

**GÜNTHER** GmbH

Temperature Measurement Technology

Temperature Measurement Technology



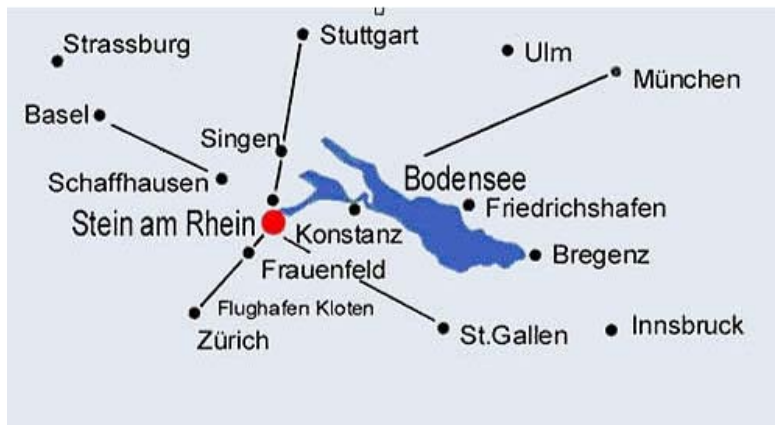
**MTS**

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## 45 Years of Precision

Starting with the founding year in 1968, the name GÜNTHER remains symbolic of state-of-the-art solutions in temperature measuring technology. Having started with the production of electronic temperature sensors for industrial furnaces, we have continually developed and expanded our expertise, offering our services to an increasing variety of industry sectors.

Today, we are standing on a foundation built on 45 years of experience, based on cooperation with numerous partners and the development of efficient solutions for their individual applications. In every instance where precise measuring data in high temperature environments are essential, GÜNTHER Temperaturmesstechnik (Temperature Measurement Technology) has established itself as a modern, reliable and leading partner.

## Success Through Preparation

At our four international production sites, we are able to manufacture almost any required, customized component for our customers. Industry standard dimensions of rare/noble metal thermowells, thermocouple wiring, metal and ceramic tubing are always in stock, allowing a prompt and flexible fulfilment of our partners' individual requirements.

Sophisticated logistics network and optimised production processes are the prerequisites for timely order fulfilment and worldwide product delivery.

Note: Apart from buying and trading precious metals for our sensors, we offer our customers the option of opening a precious metals account.





### Diversity Through Progress

Moreover, the continuous expansion of our expertise on an international scale remains as a firm cornerstone of our company philosophy.

Always on the cutting edge, with an eye on the future, we go beyond providing our customers more and precise solutions, leading the way in the field of temperature measurement.

Only in this fashion, are we able to meet a variety of application scenarios and offer customized temperature sensors, while keeping an eye on the future and sustaining preparedness in meeting the varying, growing demands of the market.

Combined, these two elements form the philosophy of our company and drive the motor in maintaining both the diversity and highest standard in quality of our products.

### Quality Through Standards

Our quality management system has been established for many years and, along with our internal calibration laboratory, allows us to guarantee the highest possible standards in quality for every process of our operation. Certification pursuant to DIN EN ISO 9001:2000, constant input and output control, the permanent training and development of our staff and high delivery performance reliability underscore our quality and reliability standards.

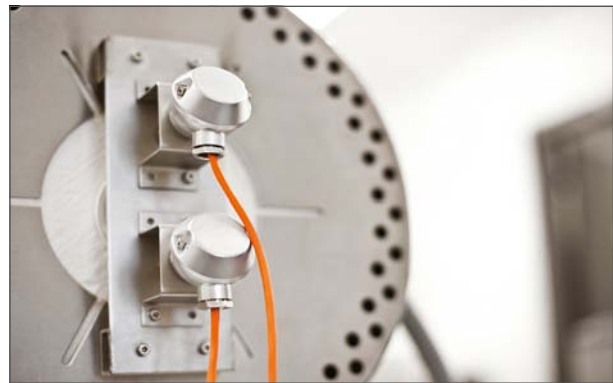
Our experience – gathered over decades, a future-oriented and sound business structure, as well as the highest quality standards, create the environment necessary in order to provide you with premium products.

Products that guarantee security and result-oriented operation.

We measure our performance against your goals. Together with our highly qualified staff, we will find ideas and solutions to ensure you receive good and reliable results.



*Our main office in Schwaig near Nuremberg*



*Our long-established QM System and internal calibration laboratory ensure the highest standard in quality.*

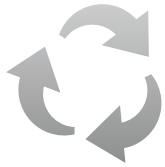


*GÜNTHER GmbH is able to manufacture nearly every desired, customized configuration in-house.*

## GÜNTHER Temperature Sensors in Action

Our temperature sensors find application in a diversity of industry sectors all around the world, wherever their exact measurements are required, all throughout the various stages of manufacturing processes.

This is a summary of the most common sectors and areas of application:



### Waste Recycling / Incineration

Applied Sensors:

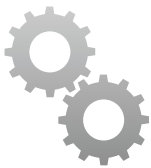
00-TMT / 05-TKT / 10-TMM / 12-THD  
13-TFL / 14-TES / 15-TKM / 20-TOM  
53-WHD / 54-WFL / 55-WES



### Glass Industry

Applied Sensors:

00-TMT / 05-TKT / 08-TMP  
10-TMM / 20-TOM



### Plant and Machine Construction

Applied Sensors:

00-TMT / 05-TKT / 10-TMM / 12-THD  
13-TFL / 14-TES / 15-TKM / 18-TKL  
20-TOM / 50-WMS / 52-WOS  
53-WHD / 54-WFL / 55-WES



### Steel and Iron industry

Applied Sensors:

00-TMT / 05-TKT / 10-TMM  
12-THD / 13-TFL / 18-TKL  
30-WTE / 35-WGG



### Automobile Industry

Applied Sensors:

00-TMT / 05-TKT / 10-TMM / 12-THD  
13-TFL / 14-TES / 15-TKM / 18-TKL  
20-TOM / 30-WTE / 35-WGG / 50-WMS  
52-WOS / 53-WHD / 54-WFL / 55-WES





**Heat Treatment**

Applied Sensors:  
05-TKT / 18-TKL / 20-TOM  
30-WTE / 35-WGG



**Chemicals Industry**

Applied Sensors:  
12-THD / 13-TFL / 14-TES /  
18-TKL / 50-WMS / 53-WHD /  
54-WFL / 55-WES



**Laboratories**

Applied Sensors:  
05-TKT / 10-TMM / 12-THD / 13-TFL  
18-TKL / 20-TOM / 52-WOS / 53-WHD  
54-WFL / 55-WES / 72-KFW



**Industrial Furnace Construction**

Applied Sensors:  
00-TMT / 05-TKT / 10-TMM  
15-TKM / 18-TKL / 20-TOM  
55-WES



**Aluminium and Nonferrous Metal Industry**

Applied Sensors:  
00-TMT / 05-TKT / 10-TMM  
20-TOM / 30-WTE / 35-WGG



**Cement and Building Material Industry**

Applied Sensors:  
00-TMT / 05-TKT / 10-TMM  
15-TKM / 20-TOM



**Energy Production**

Applied Sensors:  
00-TMT / 05-TKT / 10-TMM / 12-THD  
13-TFL / 14-TES / 15-TKM / 20-TOM  
50-WMS / 52-WOS / 53-WHD  
54-WFL / 55-WES / 72-KFW



**Plastic Industry**

Applied Sensors:  
20-TOM / 52-WOS  
60-WTH / 72-KFW



# Principals of Temperature Measurement



## Principals of Temperature Measurement

Essentially, there are several physically different possibilities of measuring temperature, such as gas or liquid thermometers, bimetallic strip thermometers, pyrometers, thermal imaging and of course thermocouple and resistance thermometers

The last two are examples of what is referred to as “touching” measurement, due to the instruments having direct contact with the measured material.

### Principals of Thermocouples

Pursuant to the Seebeck effect, the junction of two different metals results in an amount of contact voltage at the point of junction, which is dependent upon the temperature. The gauge slide of a thermocouple assembly possesses two of these touching points.

If there is no difference in temperature, both of these contact voltages cancel each other out. If the points of contact have different temperatures, a measurable thermoelectric current starts flowing.

### Principals of Resistance Thermometers

In contrast to the thermoelectric principals of thermocouples, resistance thermometers use metals that alter their electrical resistance when heated. A differentiation is made between metals with a negative temperature coefficient (NTC), whose resistance declines when heated, and metals with a positive temperature coefficient (PTC), whose resistance increases when heated. For example, platinum's electrical resistance increases when heated.







Both principals share the property that the thermometer can only indicate the temperature that exists at the point of measurement. In order to receive precise measurements, it is essential for the point of measurement to have acquired an identical temperature to the medium being measured. At first glance, this appears quite logical. In practice, this is one of the main reasons for reduced quality, regulation errors and measurement deviations between different points of measurement on the same medium. An unsuitable protective fitting or construction can lead to the measured temperature differing from the actual temperature of the measured medium.

For this reason, the main challenge in constructing a suitable temperature sensor is finding the optimal compromise between reaction time, holding time, measurement precision and economy.

With over 45 years of experience, GÜNTHER GmbH is happy to advise you in finding the best suited format for your required temperature sensor. Using our extensive inventory and sophisticated logistics, we will supply you with your custom, high quality instruments quickly and reliably.

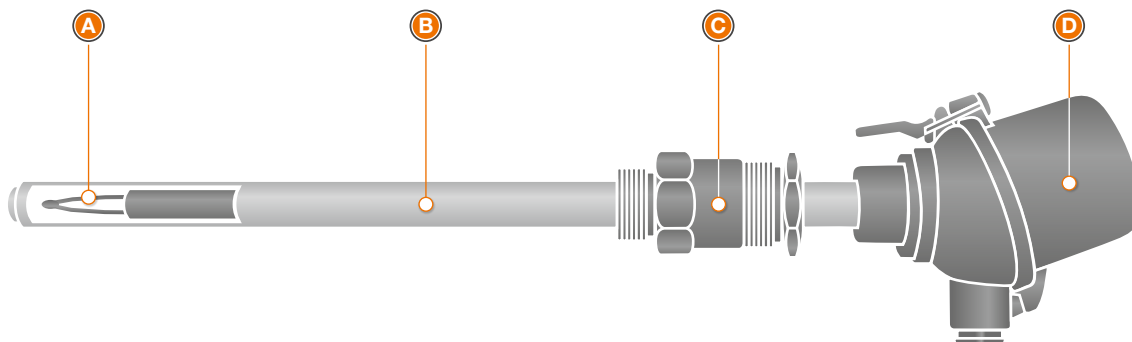
### Composition of Thermocouples and Resistance Thermometers

In most cases, the components of thermocouple assemblies and resistance thermometers are described as follows:

- A** Gauge Slide  
This insert is usually not visible from the outside and contains the actual point of measurement.
- B** Protective Fitting  
Its primary function is to protect the point of measurement from outside chemical and mechanical factors within the application environment.  
Important aspects include the type of material used, its dimensions and much more.
- C** Process Connector  
Used to affix the thermometer, for instance, to an oven wall, forging die, etc.

Differentiation is made between detachable/adjustable process connectors (threaded sleeves, stop flanges, etc.) and sealed/welded connectors (i.e. blank flanges or screw necks welded to a protective fitting).

- D** Connection Head  
These casing, mostly cast from light metal, contain a ceramic connection socket through which the compensation or copper wires are connected to the upper end of the gauge slide.  
The connection head may also contain a measurement converter (transducer), that – mounted inside the connection head – converts the measurement result into a stable signal.



## Temperature Measurement Using Thermocouples

The actual temperature measurement is made at the thermocouple within the thermocouple assembly. With a heat increase, the resulting difference in temperature between the different metals results in a measurable electrical current, allowing for exact and standardized deduction of the adjoining temperature.



## Temperature Measurement Using Resistance Thermometers

The central component here is the precision resistor, which is mounted inside the sensor tip instead of a thermocouple. This resistor is traversed by an auxiliary current with anywhere between 0,1 and 10 mA and then the adjoining electrical resistance is measured.



### The various standardized thermocouples in Europe are:

- NiCr-Ni, Type K, Colour Code Green (DIN EN 584-2)
- NiCroSil-NiSil, Type N, Colour Code Pink (DIN EN 584-2)
- Fe-CuNi, Type J, Colour Code Black (DIN EN 584-2)
- NiCr-CuNi, Type E, Colour Code Violet (DIN EN 584-2)
- Cu-CuNi, Type T, Colour Code Brown (DIN EN 584-2)
- Pt10%Rh-Pt, Type S, Colour Code Orange (DIN EN 584-2)
- Pt13%Rh-Pt, Type R, Colour Code Orange (DIN EN 584-2)
- Pt30%Rh-Pt6%Rh/B, Type B, Colour Code Grey (DIN EN 584-2)
- Fe-CuNi, Type L, Colour Code Blue (DIN 43710)
- Cu-CuNi, Type U, Colour Code Brown (DIN 43710)

For further information regarding colour codes and tolerances of the various thermocouples, please take a look at the chapter **Technical Information**, page 66.

This then, pursuant to DIN EN 60751, which standardizes resistances from  $-200^{\circ}\text{C}$  up to  $+850^{\circ}\text{C}$ , allows for an exact deduction of the resistor's ambient temperature. A sensor tip may contain up to three different precision resistors. The enclosed construction of the resistance thermometer enables use of all three without a protective fitting. Today, industrial temperature measurement commonly relies on resistance thermometers with platinum precision resistors.





## Protective Fittings

If possible, thermocouples whose conductor pairs are insulated against each other, are applied in pure, dry conditions and up to certain temperatures without protective fitting. With a fast reaction time, quick through heating and minor heat dissipation this approach is - when possible - quite advantageous.



### Metal Protective Tubes

Depending on the circumstances, several different stainless steels with high nickel and chrome content for reductive or oxidizing environments, heat resistant steels, nickel-chrome-molybdenum alloys, enamelled steel pipes, commercially pure iron, sheaths made of platinum-rhodium alloys and much more may find application. The upper temperature range for metallic protection tubes is somewhere between a maximum of 1150°C and 1200°C depending on the application scenario, or a maximum of 1700°C for platinum-rhodium alloys.

Most often, a protective tube has to be utilized to protect the thermocouple from the aggressive environmental conditions inside the measuring site.



### Ceramic Protection Tubes

These are divided into oxide ceramic protection tubes with varying oxide content (i.e. C799, C610 and C530) and furthermore into ceramic protection tubes with gas-tight and porous structures. The aluminium oxide content of a ceramic protection tube defines the temperature resistance of the sensor. The higher the content, the higher the temperatures the substance is able to withstand. Moreover, the gas-tight or porous structure of the ceramic substance will influence its resistance to temperature fluctuations. The tighter the structure, the higher its resistance. Ceramic sheaths are suited for higher temperatures than metallic protection tubes, however ceramics react more sensitively to abrupt temperature fluctuations.



### 00-TMT

#### Thermocouple Assemblies with Metal Protective Tube

Straight line thermocouple assemblies with metal protective tubes are used, depending on the properties of the protective tube, for common temperature measurements in liquid, gaseous or plastic mediums up to a temperature of 1200°C.

The protective fittings of this product line are composed of seam welded or seamlessly drawn metal tubing. Depending on the application, GÜNTHER GmbH has over 40 different, partly high-alloyed materials in a large array of measurements in stock. The tips for the protective tubes are closed either through hot forming or welded shut with a bottom blank.

Tapered measuring tips may be used in this product line in order to shorten the reaction time. For prolonging the holding time, strengthening the wall thickness and utilization of ceramic inner tubing are possible.

All internationally prevalent thermocouple pairs, detachable process connectors (for example mobile flanges or threaded sleeves) and connection heads are employed.

The selected thermocouple and/or protective tube material with the lowest permissible operating temperature defines the maximum operating temperature of the entire thermocouple assembly.

Thermoelectric voltages and tolerances of our thermocouples are pursuant to DIN EN 60584, Class 1. For specialised thermal sensors, whose construction and components require technical clarification, we engineer customized solutions. Please contact us about your specific application requirements in reference to material and assembly and we will develop your optimized individual solution.

**Further technical information for this product line is available to download on our website.**

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)

#### Application Examples for

#### Thermocouple Assemblies with Metal Protective Tube:



Waste Recycling / Incineration



Glass Industry



Plant- and Machine Construction



Steel and Iron Industry



Automobile Industry



Industrial Furnace Construction



Aluminium and Nonferrous Metal Industry



Cement and Building Material Industry



Energy Production





① Connection Head (s. page 59)

A	B
AUS	BUS
AUZ	BUZ
AUZH	BUZH
AUSH	BBK

② Protective Tube (Materials)

St. 35.8	Mat. No. 1.0305
Kanthal	
Stainless Steel	Mat. No. 1.4301
Stainless Steel	Mat. No. 1.4571
X18Cr N 28	Mat. No. 1.4749
X10Cr Al 24	Mat. No. 1.4762
X15CrNi Si 25 20	Mat. No. 1.4841
Inconel	Mat. No. 2.4816
Heat Resistant Steel	Mat. No. 1.4893

③ Process Connector (Detachable)

Flange
Threaded Socket
Flange / Counter Flange

④ Ceramic Inner Tubing

C610	TEP
C799 (gas-tight)	Aluminium Oxide

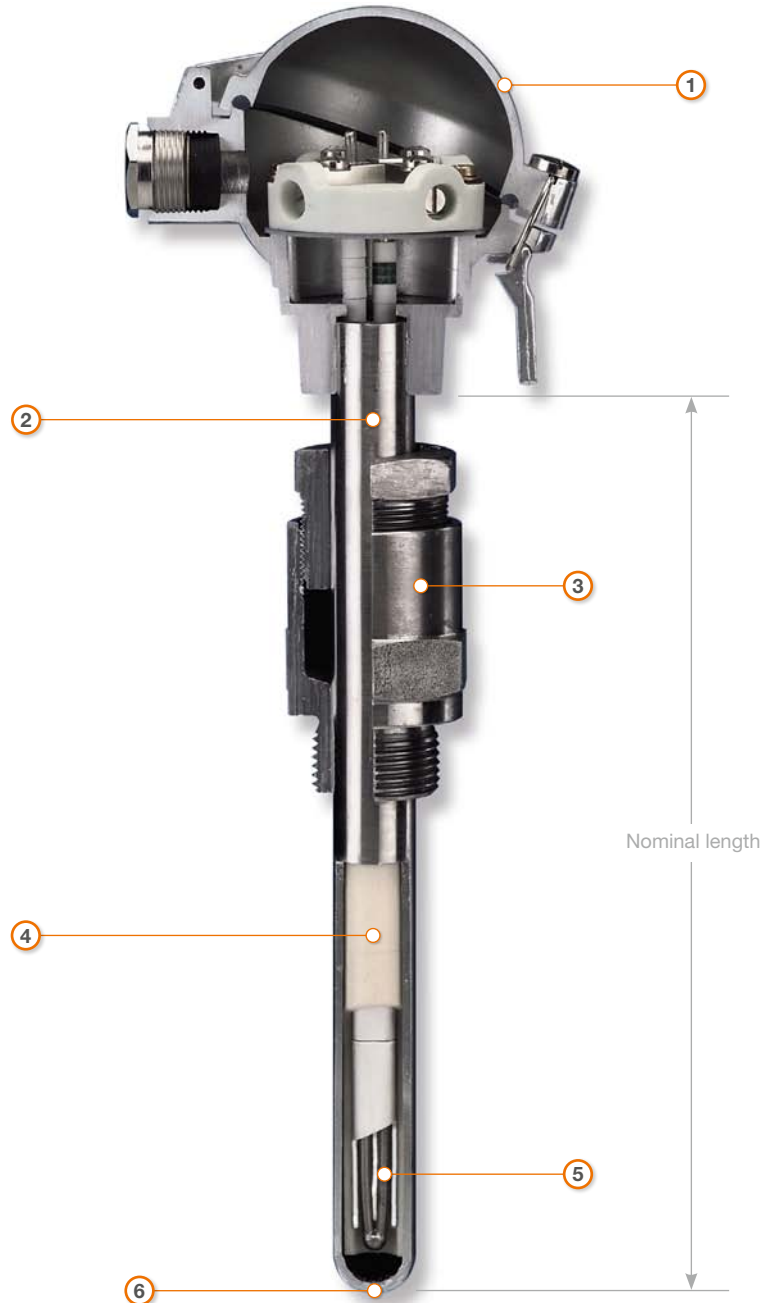
⑤ Thermocouple

Type R	PtRh13-Pt
Type S	PtRh10-Pt
Type B	PtRh30-PtRh6
Type K	NiCr-Ni
Type J	Fe-CuNi
Type L	Fe-CuNi
Type C	WRe5-WRe26
Type N	Nicrosil-Nisil
Type D	WRe3-WRe25

⑥ Configuration

Fast Response Time:
Tapered Protective Tube
Protective Sheath Diameter: 6-15 mm

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!



#### 05-TKT

#### Thermocouple Assemblies with Ceramic Protection Tube

Straight line thermocouple assemblies with ceramic protection tube (05-TKT) are mainly used for general temperature measurement in gaseous environments up to 1800°C.

Measurement and regulation processes can lead to strenuous operational demands through abrasion and corrosion. This is the reason for the protection tubes of these thermal sensors consisting of high grade heat-resistant ceramics. Metals often will not be able to bear the stress of this strain.

Aside from the industry customary oxide ceramics (purity of up to 99,8%), we offer non-oxide ceramics and individual solutions with a diversity of dimensions and materials. In most cases, GÜNTHER GmbH will have these items available from stock.

An overview of the individual properties of the most common ceramics can be found on page 67, in the chapter "Technical Information".

The assemblies of this product line can be fitted with an additional ceramic inner tube, which, in most cases, considerably increases endurance strength and total durability.










The maximum operating temperature is dependent both upon the mounting orientation (vertical / horizontal) and the corrosiveness of the respective ambient media.

Thermoelectric voltages and tolerances of our thermocouples are pursuant to DIN EN 60584, class 1.

**Further technical information for this product line is available to download on our website.**

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)

#### Application Examples for Thermocouple Assemblies with Ceramic Protection Tube:

-  Waste Recycling / Incineration
-  Glass Industry
-  Plant and Machine Construction
-  Steel and Iron Industry
-  Automobile Industry
-  Heat Treatment
-  Laboratories
-  Industrial Furnace Construction
-  Aluminium and Nonferrous Metal Industry
-  Cement and Building Material Industry
-  Energy Production





① Connection Head (Page 59)

A	B
AUS	BUS
AUZ	BUZ
AUZH	BUZH
AUSH	BBK

② Holding Pipe (Materials)

Available in various lengths

St. 35.8	Mat. No. 1.0305
Stainless Steel	Mat. No. 1.4571
X10Cr Al 24	Mat. No. 1.4762
X15CrNi Si 25 20	Mat. No. 1.4841
Inconel	Mat. No. 2.4816
Kanthal	

③ Process Connector (Detachable)

Flange
Threaded Socket
Flange / Counter Flange

④ Protective Tube (Materials)

C610	Quartz Glass
C799	Sapphire Glass
C530	SiN
SiC	

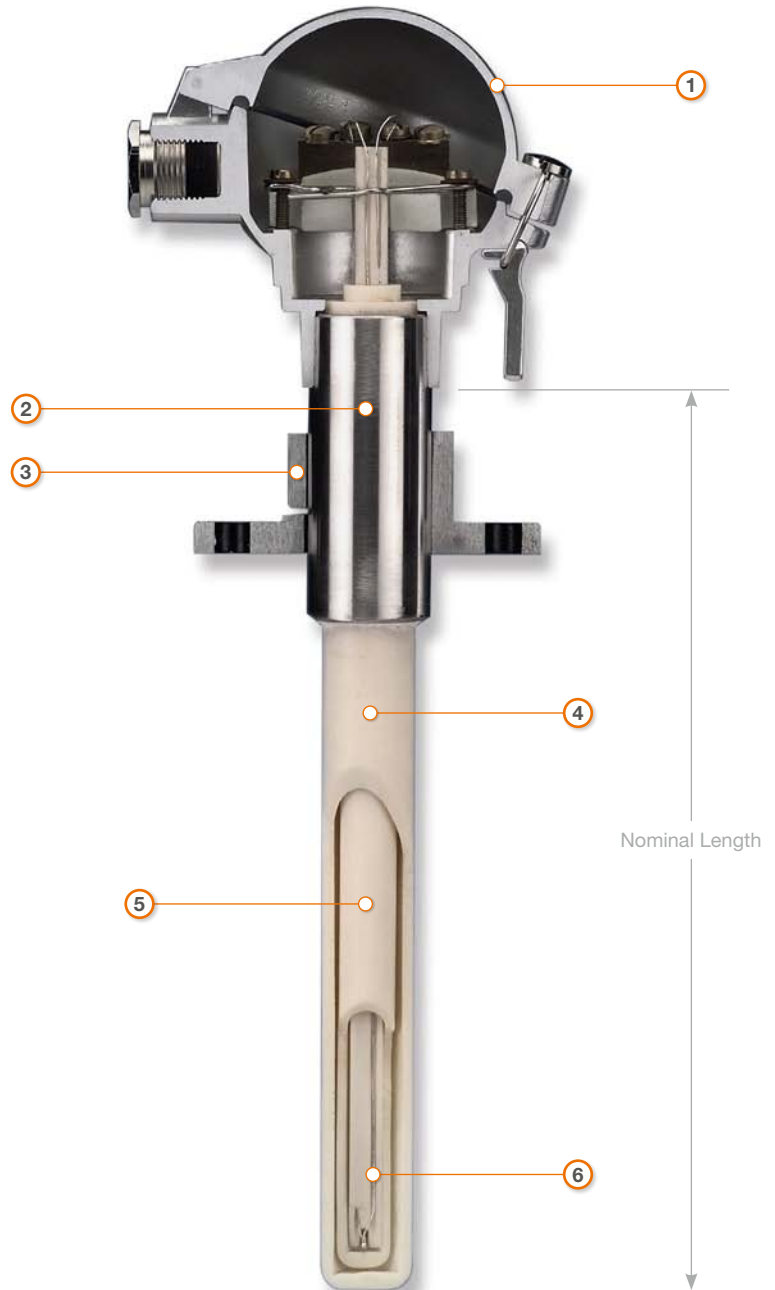
⑤ Inner Tube

C610	TEP
C799 (gas-tight)	Aluminium Oxide
C530	Porous Ceramic

⑥ Thermocouple

Type R	PtRh13-Pt
Type S	PtRh10-Pt
Type B	PtRh30-PtRh6
Type K	NiCr-Ni
Type J	Fe-CuNi
Type L	Fe-CuNi
Type C	WRe5-WRe26
Type N	Nicrosil-Nisil
Type D	WRe3-WRe25

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

## 08-TMP

### Thermocouple Assemblies with Noble Metal Protective Tube



**GÜNTHER GmbH has been a supplier of Thermocouples for over 40 years to the following sectors of the glass industry:**

- Container Glass
- Fibreglass
- Sheet Glass
- Glass Wool
- Dinnerware Glass
- Dinnerware Glass
- Medical Glass

**Further technical information for this product line is available to download on our website.**

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)

#### 08-TMP

#### Thermocouple Assemblies with Noble Metal Protective Tube

Straight line Thermocouple Assemblies with Noble Metal Protective Tube (08-TMP) are used in the glass industry for temperature measurement in glass melting. The applied protection tubes consist of alloyed noble metals. In order to meet the extreme environment conditions, only high grade materials are used in production.

A large selection of various dimensions and platinum alloys are available from stock in order to ensure fast delivery times.

Aside from alloying with other metals such as iridium and rhodium, we offer dispersion-hardened protection tubes and platinum coated ceramic pipes.

Thermocouples are available as required, in single, double or triple element version.

Also, GÜNTHER GmbH will deliver bubbler pipes or glass level probes in various versions according to customer specifications.

Thermoelectric voltages and tolerances are pursuant to DIN EN 60584, class 1 for thermocouple types S and R, class 2 for thermocouple type B.

#### Operation temperature

#### for platinum-rhodium/platinum thermocouples

Type	Diameter	Maximum Temperature
S	0,35 mm	1350 °C
S	0,50 mm	1600 °C
R	0,35 mm	1350 °C
R	0,50 mm	1600 °C
B	0,35 mm	1600 °C
B	0,50 mm	1800 °C







① Connection Head (Page 59)

A	B
AUS	BUS
AUZ	BUZ
AUZH	BUZH
AUSH	BBK

② Process Connector (detachable)

Flange
Threaded Socket
Flange / Counter Flange

③ Protection Tube (Materials)

C610
C799
C530

④ Inner Tube

C610	TEP
C799 (Gas-Tight)	Aluminium Oxide

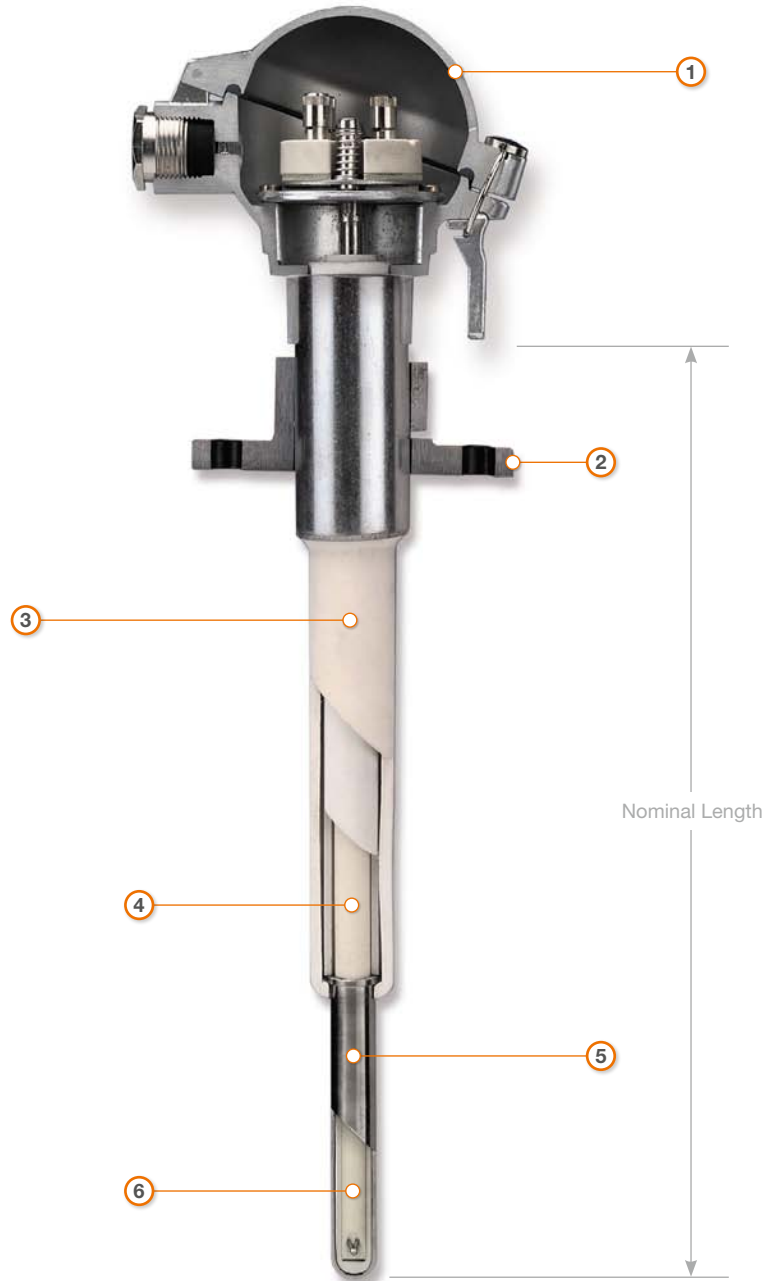
⑤ Noble Metal Protection Tube

PtRh90/10	9,1 x 0,3 mm
PtRh90/10	9,1 x 0,5 mm
PtRh90/10	6,5 x 0,5 mm
PtRh90/10	9,0 x 0,4 mm
PtRh85/15	7,3 x 0,4 mm
PtRh80/20	9,1 x 0,5 mm
PtRh90/10	9,0 x 0,5 mm

⑥ Thermocouple

Type R	PtRh13-Pt
Type S	PtRh10-Pt
Type B	PtRh30-PtRh6

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

## 10-TMM

# Thermocouple Assemblies with Metal Protection Tube and Sheathed Mineral-Insulated Gauge Slide



### 10-TMM

#### Thermocouple Assemblies with Metal Protection Tube and Sheathed Mineral-Insulated Gauge Slide

Straight line thermocouples with metal protection tubes and sheathed mineral-insulated gauge slide (10-TMM) are used for general temperature measurement in liquid, gaseous and plastic media up to 1200°C.

The main difference to thermocouples with ceramic protection tubes (00-TMT) lies in the use of a sheathed mineral-insulated gauge slide. The thermocouple wires are fully embedded in a highly pure magnesium oxide with an additional metallic sheath.

The advantages compared to thermocouples with ceramic protection tubes include:

- Ease of Replacement
- Vibration and Impact Resistance
- Increased Holding Time
- Possibility for Test Bores











In order to achieve extra speed in measuring temperature changes, we also offer these temperature sensors with tapered sensor tip.

The thermoelectric voltages and tolerances of our mineral insulated sensor inserts are pursuant to standard DIN EN 60584, Class 1.

**Further technical information for this product line is available to download on our website.**

**[www.guenther.eu/downloads](http://www.guenther.eu/downloads)**

#### Application Examples for Thermocouple Assemblies with Metal Protection Tube and Sheathed Mineral-Insulated Gauge Slide

-  Waste Recycling / Incineration
-  Glass Industry
-  Plant and Machine Construction
-  Steel and Iron Industry
-  Automobile Industry
-  Laboratories
-  Industrial Furnace Construction
-  Aluminium and Nonferrous Metal Industry
-  Cement and Building Material Industry
-  Energy Production





① Connection Head (Page 59)

A	B
AUS	BUS
AUZ	BUZ
AUZH	BUZH
AUSH	BBK

② Protective Tube (Materials)

St. 35.8	Mat. No. 1.0305
Kanthal AF	
Stainless Steel	Mat. No. 1.4301
Stainless Steel	Mat. No. 1.4571
X18Cr N 28	Mat. No. 1.4749
X10Cr Al 24	Mat. No. 1.4762
X15CrNi Si 25 20	Mat. No. 1.4841
Inconel	Mat. No. 2.4816
Heat-Resistant Steel	Mat. No. 1.4893

③ Process Connector (Detachable)

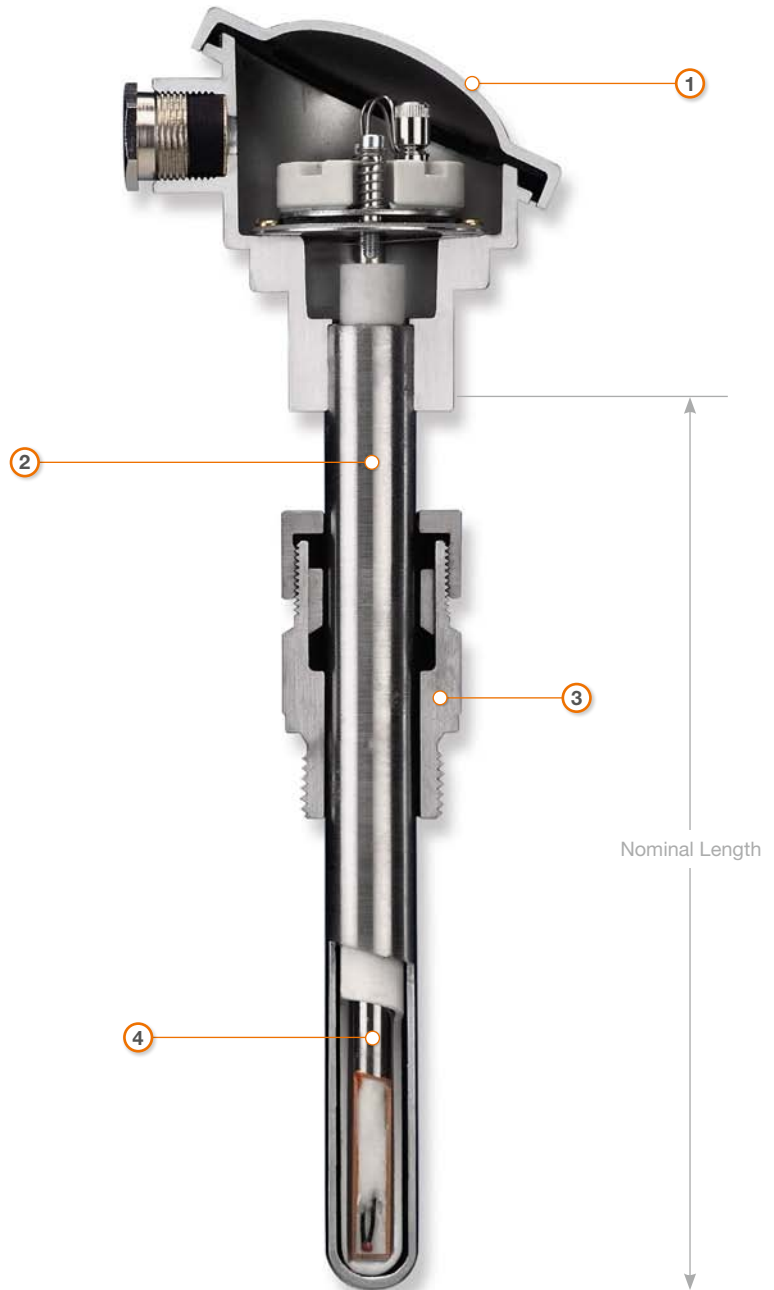
Flange
Threaded Socket
Flange / Counter Flange

④ Mineral-Insulated Gauge Slide

Sheath Material:	Inconel 2.4816
	Mat. No. 1.4541
Thermocouple:	NiCr-Ni / K
	Fe-CuNi / L
	Fe-CuNi / J
	Nicrosil-Nisil / N
Diameter:	1,5 - 8 mm

The sheathed mineral-insulated gauge slide is available as required, in single, double or triple version and may be fitted, optionally, with a parallel test bore for inserting a reference thermometer.

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

## 12-THD

### Thermocouple Assemblies for Welding with Thermowell Form 4 (Formerly D-Sleeve)



#### Application Examples for Thermocouple Assemblies for Welding with Thermowell Form 4 :

-  Waste Recycling / Incineration
-  Plant and Machine Construction
-  Steel and Iron Industry
-  Automobile Industry
-  Chemical Industry
-  Laboratories
-  Energy Production

#### 12-THD

#### Thermocouple Assemblies for Welding with Thermowell Form 4 (Formerly D-Sleeve) pursuant to DIN 43772

Thermocouple assemblies for welding (12-THD) are used in gaseous or liquid media such as air, steam, water, oil, etc. with high current speeds and pressure. The thermowell's material defines the operating temperature. Specialized assemblies for welding are suitable for up to 700 bar of pressure. The mountings of this product line are fitted with exchangeable gauge slides.

The main component is a thermowell crafted from high-grade or pressure-vessel steel, with which the thermocouple assembly is welded to the respective machine or measuring location.

Selection of the thermowell is dependent on spatial proportions at the point of installation, as well as demands as dictated by temperature, pressure, current flow and chemical attack.

Standard values for stress capacity can be found in the diagrams of DIN 43772.

In particular the question of chemical stress capacity must be examined carefully for each individual scenario. Often times, only field testing will yield authoritative information, as even minor impurities in the ambient media can have significant impact on the performance of the thermowell within the application environment.

Thermoelectric voltages and tolerances of our thermocouples and gauge slides are pursuant to DIN EN60584, class 1.

**Further technical information for this product line is available to download on our website.**

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)





① Connection Head (Page 59)

B (M24 x 1,5) BBK	
BUS	BUSH
BUZ	BUZH

② Connection Tube Pursuant to DIN 43767

with threading:	
M24 x 1,5/M18 x 1,5	Zinc Coated Steel
M24 x 1,5/M14 x 1,5	or High-Grade Steel
also available without threading	

③ Thermowell Pursuant to DIN 43772

Cone Length:	40 - 125 mm
Shaft Length:	50 or 110 mm
Thermowell Length:	115 - 260 mm
Diameter:	18 or 24 mm
Material:	1.7335
	1.4571
	1.5415

④ Gauge Slide

Sheath Material:	Inconel 2.4816
	Mat. No. 1.4541
Thermocouple:	NiCr-Ni / K
	Fe-CuNi / L
	Fe-CuNi / J
	Nicrosil-Nisil / N
Diameter:	2 - 8 mm
Single or Double	

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

## 13-TFL

### Thermocouple Assemblies with Welded Blank Flange



#### Application Examples for Thermocouple Assemblies with Welded Blank Flange:

-  Waste Recycling / Incineration
-  Plant and Machine Construction
-  Steel and Iron Industry
-  Automobile Industry
-  Chemical Industry
-  Laboratories
-  Energy Production

#### 13-TFL

#### Thermocouple Assemblies with Welded Blank Flange

Thermocouple assemblies with welded blank flange (13-TFL) are used to measure temperatures in gaseous or fluid media, such as air, steam, water or oil.

Distinctive characteristic of these sensors is a blank flange welded to or onto the protective sheath, most commonly pursuant to DIN EN 1092, enabling a tight connection of the sensor with the respective wall of an over- or under-pressure facility as can be found in power plants, for example.

Sensors in this component assembly contain either a thermocouple with ceramic insulation or an exchangeable mineral-insulated gauge slide.

#### Preferred Application Environments:

- Containers and Piping
- Instruments and Machinery
- Laboratories
- Testing Facilities
- Process Technology
- Energy Production und Heat Distribution
- Food and Beverage Industry
- Plant and Machine Construction

Thermoelectric voltages and tolerances of our thermocouples and mineral-insulated gauge slides are pursuant to DIN EN 60584, Class 1, for thermocouples and mineral-insulated gauge slides of Type L pursuant to DIN 43710.

Further technical information for this product line is available to download on our website.

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)





1 Connection Head (Page 59)

A	BUSH (M24 x 1,5)
B (M24 x 1,5)	BUZH (M24 x 1,5)
BUS (M24 x 1,5)	DL / MA (M10 x 1)
BUZ (M24 x 1,5)	

2 Blank Flange pursuant to DIN EN 1092

DN 10 - DN 100	PN 16
Material:	
Mat. No. St37-2	Mat. No. 1.4571
Mat. No. C22.8	Alloy C4

3 Mineral-Insulated Gauge Slide

Material:	NiCr-Ni
	Fe-CuNi
	Nicrosil-Nisil
Diameter:	3 - 8 mm
Single or Double	

4 Protective Tube Material / Dimensions

St. 35.8	Mat. No. 1.0305
Stainless Steel	Mat. No. 1.4571
X10Cr Al 24	Mat. No. 1.4762
X15CrNi Si 25 20	Mat. No. 1.4841
Inconel	Mat. No. 2.4816
Kanthal	
Alloy C4	
Diameter:	6 - 22 mm
Wall:	0,75 - 3 mm

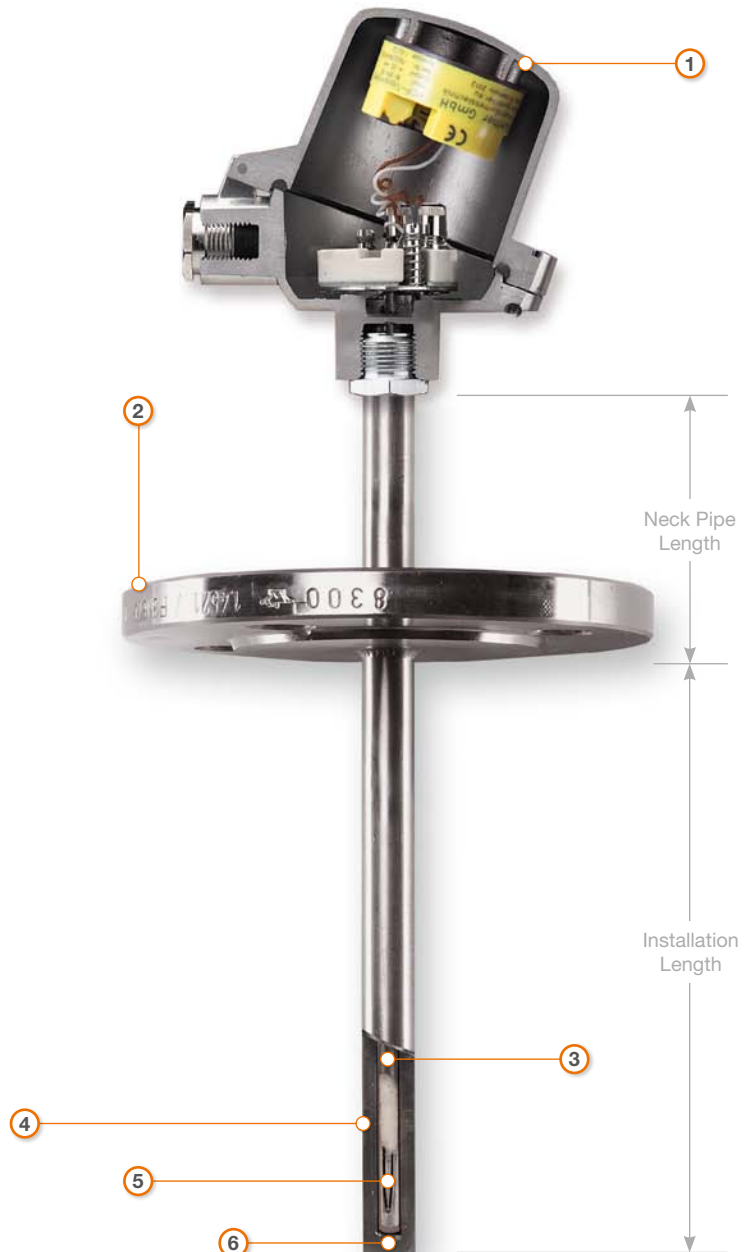
5 Thermocouple with Ceramic Insulation

Single or Double:	
NiCr-Ni/K	Fe-CuNi/J
Fe-CuNi/L	NiCrSi-NiSi/N
PtRh10-Pt/S	PtRh13-Pt/R
PtRh30-PtRh6/B	

6 Configuration

Normal (Straight Protective Tube)
Fast Reacting
(Tapered Protective Tube):
Tube Tip Diameter: 6-15 mm

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.  
Please contact us for further information!

## 14-TES

### Thermocouple Assemblies with Threaded Socket



#### Application Examples for Thermocouple Assemblies with Threaded Socket:

-  Waste Recycling / Incineration
-  Plant and Machine Construction
-  Automobile Industry
-  Chemical Industry
-  Energy Production

#### 14-TES

#### Thermocouple Assemblies with Threaded Socket

Thermocouple assemblies with threaded socket (14-TES) are used for common temperature measurement in low-pressure gaseous, liquid and plastic media environments, depending on the properties of protective tube and surrounding media up to a temperature of 1200°C.

A threaded socket is welded to the protective tube, providing for the stability of the process connector in this component assembly. Depending on the application, the socket is welded to the protective pipe either directly beneath the connection head or with a gap of 100 or 200 mm, for example.

The protective fittings are usually made from a single seamlessly drawn high-grade steel tube with a circular blank welded inside.

Optionally, our thermocouple assemblies with threaded sockets may be fitted with an internal ceramic tube, which significantly increases the long-term stability and electrical insulation of the measuring thermocouple in many application scenarios.

**Further technical information for this product line is available to download on our website.**

**[www.guenther.eu/downloads](http://www.guenther.eu/downloads)**







① Connection Head (Page 59)

B (M24 x 1,5)	BUSH
BUS	BUZH
BUZ	NA
BBK	DL / MA (M10 x 1)
other	

② Process Connector

G 1 A
G 1/2 A
M18 x 1,5
G 3/4 A
M20 x 1,5
Combined: M24 x 1,5 / G 1/2 A
M10 x 1 / G 1/2 A
Other

③ Outer Protective Tube Material / Dimensions

St. 35.8	Mat. No. 1.0305
Stainless Steel	Mat. No. 1.4571
X10Cr Al 24	Mat. No. 1.4762
X15CrNi Si 25 20	Mat. No. 1.4841
Inconel	Mat. No. 2.4816
Kanthal	
Diameter:	6 - 22 mm
Wall:	0,75 - 3 mm

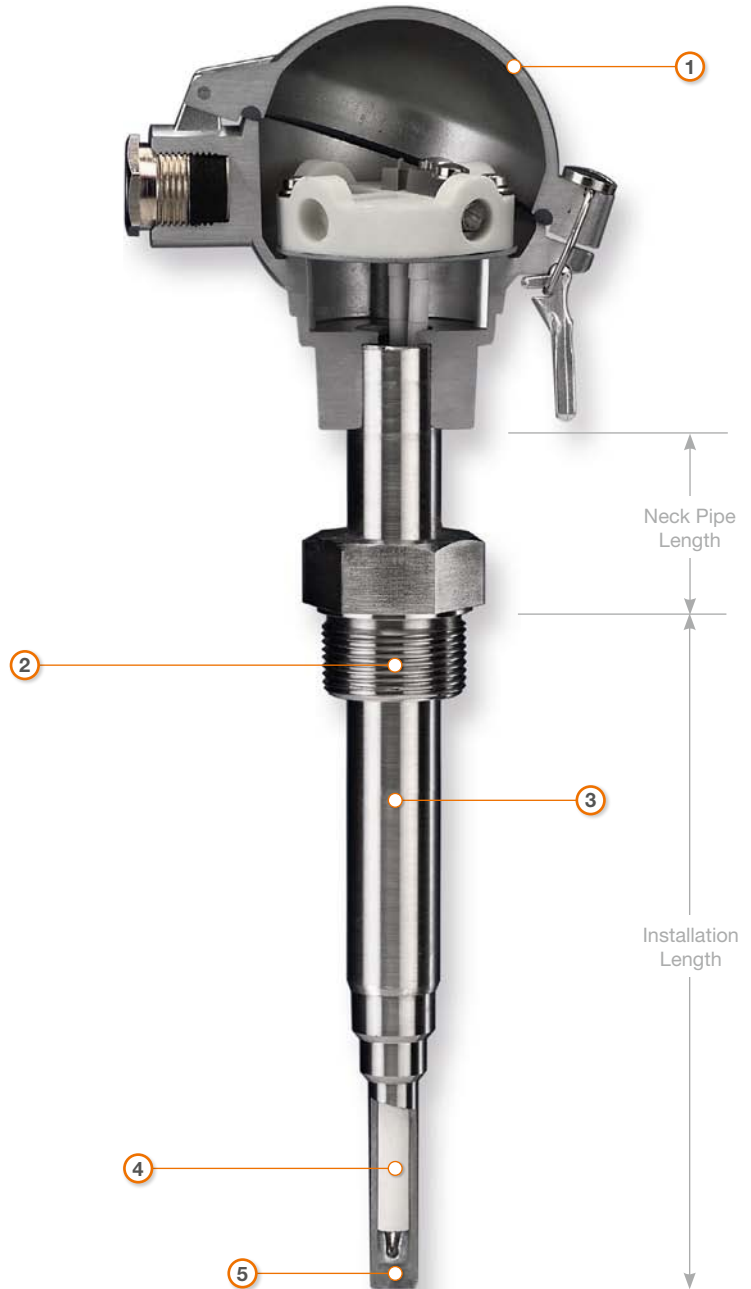
④ Mineral-Insulated Gauge Slide

Thermocouple Type / Mantle Material:	
Fe-CuNi / L	1.4541
Fe-CuNi / J	1.4541
Nicrosil-Nisil / K	Inconel 2.4816
Nicrosil-Nisil / N	Inconel 2.4816
Gauge Slide:	1,5 - 6 mm
Thermocouple:	1 - 3 mm
Single or Double	

⑤ Configuration

Normal (Straight Protective Tube)
Fast Reacting
(Tapered Protective Tube):
Tube Tip Diameter: 6-15 mm

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!



### Application Examples for Thermocouple Assemblies with Ceramic Protection Tube and Mineral-Insulated Gauge Slide:



Waste Recycling / Incineration



Plant and Machine Construction



Automobile Industry



Industrial Furnace Construction



Cement and Building Material Industry



Energy Production

### 15-TKM

#### Thermocouple Assemblies with Ceramic Protection Tube and Mineral-Insulated Gauge Slide

Straight line thermocouple assemblies with ceramic protection tube and mineral-insulated gauge slides (15-TKM) are used for common temperature measurement up to 1200°C, mainly in gaseous media.

For sensors of this product line, mainly base metal thermocouples are employed, combining the advantages of mineral-insulated gauge slides on one hand, and the advantages of technical ceramics on the other hand.

The individual properties of the most common ceramic types can be found on page 67, in the chapter "Technical Information".

Additionally and in contrast to thermocouples, mineral-insulated gauge slides are easily exchangeable, they are resilient to temperature changes, vibration and impact resistant. In consequence of the compact and slender configuration of the mineral-insulated gauge slides, enough space usually remains to allow for the insertion of an additional mineral insulated thermocouple for measurement verification if necessary.

During measurement and control processes, often high operational wear occurs due to corrosion and abrasion, which even high grade metal protective tubes are not able to withstand. In these scenarios, thermal sensors with protective tubes made of heat-resistant, technical ceramics allow for increased holding time in many instances.

Thermoelectric voltages and tolerances of our mineral-insulated gauge slides are pursuant to DIN EN 60584, Class 1.

Further technical information for this product line is available to download on our website.

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)





① Connection Head (Page 59)

A	B
AUS	BUS
AUZ	BUZ
AUZH	BUZH
AUSH	BBK

② Holding Tube (Materials)

Available in various lengths

St. 35.8	Mat. No. 1.0305
Stainless Steel	Mat. No. 1.4571
X10Cr Al 24	Mat. No. 1.4762
X15CrNi Si 25 20	Mat. No. 1.4841
Inconel	Mat. No. 2.4816
Kanthal	

③ Process Connector (Detachable)

Flange
Threaded Socket
Flange / Counter Flange

④ Protective Tube (Materials)

C610	Quartz Glass
C799	Sapphire Glass
C530	SiN
SiC	

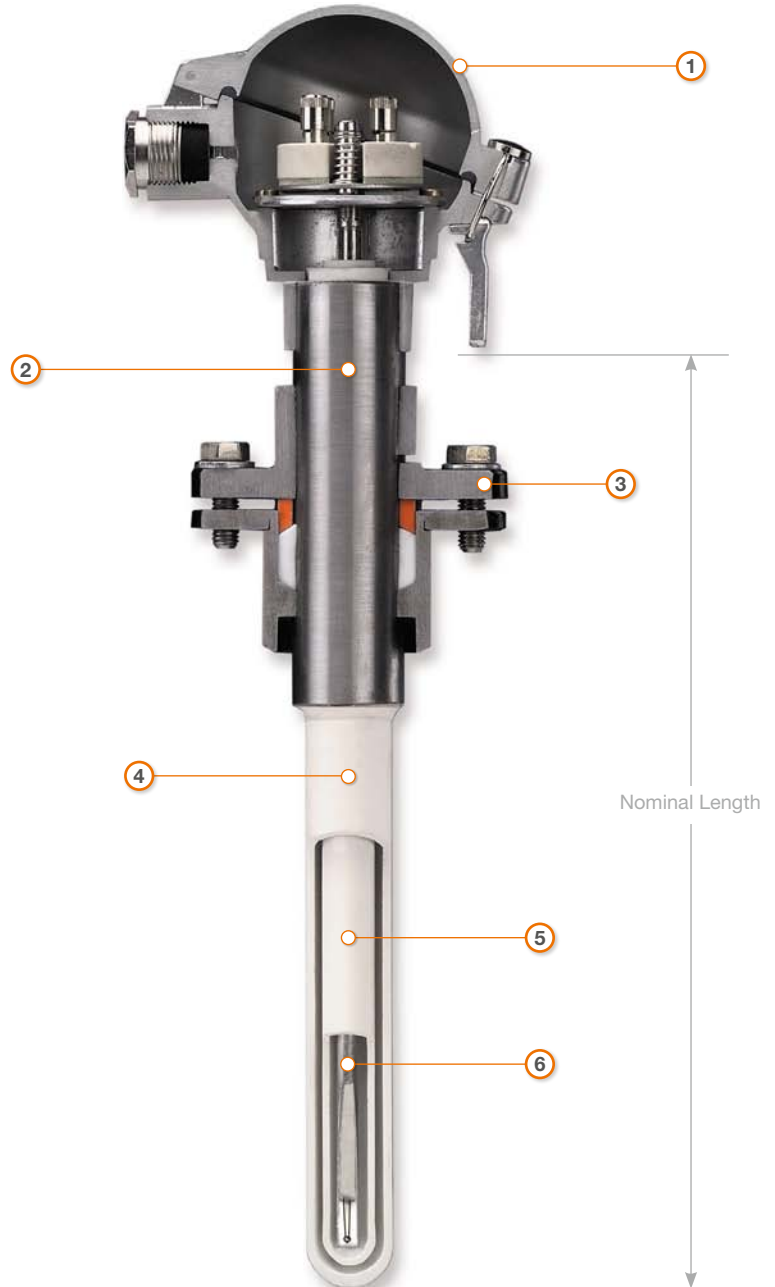
⑤ Inner Tube

C530	Porous Ceramic
C610	TEP
C799	Aluminium Oxide

⑥ Mineral Insulation Mantle / Thermocouple

Thermocouple / Mantle Material:	
Fe-CuNi / L	1.4541
Fe-CuNi / J	1.4541
Nicrosil-Nisil / K	Inconel 2.4816
Nicrosil-Nisil / N	Inconel 2.4816
Mantle-Diameter:	1,5 - 8 mm
Single or Double Testable	

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

# 18-TKL

## Micro- and Laboratory Thermocouple Assemblies



The individual properties of the most common ceramic types can be found on page 67, in the chapter "Technical Information".

### Application Examples for Micro- and Laboratory Thermocouple Assemblies:

-  Plant and Machine Construction
-  Steel and Iron Industry
-  Automobile Industry
-  Heat Treatment
-  Chemical Industry
-  Laboratories
-  Industrial Furnace Construction

### 18-TKL

#### Micro- and Laboratory Thermocouple Assemblies

Micro- and laboratory thermocouple assemblies (18-TKL) are preferentially used for technical temperature measurements in liquid and gaseous media within a temperature range between 200°C and 1800°C.

Micro- and laboratory thermocouple assemblies differ from conventional thermocouple assemblies in their very small dimensions, light weight and variable mounting options. They also warrant exact temperature measurements within a constrained installation space. In consequence of design, these sensors also have very short reaction times.

There is a notable danger of "poisoning" noble metal thermocouples in micro- and laboratory thermocouple assemblies by substances diffusing through the protective fitting, such as those to be found in flue gas, for example. In order to avoid these types of influences, we recommend using a version employing gas-tight ceramic.

#### Operation Temperature for Platinum-Rhodium /

##### Platinum Thermocouples:

Type	Diameter	Maximum Temperature
S	0,35 mm	1350°C
S	0,50 mm	1600°C
R	0,35 mm	1350°C
R	0,50 mm	1600°C
B	0,35 mm	1600°C
B	0,50 mm	1800°C

The thermal materials used by GÜNTHER GmbH for micro- and laboratory thermocouple assemblies are pursuant to DIN EN 60584.

Further technical information for this product line is available to download on our website.

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)





1 Connection Types

Head B

Head DL

Head L

Connection Socket Type S

The following listed connection types are fitted with welded holding tubes and connection socket type S.

Head L with Tube 1.4571

Connection Clip 55x20 mm

Flanged Plate 60x60 mm

Connection Socket Type S

2 Holding Tube (Materials)

St. 35.8 Mat. No. 1.0305

Brass

Stainless Steel Mat. No. 1.4571

Inconel Mat. No. 2.4816

3 Process Connector (Detachable)

Flange

Threaded Socket

Flange / Counter Flange

4 Protective Tube (Materials)

C610

C799

5 Thermocouple (Single, Double or Triple)

Type R PtRh13-Pt

Type S PtRh10-Pt

Type B PtRh30-PtRh6

Type K NiCr-Ni

Type J Fe-CuNi

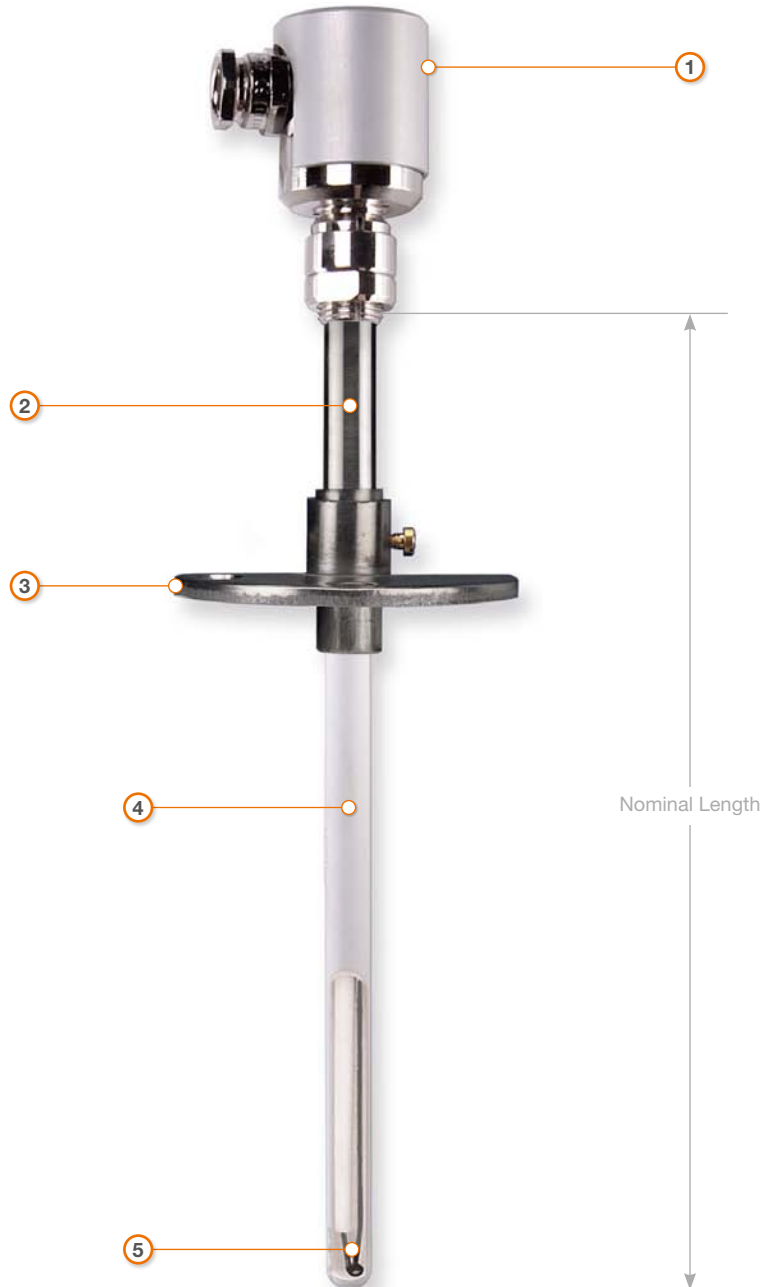
Type L Fe-CuNi

Type C WRe5-WRe26

Type N Nicrosil-Nisil

Type D WRe3-WRe25

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.




Please contact us for further information!

## 20-TOM

### Sheathed Thermocouple Assemblies without Protection Tube



#### Application Examples for Sheathed Thermocouple Assemblies without Protection Tube:

-  Waste Recycling / Incineration
-  Glass Industry
-  Plant and Machine Construction
-  Automobile Industry
-  Heat Treatment
-  Laboratories
-  Industrial Furnace Construction
-  Aluminium and Nonferrous Metal Industry
-  Cement and Building Material Industry
-  Energy Production
-  Plastic Industry

#### 20-TOM

#### Sheathed Thermocouple Assemblies without Protection Tube

Sheathed thermocouple assemblies without protection tube (20-TOM) are used in almost every branch of industry up to a temperature of 1100°C, with a platinum-rhodium-mantle up to 1300°C. Sheathed thermocouple assemblies essentially consist of thermo wires (inner conductors) insulated with high-purity, condensed magnesium oxide powder and an external mantle (sheath) of heat-resistant high-grade steel or nickel alloy (e.g. Inconel 600®). Sheathed thermocouple assemblies are available in single, double or triple element version. The outer diameter lies somewhere between 0,25 mm and 8,0 mm depending on technical assembly and customer preference. As a result of their structure, sheathed thermocouple assemblies offer numerous advantages when compared to their conventional counterparts.

- Small dimensions for temperature measurements at measuring sites with difficult accessibility (any desired length available)
- Short response time for exact measurements of temperature fluctuations
- Vibration and pressure resistant
- Optimal protection of inner conductors against corrosion, oxidation, mechanical damage and chemical contamination
- Increased stability of electric insulation compared to ceramic insulated thermocouples
- Simple and sealed assembly

#### Availability

We are able to deliver every current design and diameter of sheathed thermocouple assemblies with mounted sockets, connection heads, compensation cables, as well as accessories and mounting structures of every type.

For specialised requirements and standards (such as AMS, CQI-9, etc.), we offer sheathed thermocouple assemblies available with exceptionally narrow tolerances, often referred to as “better class 1”. Thermoelectric voltages and tolerances of our mineral-insulated gauge slides are pursuant to DIN EN 60584, class 1.





① Connectors (Plug/Socket)

LEMO Size 0 - 3
Standard
Miniature
High-Temp.-Standard
High-Temp.-Miniature
Ceramic-Standard
Ceramic-Miniature

② Connection Head (Page 59)

With connecting thread	
B	(M24 x 1,5)
BUS	(M24 x 1,5)
BUZ	(M24 x 1,5)
BUZH	(M24 x 1,5)
BBK	(M24 x 1,5)
DL (MA)	(M10 x 1)

or with thread diameter of 15,3 mm

③ Process Connector (Detachable)

Clamp Connectors	Steel/High-Grade Steel
Pressure Ring	Teflon
Cutting Ring	High-Grade Steel

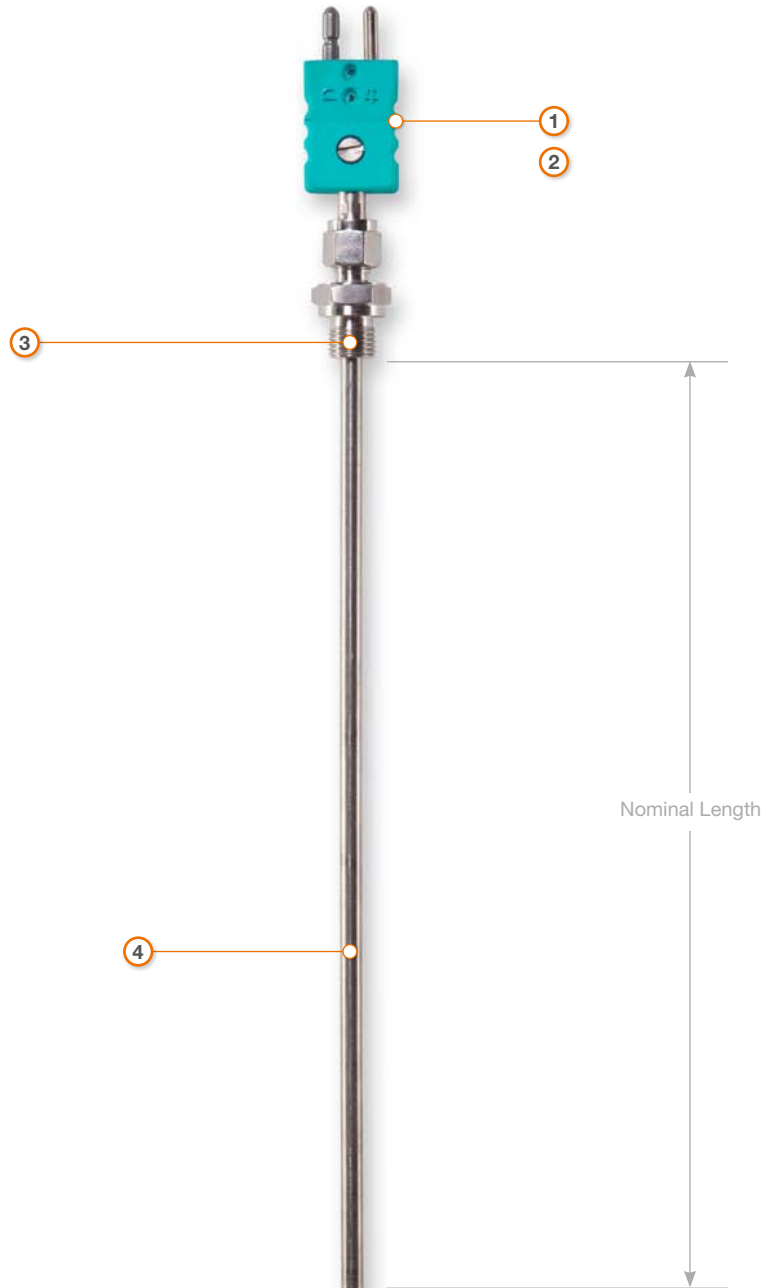
M 8x1 for Mantle Diameter 1,0-3,0 mm
G 1/8 A for Mantle Diameter 1,0-3,0 mm
G 1/4 A for Mantle Diameter 4,5-8,0 mm
G 1/2 A for Mantle Diameter 4,5-8,0 mm

④ Sheathed Thermocouple

(Thermocouple/Mantle Materials)

NiCr-Ni/K	Inconel 2.4816
Fe-CuNi/L	1.4541/2.4816
Fe-CuNi/J	1.4541/2.4816
PtRh-Pt/S	Inconel 2.4816
Nicrosil-Nisil/N	Inconel 2.4816
Mantle Diameter:	0,5 - 8 mm
Single, Double or Triple	

Example of a common implementation in this product line



Thermocouples

Further technical information for this product line is available to download on our website.  
[www.guenther.eu/downloads](http://www.guenther.eu/downloads)

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.  
Please contact us for further information!



### 30-WTE

#### Angular Thermocouple Assemblies with Threaded Elbow Tubing

Angular thermocouple assemblies with threaded elbow tubing (30-WTE) are primarily used for temperature measurement in metal smelting and salt baths.

The angular shape allows for placement of the connector head away from the actual bath/smelt in order to avoid direct exposure to high temperatures and aggressive vapours.

Angular thermocouple assemblies with threaded elbow tubing offer the advantages of an exchangeable immersion tube and the possibility of using more economic material for the supporting tube due to reduced ambient stress factors.

GÜNTHER GmbH has all prevalent angular thermocouples used in smelting and foundry technology. Standard assemblies with immersion tubes made of steel, pure iron, heat-resistant steels and special alloys are applied, as well as silicon nitride, graphite, SiC or special metal ceramics.

Optionally, these thermocouple assemblies may be fitted with in an internal ceramic tube, which significantly increases the long-term stability and electrical insulation in many application scenarios.

As an alternative to the installed thermocouple, numerous angular thermocouple assemblies may be fitted with a mineral-insulated gauge slide, which yields several crucial advantages, such as optimal protection of the inner conductors from corrosion, oxidation, physical damage, and chemical contamination due to the enclosed structure of the outer insulation.

In order to ensure functionality of the thermocouple assembly during a suitable timeframe, careful consideration should be used when selecting the materials for thermocouple and protective tube depending on the operating conditions.

Thermoelectric voltages and tolerances of our thermocouples and mineral-insulated gauge slides are pursuant to DIN EN 60584, class 1, for thermocouples and mineral-insulated gauge slides of type L pursuant to DIN 43710.

#### Recommended Protection Tube Materials in Salt Baths

Smelter	Maximum Temperature	Materials
Tenifer®	600°C	Titanium NT
Saltpetre-, Chloride- & Cyanogen containing Annealing, Tempering and Hardening Baths	1000°C	Pure Iron
	1300°C	1.4821

#### Recommended Protection Tube Materials in Metal Smelting:

Aluminium	700°C	SiN SiC
Magnesium Al/Mg-Alloys	700°C	Pure Iron SiN
Lead	600°C	SiN
Zinc	600°C	Pure Iron / Steel / SiN
Copper	1200°C	1.4762 Graphite
Brass	900°C	1.4762 / Graphite / SiN







1 Connection Head (Page 59)

A	B
AUS	BUS
AUZ	BUZ
AUZH	BUZH
AUSH	BBK

2 Supporting Tube (Materials)

ST 35.8
1.4571

3 Insertion Tube

Pure Iron (Techn. Pure) with Prot. Sleeve	
Steel SL 25	Tapered Tip
Cast Iron GG-22	
Graphite	
Titanium	
Enamelled Steel	

Materials:

High-Grade Steel	1.4541
X10CrAl24	1.4762
X15CrNiSi 25 20	1.4841
Inconel	2.4816
SiN (Silicon Nitride)	
SiC (Silicon Carbide)	
Metal-Ceramic	
Quartz Glass	

4 Inner Tube

C610
C799

5 Mineral-Insulated Gauge Slide

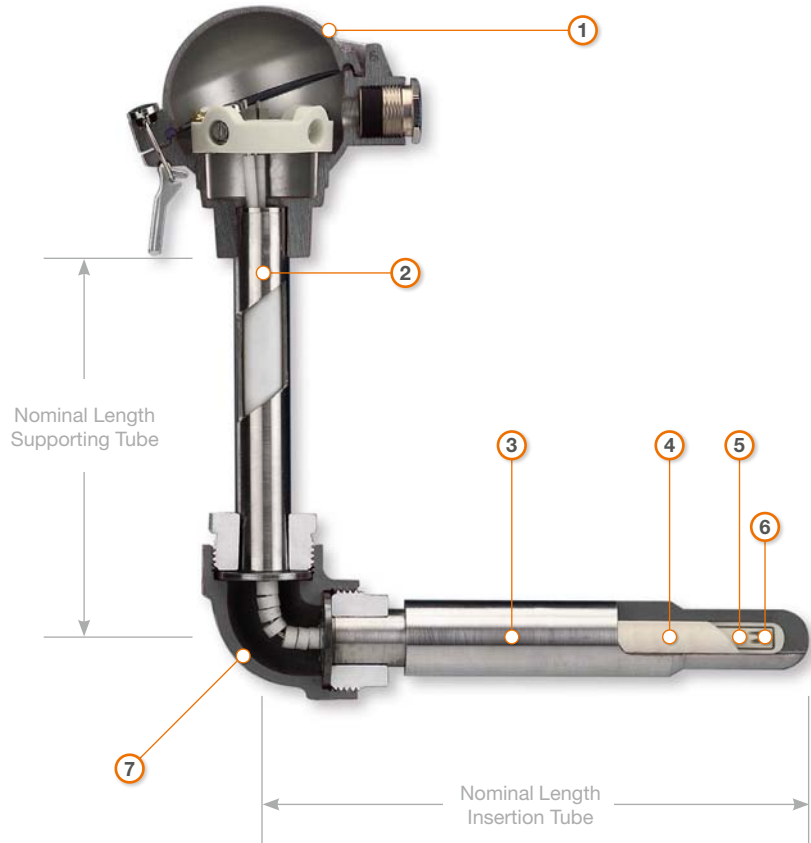
NiCr-Ni	Typ KI
Fe-CuNi	Typ LV
Fe-CuNi	Typ JV
Nicrosil-Nisil	Typ NI
Mantle Diameter:	3,0 - 8,0 mm
Single or Double	

Further technical information for this product line

is available to download on our website.

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)

Example of a common implementation in this product line



6 Ceramic Insulated Thermocouple

NiCr-Ni/K
Fe-CuNi/L
Fe-CuNi/J
Nicrosil-Nisil/N
PtRh10-Pt/S
PtRh13-Pt/R
PtRh30-PtRh6/B
Single or Double

7 Angular Section

Elbow Pipe	3/4"
	3/8"
	1 1/4"
	1/2"

Thermocouples



### 35-WGG

#### Angular Thermocouple Assemblies with Bent or Welded Protection Tube

Angular thermocouple assemblies with bent or welded protection tube (35-WGG) are primarily used for temperature measurement in metal smelting and salt baths.

The angular shape allows for placement of the connector head away from the actual bath/melt in order to avoid direct exposure to high temperatures and aggressive vapours.

As an alternative to the installed thermocouple, numerous angular thermocouple assemblies may be fitted with a mineral-insulated gauge slide, which can have several crucial advantages:

- Optimal protection of the inner conductors from corrosion, oxidation, physical damage, and chemical contamination due to the enclosed structure of the outer insulation.
- Increased stability of the electrical insulation compared to ceramic insulated thermocouples.

In order to ensure functionality of the thermocouple assembly during a suitable timeframe, careful consideration should be used when selecting the materials for thermocouple and protective tube depending on the operating conditions.

Thermoelectric voltages and tolerances of our thermocouples and mineral-insulated gauge slides are pursuant to DIN EN 60584, class 1, for thermocouples and mineral-insulated gauge slides of type L pursuant to DIN 43710.

Further technical information for this product line is available to download on our website.

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)

#### Recommended Protective Tube Materials for Salt Baths:

Smelter	Maximum Temperature	Materials
Tenifer®	600°C	Titanium NT
Saltpetre-, Chloride- & Cyanogen containing Annealing, Tempering and Hardening Baths	1000°C	Pure Iron
	1300°C	1.4821

#### Recommended Protective Tube Materials for Metal Smelting:

Aluminium	700°C	SiN SiC
Magnesium Al/Mg-Alloys	700°C	Pure Iron SiN
Lead	600°C	SiN
Zinc	600°C	Pure Iron / Steel / SiN
Copper	1200°C	1.4762 Graphite
Brass	900°C	1.4762 / Graphite / SiN





① Connection Head (Page 59)

A	B
AUS	BUS
AUZ	BUZ
AUZH	BUZH
AUSH	BBK

② Protection Tube/Supporting Tube (Materials)

High-Grade Steel	1.4571
	1.4541
	1.4404
Heat-Resistant Steels	1.4762
	1.4841
	1.4893
	1.4749
Pure Iron	

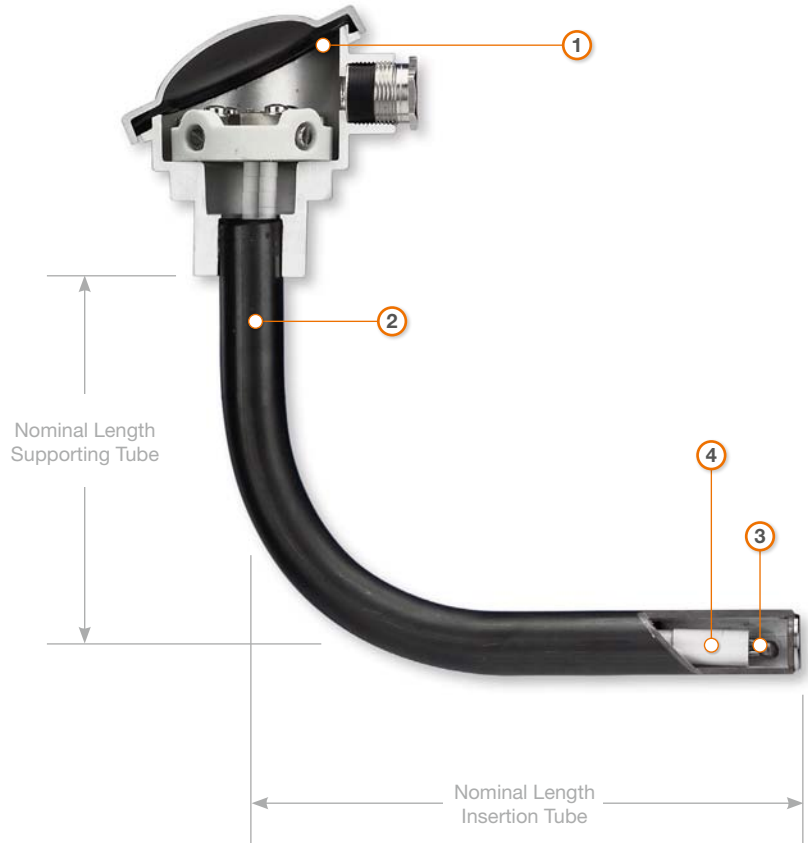
③ Ceramic Insulated Thermocouple

NiCr-Ni/K
Fe-CuNi/L
Fe-CuNi/J
Nicrosil-Nisil/N
Single or Double

④ Mineral insulated Gauge Slide

NiCr-Ni	
Fe-CuNi	
Fe-CuNi	
Nicrosil-Nisil	
Mantle Diameter:	3,0 - 8,0 mm
Single or Double	

Example of a common implementation in this product line



Thermocouples

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!



**Due to their structure, protected resistance thermometers offer a number of advantages when compared to regular thermocouple assemblies:**

- Small physical dimensions with maximum flexibility for temperature measurement at sites with difficult accessibility (diameter 1,5 – 6,0 mm).
- Short response time for exact measurements of temperature variations
- Optimal protection for the sensor system by the enclosed structure

**Application Examples for Resistance Thermometers with Metal Protection Tube:**

-  Plant and Machine Construction
-  Automobile Industry
-  Chemical Industry
-  Energy Production

### 50-WMS

#### Resistance Thermometers with Metal Protection Tube

Sensors of this type are used for general temperature measurement, mostly in liquid and gaseous media at temperatures up to 600°C, on rare occasions up to 800°C. Typical applications include refrigeration and air conditioning technology, heating, oven and apparatus construction, as well as chemical industry.

Protective fittings in this product line consist of seam welded or seamlessly drawn metal tubes. Depending on the application, GÜNTHER GmbH has over 40 different, partly high-alloyed materials in a large array of measurements in stock. The tips for the protective tubes are either closed through hot forming or welded shut with a bottom blank.

Tapered measuring tips may be used in this product line in order to shorten the reaction time. For prolonging the holding time, strengthening the wall thickness and utilization of ceramic inner tubing are possible.

All internationally prevalent precision resistors, detachable process connectors (for example mobile flanges or threaded sleeves) and connection heads are used.

Depending on the connection type (2-wire, 3-wire or 4-wire – in turn depending on the required measurement precision and connector length), resistance thermometers consist of 2, 4 or 6 feed lines (inner conductors), surrounded by a thin metallic protective mantle, usually made of high-grade steel. The inner conductors are firmly press-fitted and insulated in ceramic powder. The precision resistor inside the sensor tip is connected through the inner conductors. The gauge slide in serial-production is fitted with a Pt 100 temperature sensor pursuant to DIN 60751, however versions with Pt 500 or Pt 1000 sensors are possible. The gauge slide is hermetically sealed.

For specialised applications (precision, long-term stability, etc.) we recommend the application of precision resistors with narrowed tolerance.

The resistance values and tolerances of our resistance thermometers are pursuant to DIN EN 60751.





① Connection Head (Page 59)

A	B
AUS	BUS
AUZ	BUZ
AUZH	BUZH
AUSH	BBK

② Process Connector (Detachable)

Flange
Threaded Socket
Flange / Counter Flange

③ Outer Protective Tube

Materials:	
St. 35.8	Mat. No. 1.0305
Stainless Steel	Mat. No. 1.4571
X10Cr Al 24	Mat. No. 1.4762
X15CrNi Si 25 20	Mat. No. 1.4841
Heat-Resistant Steel	Mat. No. 1.4893

④ Sensor Tip

Straight
or Tapered to 6 - 15 mm

⑤ Mineral-Insulated Gauge Slide

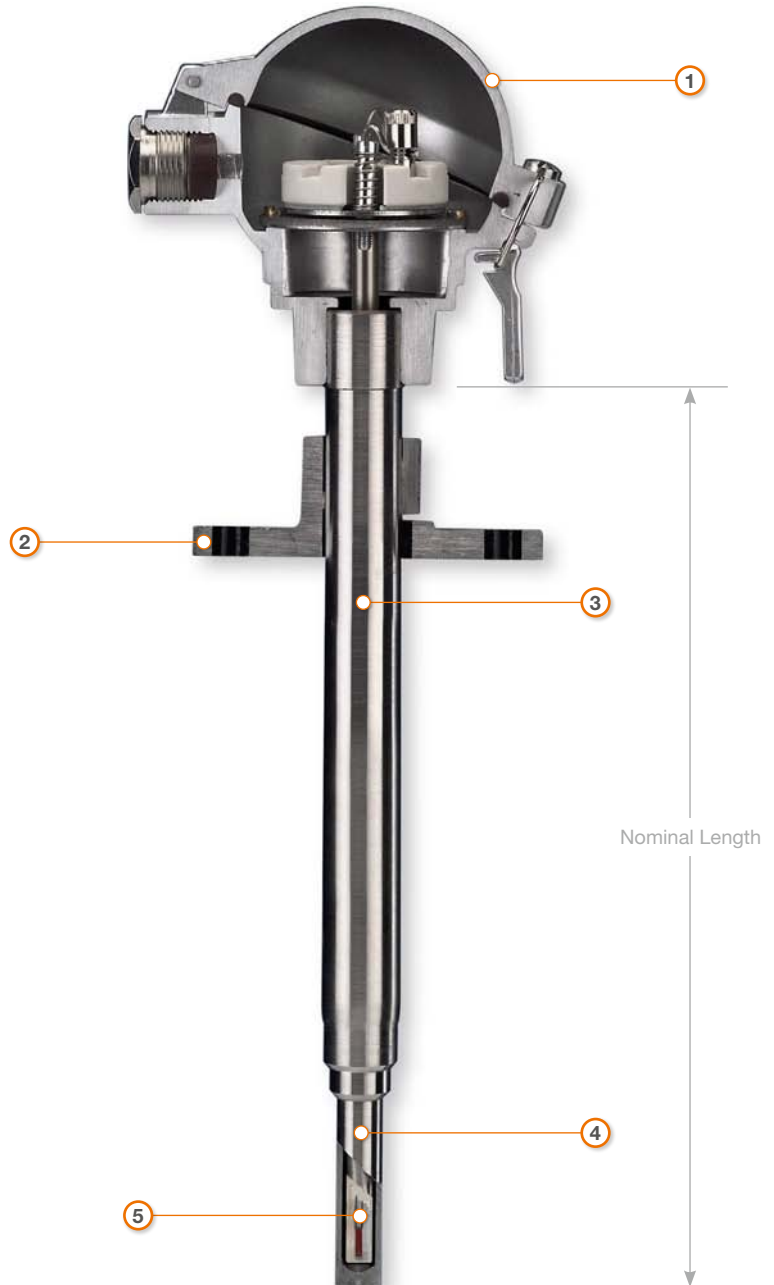
Mantle Diameter:	1,5 - 8,0 mm
Tip Diameter:	2,0 - 10,0 mm
Connection:	
1 x Pt100 up to 3 x Pt100 Ohm	
2-Wire up to 4-Wire	

Our resistance thermometers are also available in explosion protected ATEX models. (see page 50)

Further technical information for this product line is available to download on our website.

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)

Example of a common implementation in this product line



Resistance Thermometers

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!



#### Application Examples for Mineral Insulated Resistance Thermometers without Protection Tube:

-  Plant and Machine Construction
-  Automobile Industry
-  Laboratories
-  Plastic Industry

#### Availability:

We offer every current version and diameter of mineral insulated resistance thermometer with mounted plug-and-socket connectors, connector heads, compensation lines with or without specialised contacts, as well as accessories and every type of mounting.

#### 52-WOS

#### Mineral Insulated Resistance Thermometers without Protection Tube

Sensors of this type are used for general temperature measurement up to 600°C, on rare occasions up to 800°C. They are suited for surface temperature measurement as well as measurements of liquids and gases.

Depending on the connection type (2-wire, 3-wire or 4-wire – in turn depending on the required measurement precision and connector length), resistance thermometers consist of 2, 4 or 6 copper feed lines (inner conductors), surrounded by a thin metallic protective mantle, usually made of high-grade steel. The inner conductors are firmly press-fitted and insulated in ceramic powder. The precision resistor inside the sensor tip is connected through the inner conductors.

As a result of their structure, mineral insulated resistance thermometers have the following advantages:

- Small physical dimensions with maximum flexibility for temperature measurement at sites with difficult accessibility (diameter 1,5 – 6,0 mm).
- Short response time for exact measurements of temperature variations
- Optimal protection for the sensor system against corrosion, oxidation, physical damage and chemical contamination as a result of the enclosed structure
- The enclosed structure also facilitates application of these sensors without additional protective fitting

**Our resistance thermometers are also available in explosion protected ATEX models. (see page 50)**

**Further technical information for this product line is available to download on our website.**

**[www.guenther.eu/downloads](http://www.guenther.eu/downloads)**





① Connection Components (Plug/Socket)

LEMO Size 0 - 3
Standard
Miniature
High-Temp.-Standard
High-Temp.-Miniature
Ceramic-Standard
Ceramic-Miniature

② Connection Head (Page 59)

with connecting thread	
B	(M24 x 1,5)
BUS	(M24 x 1,5)
BUZ	(M24 x 1,5)
BUZH	(M24 x 1,5)
BBK	(M24 x 1,5)
DL (MA)	(M10 x 1)

or with thread diameter of 15,3 mm

③ Process Connector (Detachable)

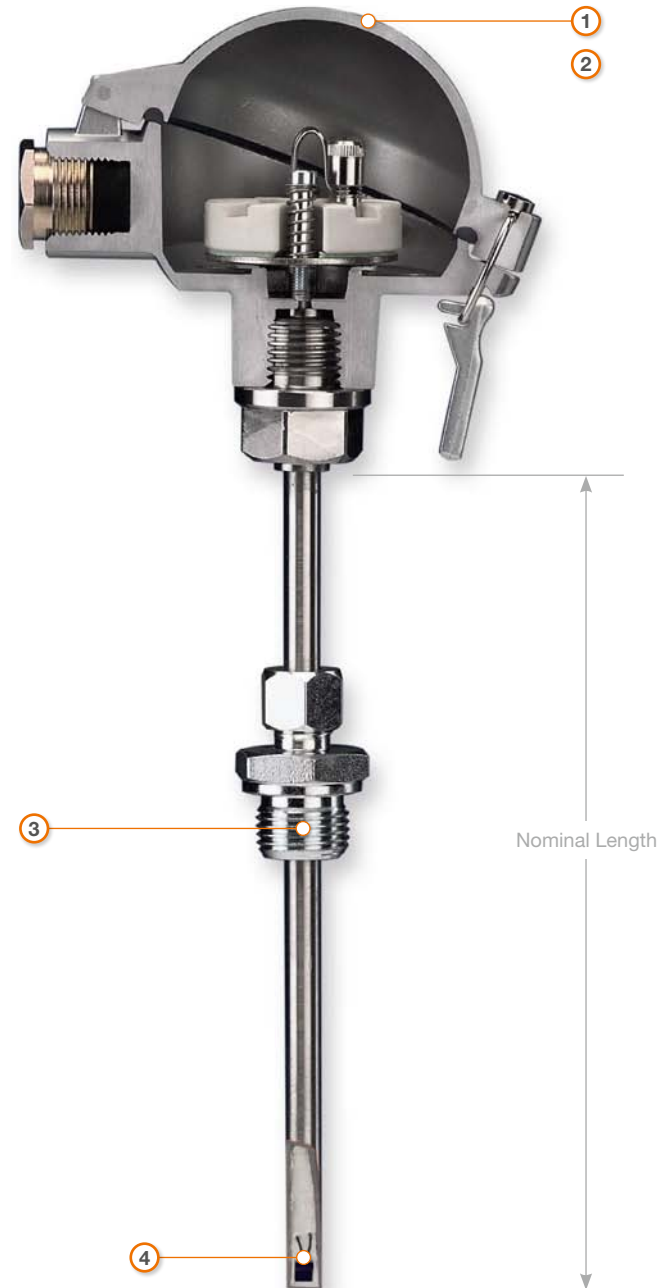
Clamp Connectors	Steel/High-Grade Steel
Pressure Ring	Teflon
Cutting Ring	High-Grade Steel

M 8x1 for Mantle Diameter 1,0-3,0 mm
G 1/8 A for Mantle Diameter 1,0-3,0 mm
G 1/4 A for Mantle Diameter 4,5-8,0 mm
G 1/2 A for Mantle Diameter 4,5-8,0 mm

④ Mineral-Insulated Gauge Slide

Mantle Diameter:	2,0 - 8,0 mm
Tip Diameter:	2,0 - 10,0 mm
<b>Connection:</b>	
1 x Pt100 up to 3 x Pt100 Ohm	
2-Wire up to 4-Wire	

Example of a common implementation in this product line



Resistance Thermometers

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!



### Application Examples for Resistance Thermometers with Welding Thermowell

-  Waste Recycling / Incineration
-  Plant and Machine Construction
-  Automobile Industry
-  Chemical Industry
-  Laboratories
-  Energy Production

### 53-WHD

#### Resistance Thermometer with Welding Thermowell Form 4 (Formerly D-Sleeve) pursuant to DIN 43772

Resistance thermometers with welding thermowell (53-WHD) are used for temperature measurement in gaseous and liquid media such as air, steam, water, oil, etc. with high current velocities and pressures. The material of the thermowell defines the operation temperature. Specialised thermowells are suitable up to 700 bar of pressure. The instruments of this product line are fitted with exchangeable mineral-insulated gauge slides.

The main construction component is a thermowell of high-grade or pressure-vessel steel, which is used to weld the thermometer into the respective machine.

Selection of the thermowell is dependent on spatial proportions at the point of installation, as well as demands as dictated by temperature, pressure, current flow and chemical attack.

Standard values for stress capacity can be found in the diagrams of DIN 43772.

In particular the question of chemical stress capacity must be examined carefully for each individual scenario. Often times, only field testing will yield authoritative information, as even minor impurities in the ambient media can have significant impact on the performance of the thermowell within the application environment.

For specialised applications (precision, long-term stability, etc.) we recommend the application of precision resistors with narrowed tolerance.

Resistance values and tolerances of our resistance thermometers are pursuant to DIN EN 60751.







① Connection Head (Page 59)

B (M24 x 1,5)	BUSH
BUS	BUZH
BUZ	NA
BBK	DL / MA

② Neck Tube (Pursuant to DIN 43767)

with or without threading, made of
high grade steel or
zinc-plated steel

③ Thermowell (Pursuant to DIN 43763)

Cone Length:	40 - 125 mm
Shaft Length:	50 or 110 mm
Protective Tube Length:	115 - 260 mm
Diameter:	18 or 24 mm

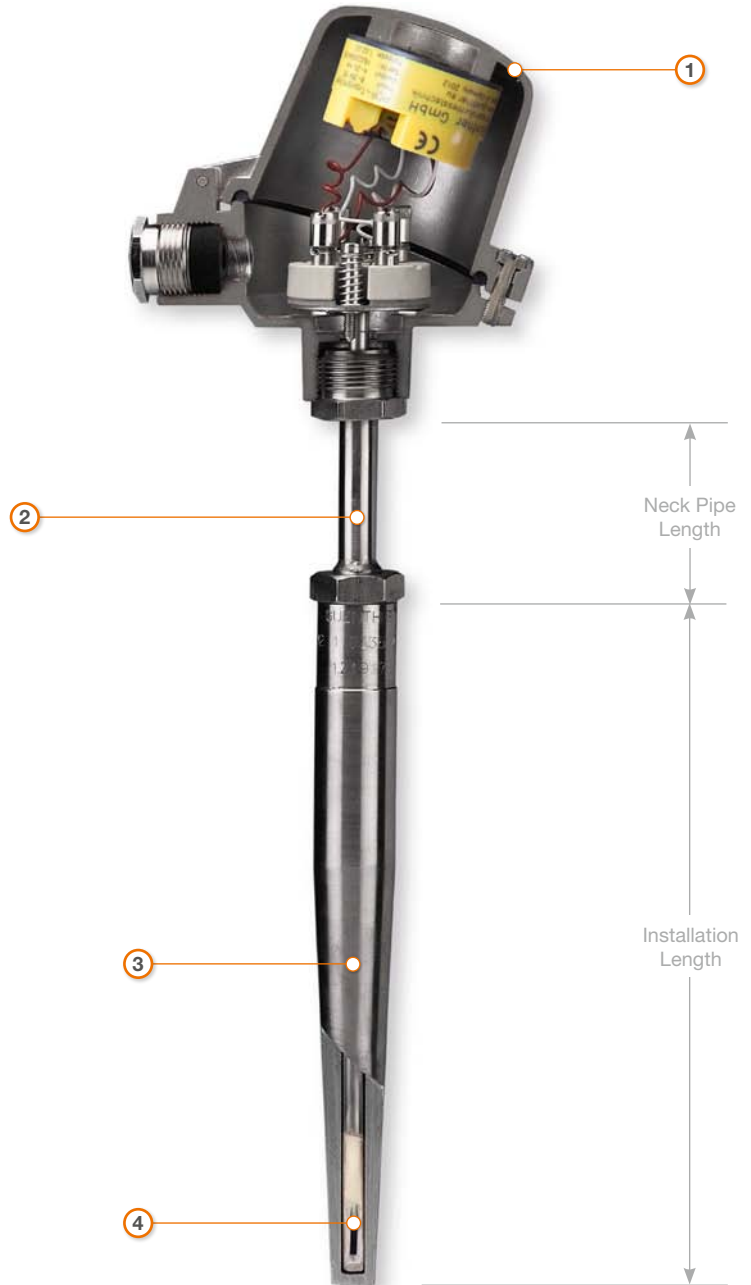
④ Mineral-Insulated Gauge Slide

Mantle Diameter:	1,5 - 8,0 mm
Tip Diameter:	2,0 - 10,0 mm
<b>Connection:</b>	
	1 x Pt100 up to 3 x Pt100 Ohm
	2-Wire up to 4-Wire

Our resistance thermometers are also available in explosion protected ATEX models. (see page 50)

Further technical information for this product line is available to download on our website. [www.guenther.eu/downloads](http://www.guenther.eu/downloads)

Example of a common implementation in this product line



Resistance Thermometers

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!



### Application Examples for Resistance Thermometers with Welded Blank Flanges

-  Waste Recycling / Incineration
-  Plant and Machine Construction
-  Automobile Industry
-  Chemical Industry
-  Laboratories
-  Energy Production

### 54-WFL

#### Resistance Thermometers with Welded Blank Flanges

Resistance thermometers with welded blank flanges (54-WFL) are used for temperature measurements in gaseous or fluid media such as air, steam, water or oil.

Distinctive characteristic of these sensors is a blank flange welded to or onto the protective tube, most commonly pursuant to DIN EN 1092, enabling a sealed connection of the sensor with the respective wall of an over- or under-pressure facility as can be found in power plants, for example.

Both the employed protection tube and the blank flanges should consist of the same material if possible.

When particularly quick recognition of temperature changes are required, we recommend the use of sensors with a tapered protective tube tip.

For specialised applications (precision, long-term stability, etc.) we recommend the application of precision resistors with narrowed tolerance.

Resistance values and tolerances of our resistance thermometers are pursuant to DIN EN 60751.

**Our resistance thermometers are also available in explosion protected ATEX models. (see page 50)**

**Further technical information for this product line is available to download on our website.**

**[www.guenther.eu/downloads](http://www.guenther.eu/downloads)**





① Connection Head (Page 59)

A	BUSH
B	BUZH
BUS	DL / MA
BUZ	

② Blank Flanges Pursuant to DIN EN 1092

DN 10 - DN 100	PN 16
Material:	
Mat. No. St37-2	Mat. No. 1.4571
Mat. No. C22.8	Alloy C4

③ Protective Tube (Materials/Dimensions)

St. 35.8	Mat. No. 1.0305
Stainless Steel	Mat. No. 1.4571
X10Cr Al 24	Mat. No. 1.4762
X15CrNi Si 25 20	Mat. No. 1.4841
Inconel	Mat. No. 2.4816
Kanthal	
Alloy C4	
Diameter:	6 - 22 mm
Wall:	0,75 - 3 mm

④ Mineral-Insulated Gauge Slide

Mantle Diameter:	2,0 - 8,0 mm
Tip Diameter:	2,0 - 10,0 mm
<b>Connection:</b>	
1 x Pt100 up to 3 x Pt100 Ohm	
2-Wire up to 4-Wire	

⑤ Configuration

Straight
or Tapered to between 6 and 15 mm

Example of a common implementation in this product line



Resistance Thermometers

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!



### Application Examples for Resistance Thermometers with Threaded Socket and Mineral-Insulated Gauge Slide:

-  Waste Recycling / Incineration
-  Plant and Machine Construction
-  Automobile Industry
-  Chemical Industry
-  Laboratories
-  Energy Production

### 55-WES

#### Resistance Thermometers with Threaded Socket and Mineral-Insulated Gauge Slide

Resistance thermometers with threaded socket and mineral-insulated gauge slide (55-WES) are used for general temperature measurement in low-pressure gaseous, liquid and plastic media environments, depending on the properties of the protective tube and surrounding media, up to a temperature of 800°C.

A threaded socket is welded to the protective tube, providing for the stability of the process connector in sensors of this product line. Depending on the application, the socket is welded to the protective pipe, either directly beneath the connection head or with a gap of 100 or 200mm, for example.

The protective fittings are usually made from a single seamlessly drawn high-grade steel tube with a circular blank welded inside. In order to facilitate particularly quick temperature change measurements, we offer sensors with a tapered sensor tip.

For specialised applications (precision, long-term stability, etc.) we recommend the application of precision resistors with narrowed tolerance.

Resistance values and tolerances of our resistance thermometers are pursuant to DIN EN 60751.

**Our resistance thermometers are also available in explosion protected ATEX models. (see page 50)**

**Further technical information for this product line is available to download on our website.**

**[www.guenther.eu/downloads](http://www.guenther.eu/downloads)**





① Connection Head (Page 59)

B	BUSH
BUS	BUZH
BUZ	NA
BBK	DL / MA

② Process Connector (Detachable)

G 1 A
G 1/2 A
M18 x 1,5
G 3/4 A
M20 x 1,5
Combined: M24 x 1,5 / G 1/2 A
M10 x 1 / G 1/2 A

③ Outer Protective Tube Materials/Dimensions

St. 35.8	Mat. No. 1.0305
Stainless Steel	Mat. No. 1.4571
X10Cr Al 24	Mat. No. 1.4762
X15CrNi Si 25 20	Mat. No. 1.4841
Inconel	Mat. No. 2.4816
Kanthal	
Diameter:	6 - 22 mm
Wall:	0,75 - 3 mm

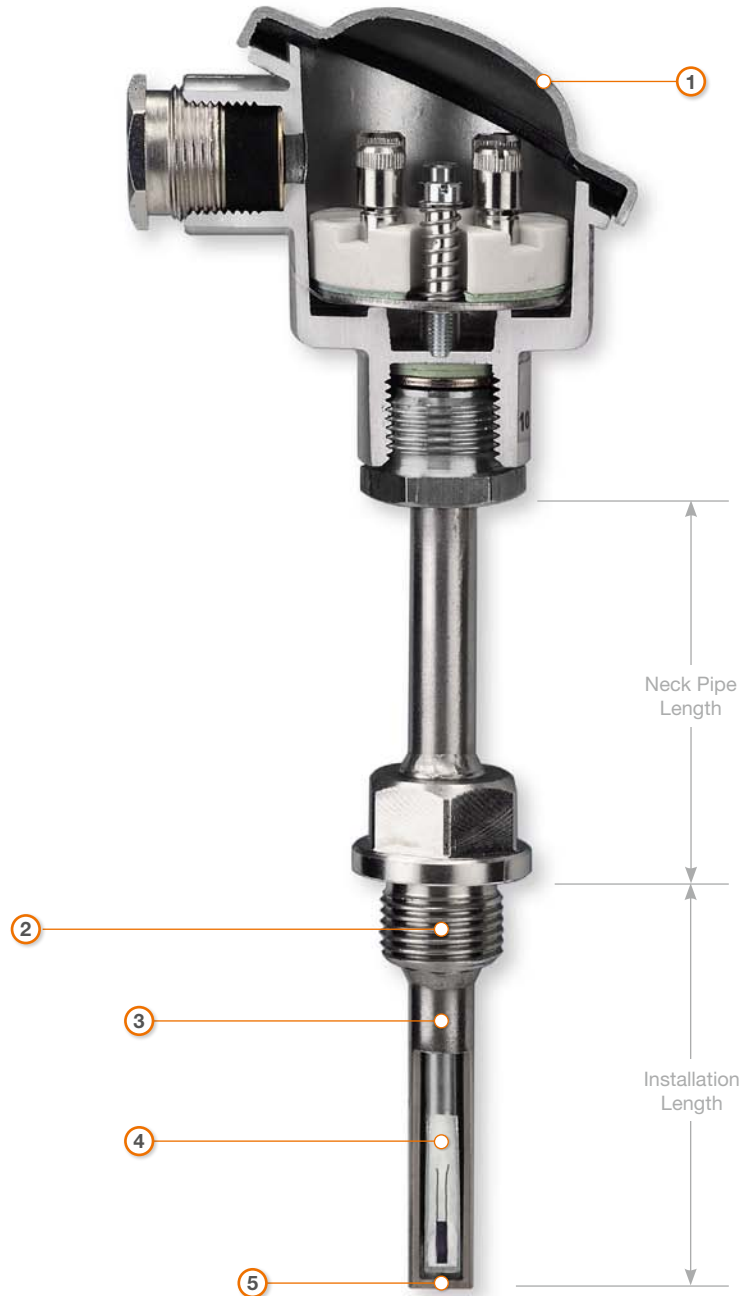
④ Mineral-Insulated Gauge Slide

Mantle Diameter:	1,5 - 8,0 mm
Tip Diameter:	2,0 - 10,0 mm
<b>Connection:</b>	
	1 x Pt100 up to 3 x Pt100 Ohm
	2-Wire up to 4-Wire

⑤ Configuration

Straight
or Tapered to between 6 and 15 mm

Example of a common implementation in this product line



Resistance Thermometers

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

## 60-TE / 60-WTH

### Thermocouple Assemblies and Resistance Thermometers with Bayonet Nut Connector



#### Application Examples for Thermocouple Assemblies and Resistance Thermometers with Bayonet Nut Connector:



Plant and Machine Construction



Heat Treatment



Plastic Industry

#### 60-TE / 60-WTH

#### Thermocouple Assemblies and Resistance Thermometers with Bayonet Nut Connector

Sensors with bayonet nut connectors are recommended for measuring temperatures inside the blocks of machines, mechanisms and die cast forms, primarily in the plastic industry, at temperatures up to 400°C.

#### Advantages of Sensors with Bayonet Nut Connectors

- Reliable construction
- Bending resistant cabling
- Class 1 for type J and type K  
(High measurement precision)

The form of the measuring tip is mostly half-round, planar or with a point angle of 118°. The latter aligns itself very well into a standard bore hole.

The sensors are fitted with a pressure spring that, in combination with the correct installation length, respectively contact pressure at the installation point, protects the cable from deflexion. The installation length is variable, limited by the length of the pressure spring.

Please find the standardised inner diameter of bayonet nut connectors in the table on the right. Please note, that we do offer customised versions.

The standard mounted measuring elements are Pt 100: 2-, 3- or 4-wire, accuracy class N pursuant to EN 60751 or thermocouple types J and K in class 1. Double versions or the application of special sensors are also possible.

Further technical information for this product line is available to download on our website.

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)





① Sensor Type

1xPt100-2L
1xPt100-3L
1xPt100-4L
NiCr-Ni/K
Fe-CuNi/J
Fe-CuNi/L

② Sensor Tip

Ø 6 mm	planar
	118°-Angle
	other
Ø 8 mm	planar
	118°-Angle
	other

③ End Termination

Free Ended (Non Tin-Plated)
Soldered Ends
Ends with Cable End Sleeves
Plug / Socket (Standard)
Plug / Socket (Miniature)
Plug / Socket (LEMO)

Example of a common implementation in this product line



Special Temperature Sensors

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

## 71-KFT / 72-KFW

### Cable Thermocouples and Cable Resistance Thermometers



#### