrewed, sliding along the sheath is no longer possible.

Permissible temperature at process connection -30 ... +100 °C

A pressure load on the spring-loaded compression fitting is permissible up to a max. 8 bar.



Union nut

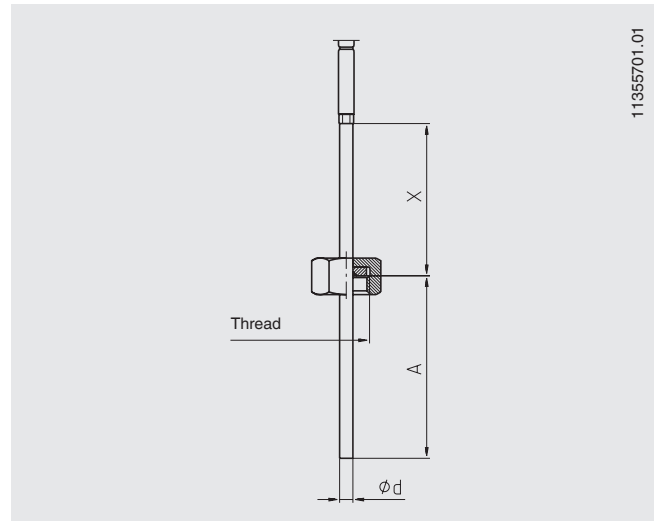
used to mount the probe into a threaded coupling with a male thread.

The probe and threads rotate against each other, so the order in which the mechanical and electrical installation is made is not important.

This option is not advisable for NPT threads.

Insertion length A: in accordance with customer specification

Material: stainless steel, others on request



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Male nut

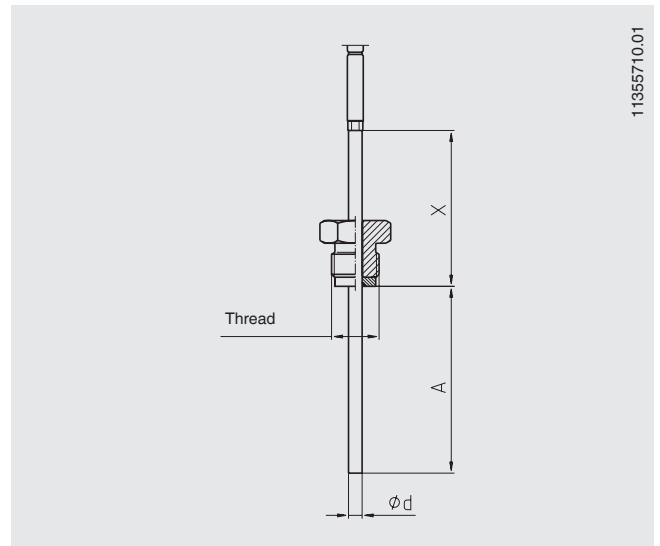
used to mount the probe into a threaded coupling with a female thread.

The probe and threads rotate against each other, so the order in which the mechanical and electrical installation is made is not important.

This option is not advisable for NPT threads.

Insertion length A: in accordance with customer specification

Material: stainless steel, others on request



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Angled probes

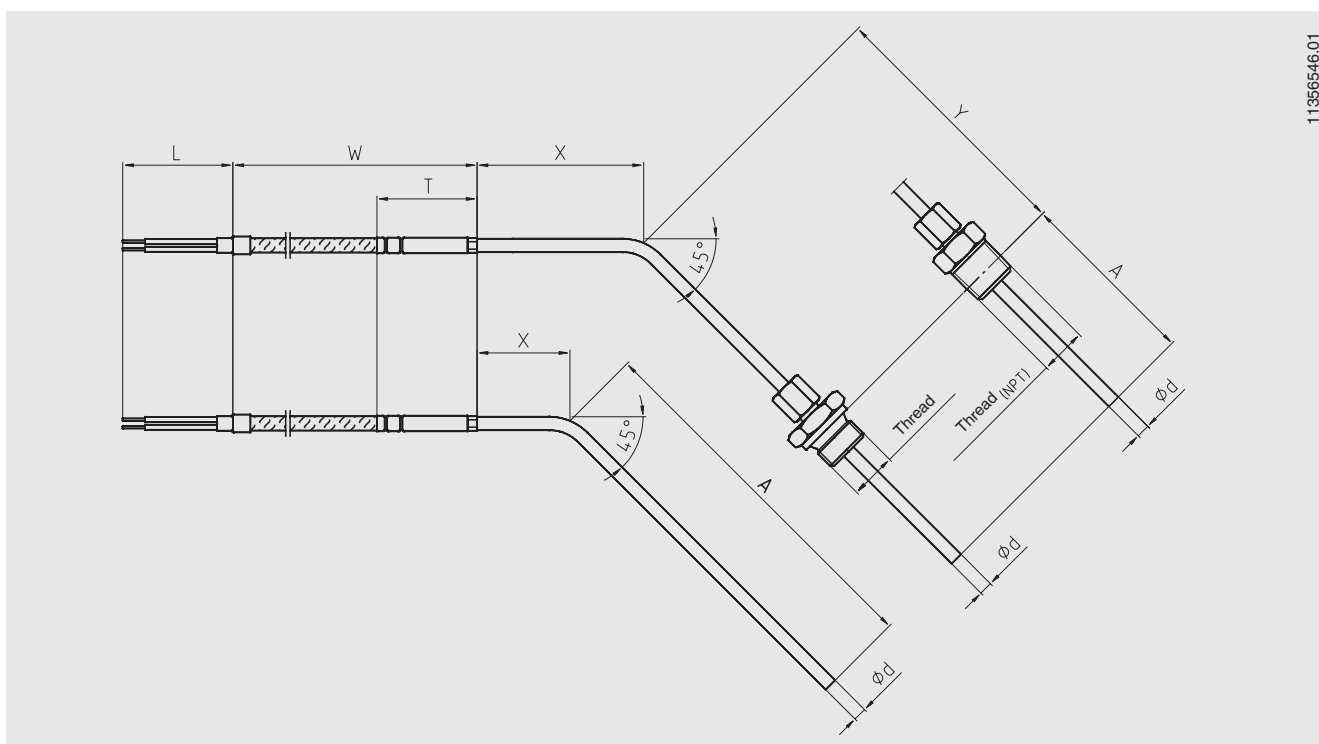
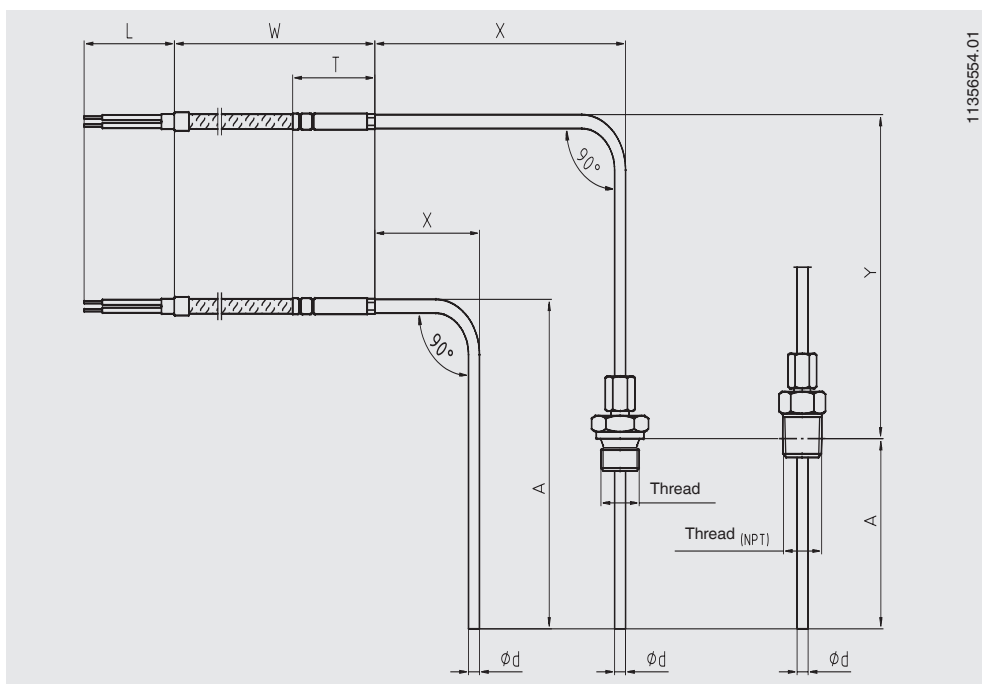
Cable thermocouples made from sheathed cable can be delivered in a pre-formed shape. In this case, the position of the bend is defined by a further dimension.

