

Application

- For direct installation into the process
- General industrial services

Features

- Single and double thermocouple
- Sensing element according to EN 60584-1:
 - Type K (NiCr-NiAl)
 - Type J (Fe-CuNi)
 - Type N (NiCrSi-NiSi)
 - Type E (NiCr-CuNi)
 - Type T (Cu-CuNi)
- Versions with/without connector
- Cable from PVC, silicone, PFA or other materials

Options

- Cable material according to customer's specification
- Reduced diameter of the thermowell
- Spring protection at cable relief
- ATEX, IECEx certification

Description

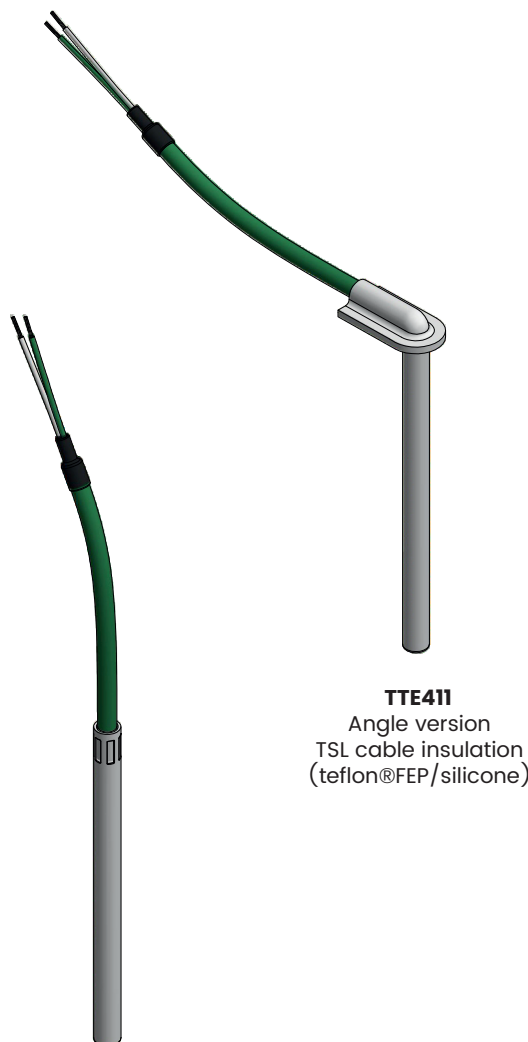
Cable thermocouples TTE411 and TTE412 are designed for push-in directly into the process or into the machine parts.

Complete probe consist of thermocouple cable and protection tube. Inner space between the measuring junction and the wall of the protection tube is filled by thermo-conductive mass, which ensures very good heat transfer and high vibration resistance.

Insertion length, protection tube diameter, number of sensing elements, accuracy, cable length and material can be selected individually for the respective application.

Temperature transmitter (Option)

It is possible to use a temperature transmitter with signal output 4÷20mA or 0÷10V in the control cabinet. Transmitters with communication protocol HART®, Profibus® are also available. More details in "Temperature transmitters" section.



TTE411
Angle version
TSL cable insulation
(teflon®/FEP/silicone)

TTE412
Straight version
TSL cable insulation
(teflon®/FEP/silicone)

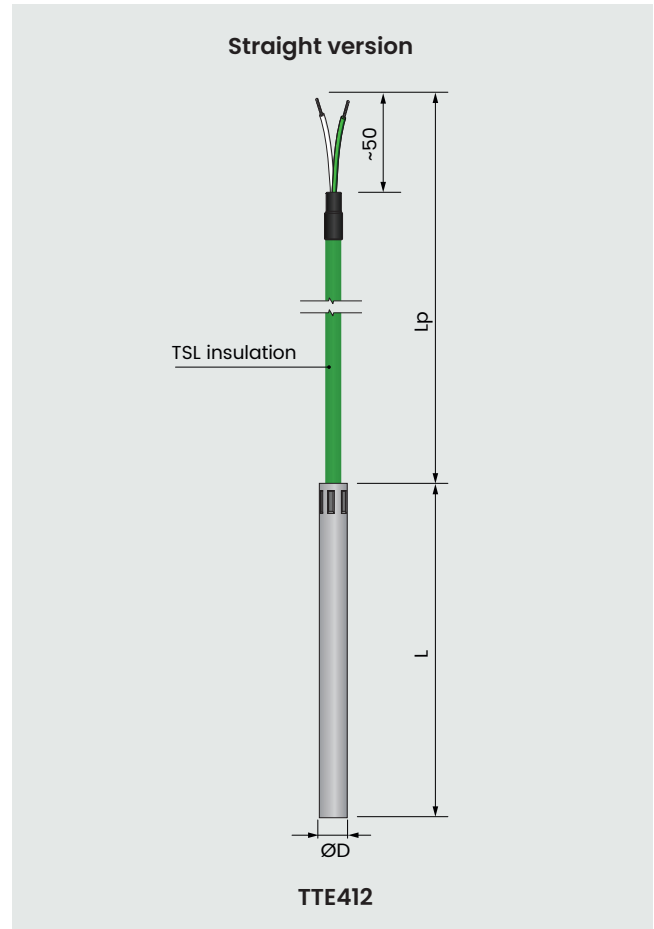
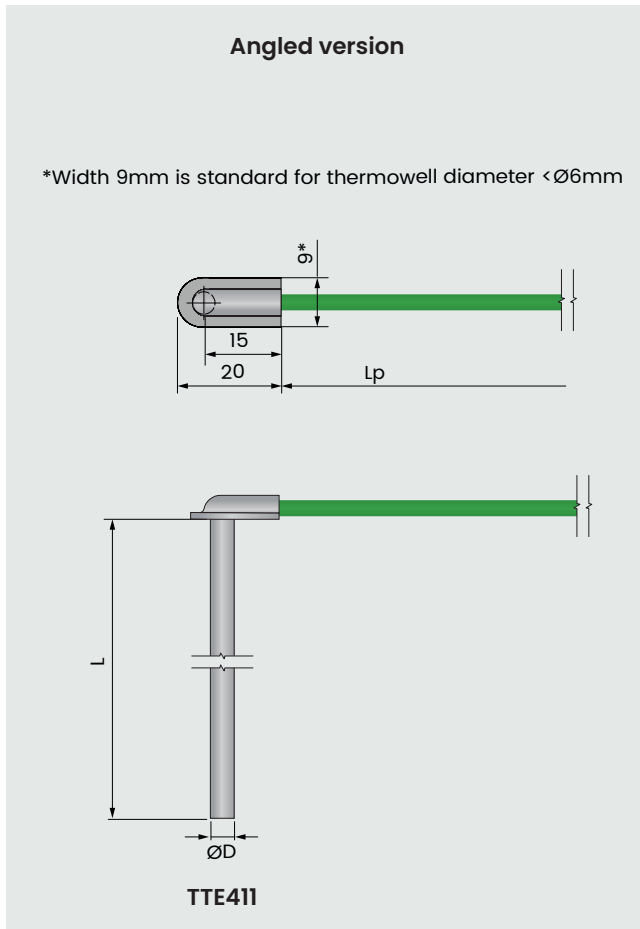
ATEX, IECEx, EAC Ex versions

Intrinsically safe designs are available for applications in hazardous areas. These models are provided with certificate for „intrinsically safe“ type of protection according to Directive 2014/34/UE (ATEX), IECEx scheme and EAC Ex TR-CU 012/2011 (Eurasian Economic Union).

CABLE THERMOCOUPLE

TYPE TTE411, TTE412

Construction



Basic values of Thermocouples type J, K, N according to PN-EN 60584 / IEC 584

Temperature		°C	100	200	300	400
Basic value	Type J	mV	5.27	10.78	16.33	21.85
	Type K	mV	4.10	8.14	12.21	16.40
	Type N	mV	2.77	5.91	9.34	12.97
Tolerance	Class 1	°C	±1.5	±1.5	±1.5	±1.6
	Class 2	°C	±2.5	±2.5	±2.5	±3.0

Tolerances

The EN 60584 Standard defines the formulas for calculating acceptable measure tolerance. More information available in the general thermocouple brochure.

Type K (NiCr-NiAl), Type N (NiCrSi-NiSi)

Tolerance Class	Temperature Range (°C)	Permissible error
1	-40°C ... +375°C	± 1.5°C
	+375°C ... +1000°C	± 0.0040 × t
2	-40°C ... +333°C	± 2.5°C
	+333°C ... +1200°C	± 0.0075 × t

Type J (Fe-CuNi)

Tolerance Class	Temperature Range (°C)	Permissible error
1	-40°C ... +375°C	± 1.5°C
	+375°C ... +750°C	± 0.0040 × t
2	-40°C ... +333°C	± 2.5°C
	+333°C ... +750°C	± 0.0075 × t

CABLE THERMOCOUPLE

TYPE TTE411, TTE412



Data sheet TTE411-412 | Edition 2023

Measuring ranges and thermowell diameters

Measuring range of the sensor depends on selected cable insulation material. Below table presents standard cable types and available thermowell diameters.

Measuring range	Thermowell diameter D [mm]	Code	Insulation material
-10 .. +105°C	Ø5, Ø6, Ø8	JJ	PVC
-50 .. +180°C	Ø5, Ø6, Ø8	TSL	silicone
-50 .. +205°C	Ø5, Ø6, Ø8	TCuT	teflon® FEP
-50 .. +260°C	Ø3, Ø4, Ø5, Ø6, Ø8	TT	teflon® PFA
-50 .. +400°C	Ø5, Ø6, Ø8	GLP, GLGLP	fiberglass

Electrical parameters

Isolation resistance >10 GΩ (test 500 VDC)

Housing material

Stainless steel 1.4541 (AISI321)

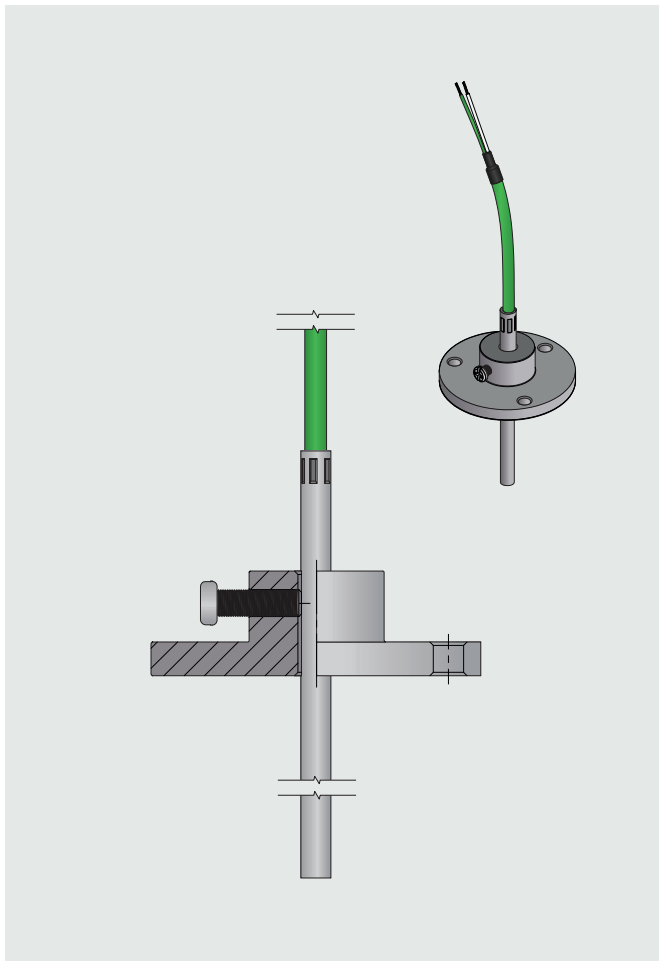
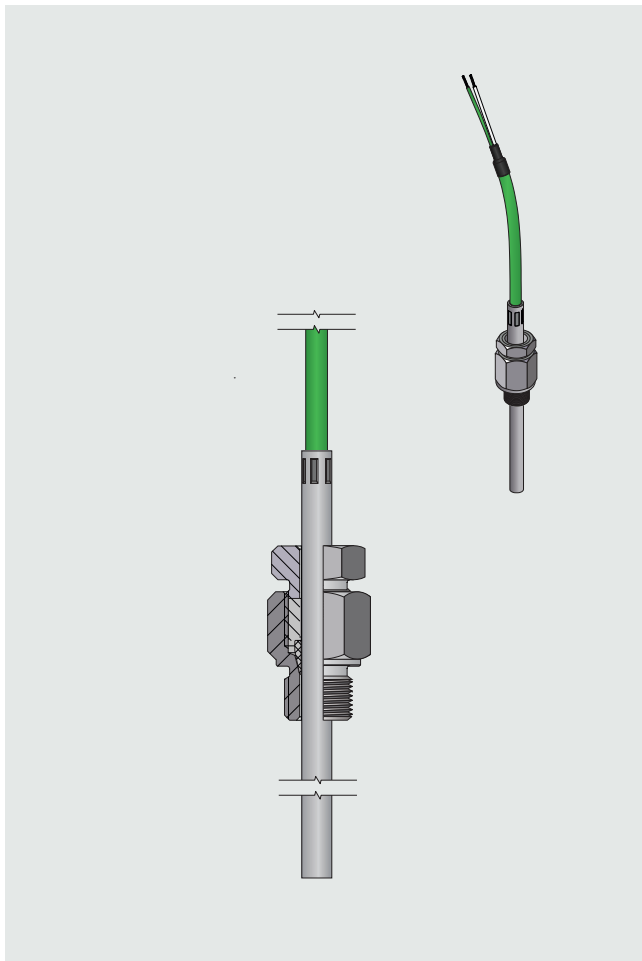
Accessories

Compression fitting UG

Allows to adjust sensor insertion depth and provides a seal.

Mounting bracket KM

Allows to adjust sensor insertion depth.

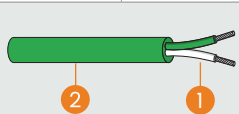


Insulation types of connection cable

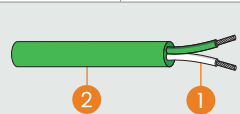
Cable insulation plays a crucial role in ensuring the durability of thermocouples in various applications. Among the many available insulation materials, several stand out for their versatility and ability to work across a wide range of applications, considering factors such as temperature resistance, chemical resistance, and mechanical properties. Below presented the most popular versions of cables.

Type K (NiCr-NiAl), color coding according to EN 60584-3

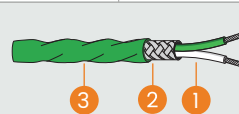
JJ insulation

① Conductor	PVC
② Sheath	PVC
	

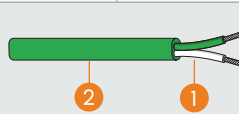
TSL insulation

① Conductor	Teflon® FEP
② Sheath	Silicone
	

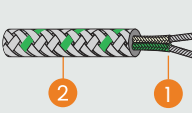
TCuT insulation

① Conductor	Teflon® FEP
② Screen	Copper braid
③ Sheath	Teflon® FEP
	

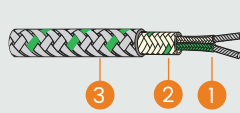
TT insulation

① Conductor	Teflon® PFA
② Sheath	Teflon® PFA
	

GLP insulation

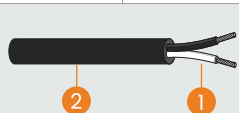
① Conductor	Fiberglass
② Braid	Stainless steel braid
	

GLGLP insulation

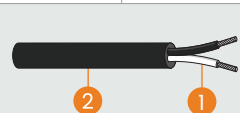
① Conductor	Fiberglass
② Sheath	Fiberglass
③ Braid	Stainless steel braid
	

Type J (Fe-CuNi), color coding according to EN 60584-3

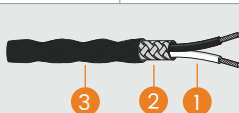
JJ insulation

① Conductor	PVC
② Sheath	PVC
	

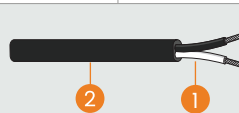
TSL insulation

① Conductor	Teflon® FEP
② Sheath	Silicone
	


TCuT insulation

① Conductor	Teflon® FEP
② Screen	Copper braid
③ Sheath	Teflon® FEP
	

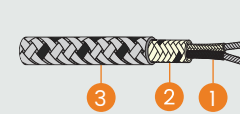
TT insulation

① Conductor	Teflon® PFA
② Sheath	Teflon® PFA
	

GLP insulation

① Conductor	Fiberglass
② Braid	Stainless steel braid
	

GLGLP insulation

① Conductor	Fiberglass
② Sheath	Fiberglass
③ Braid	Stainless steel braid
	

CABLE THERMOCOUPLE

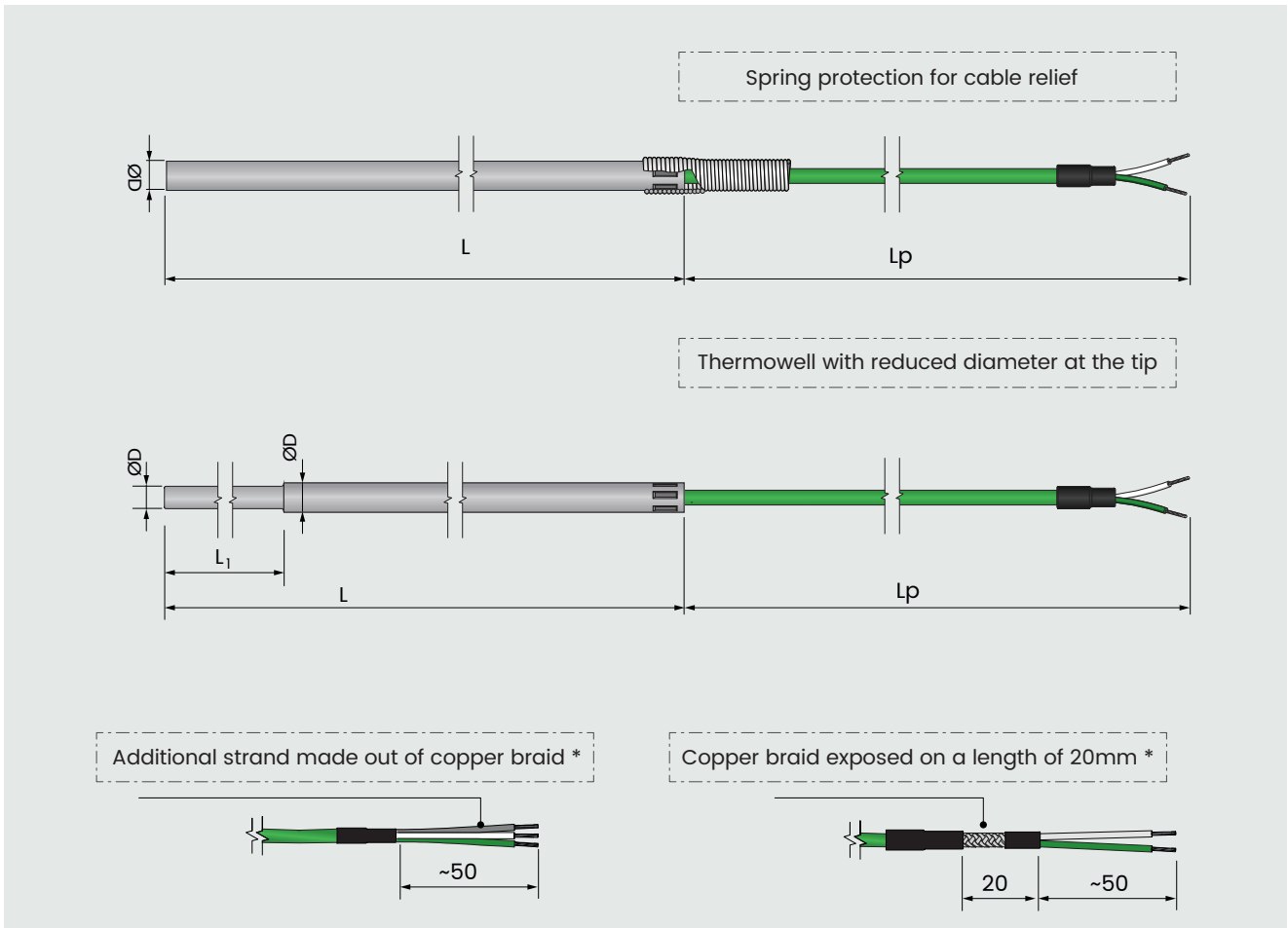
TYPE TTE411, TTE412



Data sheet TTE411-412 | Edition 2023

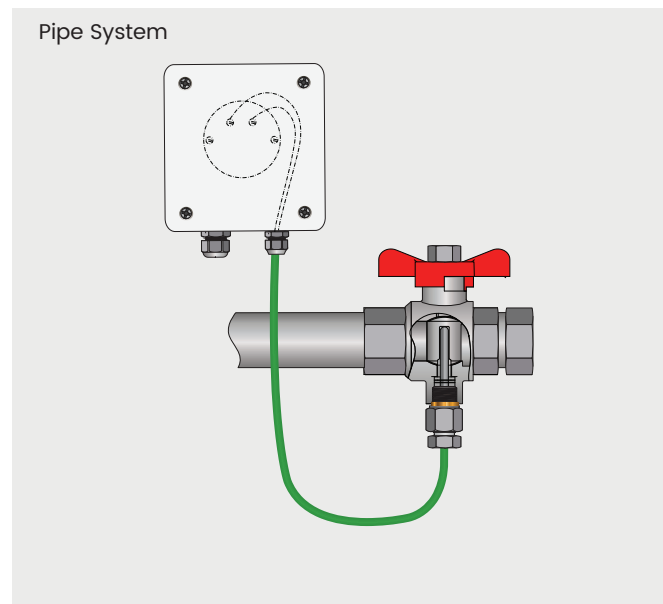
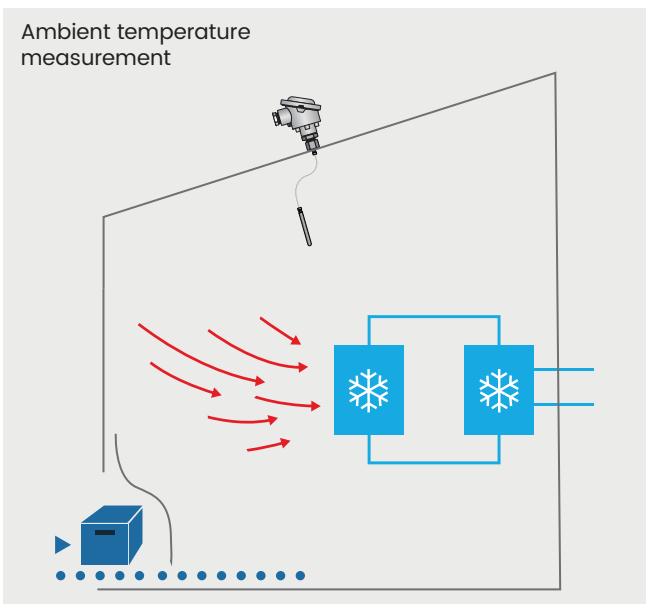
Non-standard sensor versions

This data sheet contains only a small portion of our program of supplying cable thermocouples. Other versions can be supplied upon customer's request. Below presented examples of customized versions.



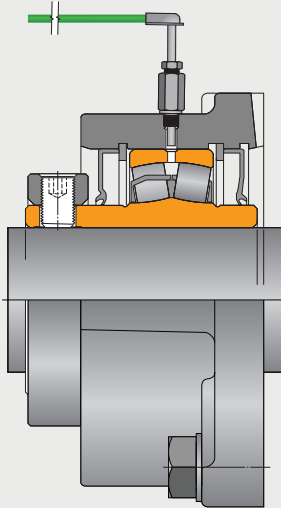
* Available only for TCuT and TPSL cable insulation

Installation examples



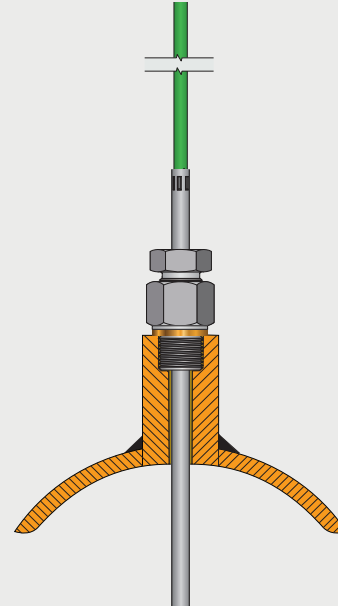
Installation examples

Bearing temperature measurement



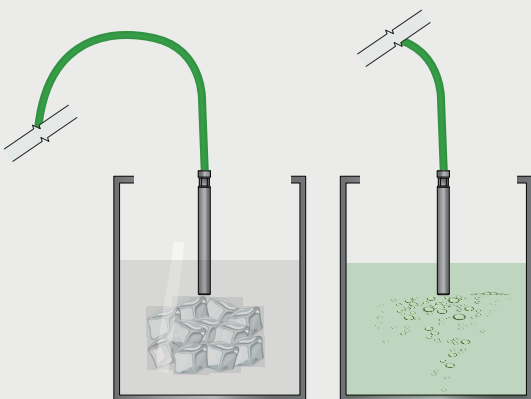
Model
TTE411

Pipeline installation



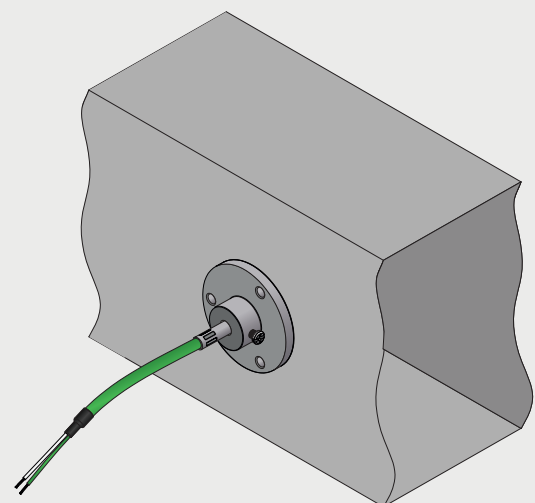
Model
TTE412

Chemical industry temperature measurement



Model
TTE412

Ventilation channel temperature measurement



Model
TTE412

CABLE THERMOCOUPLE

TYPE TTE411, TTE412

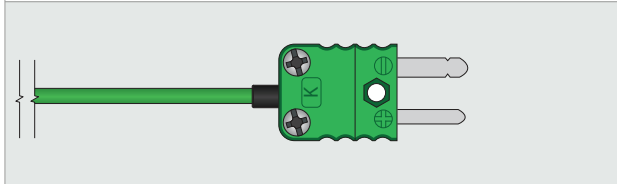
Connectors (Optional)

Sensors with connection cable can be equipped with connector.

Available options:

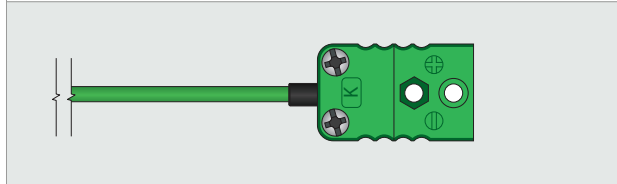
Connector S-010-(thermocouple type)-W

Miniature plug, 2-pin.



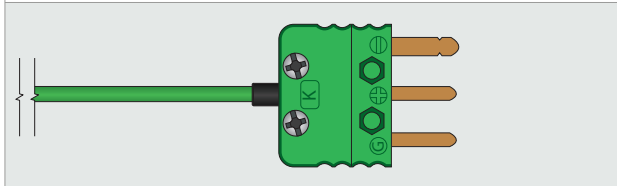
Connector S-010-(thermocouple type)-G

Miniature socket, 2-pin.



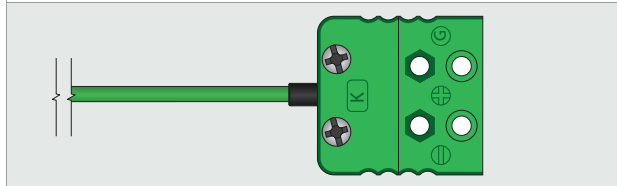
Connector S-013-(thermocouple type)-W

Miniature plug, 3-pin.



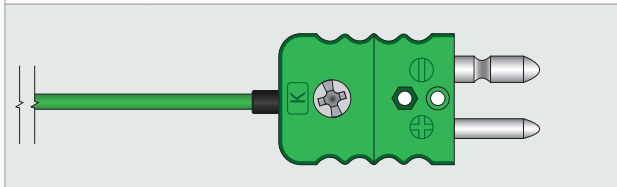
Connector S-013-(thermocouple type)-G

Miniature socket, 3-pin.



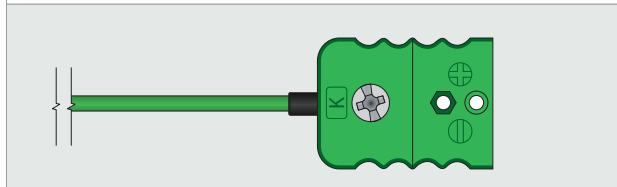
Connector S-020-(thermocouple type)-W

Standard plug, 2-pin.



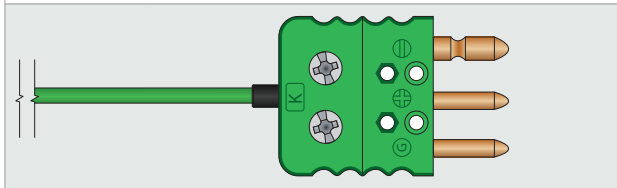
Connector S-020-(thermocouple type)-G

Standard socket, 2-pin.



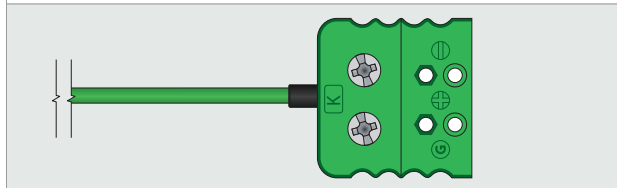
Connector S-023-(thermocouple type)-W

Standard plug, 3-pin.



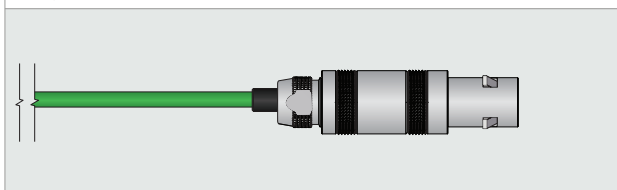
Connector S-023-(thermocouple type)-G

Standard socket, 3-pin.



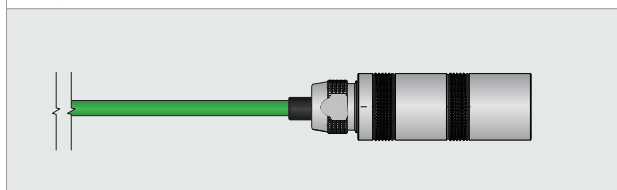
Connector LEMO® FFA

Plug size from 0S to 3S. 2-, 3-, 4-, 6-pin.



Connector LEMO® PCA

Plug size from 0S to 3S. 2-, 3-, 4-, 6-pin.



Ordering code

TTE4 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8

Order	Parameter	Code	<input checked="" type="checkbox"/>	Description
1	Model type	11	<input type="checkbox"/>	Angle version
		12	<input type="checkbox"/>	Straight version
2	Type of sensing element	J	<input type="checkbox"/>	Type J (Fe-CuNi)
		K	<input type="checkbox"/>	Type K (NiCr-NiAl)
		xxx	<input type="checkbox"/>	Other, please specify
3	Thermowell diameter ØD	3	<input type="checkbox"/>	Ø3 mm
		4	<input type="checkbox"/>	Ø4 mm
		5	<input type="checkbox"/>	Ø5 mm
		6	<input type="checkbox"/>	Ø6 mm
		8	<input type="checkbox"/>	Ø8 mm
		xxx	<input type="checkbox"/>	Other, please specify
4	Thermowell length L	50	<input type="checkbox"/>	50mm
		100	<input type="checkbox"/>	100mm
		150	<input type="checkbox"/>	150mm
		xxx	<input type="checkbox"/>	Other, please specify
5	Connecting cable length Lp	1000	<input type="checkbox"/>	1000mm
		2500	<input type="checkbox"/>	2500mm
		xxx	<input type="checkbox"/>	Other, please specify
6	Tolerance class	1	<input type="checkbox"/>	Class 1 according to PN-EN 60584-1
		2	<input type="checkbox"/>	Class 2 according to PN-EN 60584-1
7	Connecting cable type	JJ	<input type="checkbox"/>	PVC / PVC -10 .. +105°C
		TSL	<input type="checkbox"/>	Teflon® FEP / Silicone -40 .. +180°C
		TCuT	<input type="checkbox"/>	Teflon® FEP / Cu braid / FEP -40 .. +205°C
		TT	<input type="checkbox"/>	Teflon® PFA / Teflon® PFA -40 .. +260°C
		TP	<input type="checkbox"/>	Teflon® PFA / Stainless steel -40 .. +260°C
		GLP	<input type="checkbox"/>	Fiber glass / Stainless steel -40 .. +400°C
		GLGLP	<input type="checkbox"/>	Fiberglass / Fiber glass / Stainless steel -40 .. +400°C
8	Connector (optional)		<input type="checkbox"/>	without connector, free end conductors of connection cable
		S-013-W	<input type="checkbox"/>	Miniature plug, 3-pin
		FFA.IS	<input type="checkbox"/>	Connector LEMO® FFA size IS
		xxx	<input type="checkbox"/>	Other, please specify

Example
TTE411-K-8-150-2000-1-TSL

Angle version type, TC sensor type K, thermowell diameter Ø8 mm, thermowell length L=150 mm, connection cable length Lp=2000 mm, tolerance class 1, single conductors in teflon insulation, sheath in silicone insulation.

TTE412-J-6-100-2500-2-TT-FFA.IS

Straight version type, TC sensor type J, thermowell diameter Ø6 mm, thermowell length L=100 mm, connection cable length Lp=2500 mm, tolerance class 2, single conductors in teflon insulation, sheath in teflon insulation, connection cable equipped with LEMO® FFA plug size IS.