The dimension X describes the distance of the bend from the lower edge of the transition sleeve.

The dimension A is always the insertion length of the probe, and thus the area which is built in to the process.

If a threaded connection is used on the bent probe, then the dimension Y describes the distance from the centre of the bend to the measurement plane of the threaded connection.

Using a fixed threaded connection is not recommended, as the bent probe would need to be screwed into the process with a wide sweeping movement.



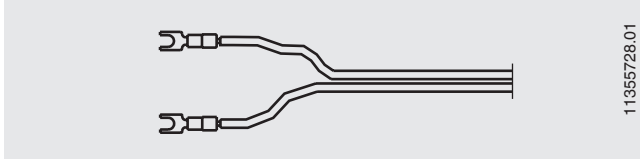
Connector (option)

Cable thermocouples can be supplied with connectors fitted.

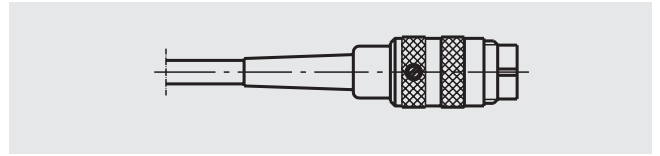
The following options are available:

■ Spade lugs

(not suitable for versions with bare connecting wires)

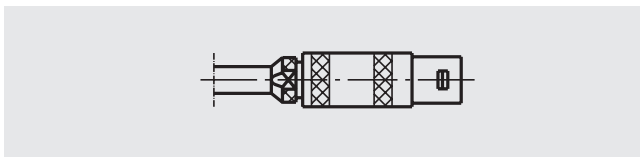


■ Screw-in-plug, Binder (male)

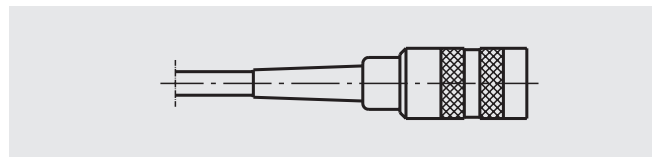


■ Lemos connector size 1 S (male)

■ Lemos connector size 2 S (male)

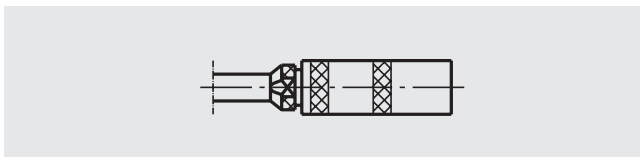


■ Screw-in-plug, Binder (female)



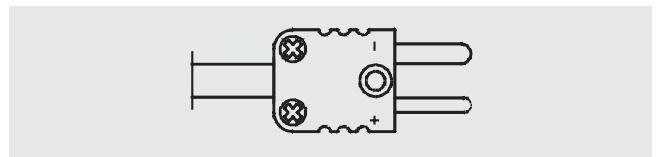
■ Lemos free socket size 1 S (female)

■ Lemos free socket size 2 S (female)



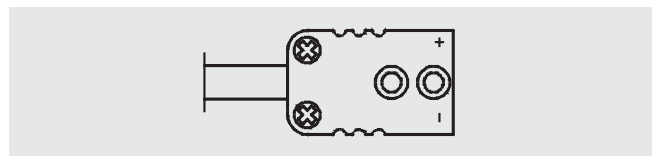
■ Standard thermo connector 2-pin (male)

■ Miniature thermo connector 2-pin (male)



■ Standard thermo socket 2-pin (female)

■ Miniature thermo socket 2-pin (female)



Further options

Stain relief

A stain relief (spring or shrink hose) is used to protect the transition point from rigid probe to flexible connecting cable. This should always be used when a relative movement between the cable and the thermometer mounting is expected.

For designs to Ex n the use of stain relief is obligatory.

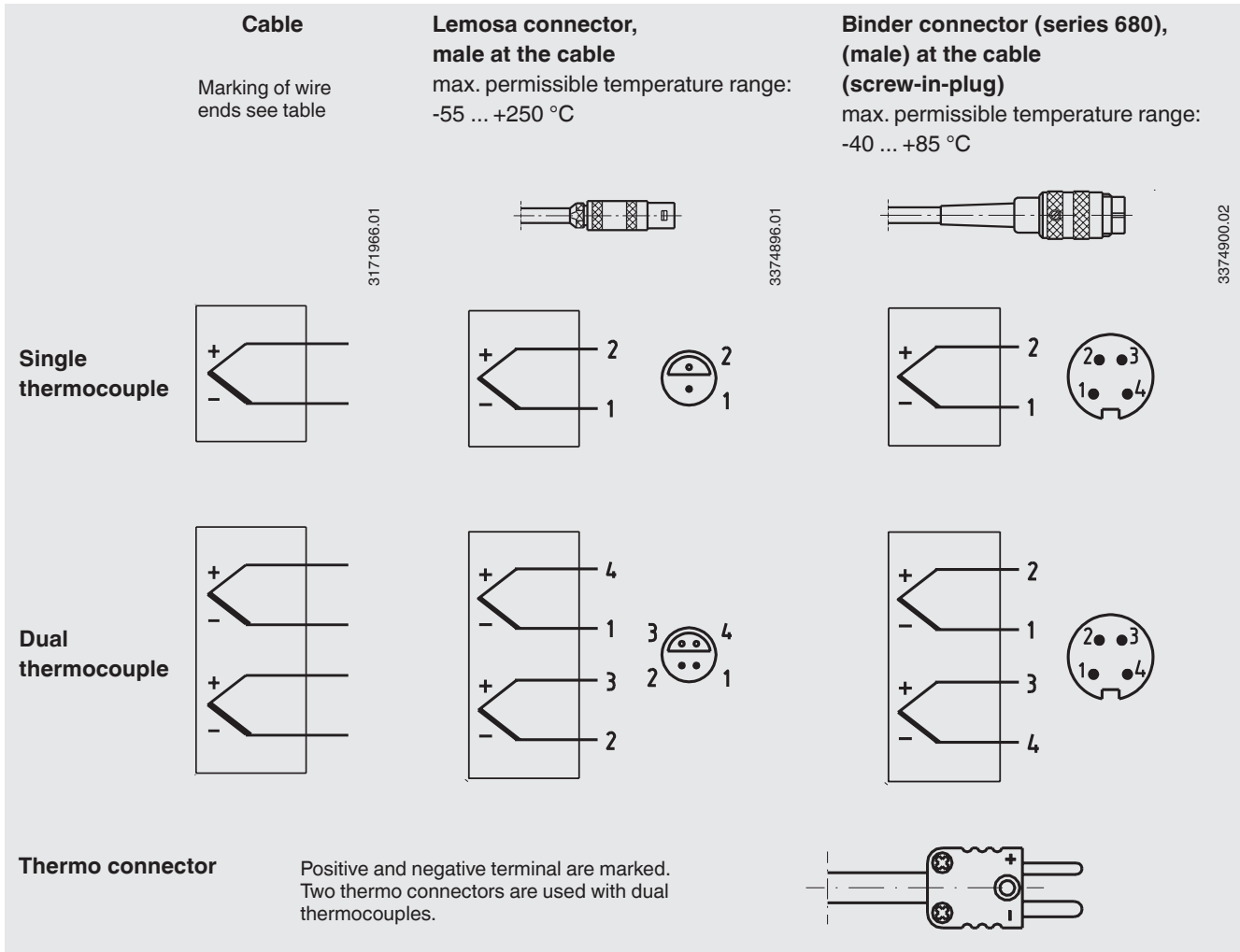
The standard length of the stain relief spring is 60 mm.

Transition sleeve with the same diameter as the probe

Optionally, a transition sleeve can also be selected that has the same diameter as the metal probe. This makes it possible to slide on cable glands or compression fittings from both ends of the probe. The transition is hardly visible.

The operating limits of the transition sleeve do not change, however, i.e. they must still remain outside the process and should not be loaded with a compression fitting.

Electrical connection



Other coupler connectors and pin assignments on request.

Colour code of cable

Sensor type	Standard	Positive	Negative
K	IEC 60584	Green	White
J	IEC 60584	Black	White
E	IEC 60584	Violet	White
T	IEC 60584	Brown	White
N	IEC 60584	Pink	White

Certificates

- 2.2 test report
- 3.1 inspection certificate
- DKD/DAkkS calibration certificate

Ordering information

Model / Explosion protection / Sensor version / Threaded connection version / Thread size / Materials / Sensor diameter / Measuring element / Connection method / Temperature range / Connection cable, jacket / Lead ends version / Certificates / Options

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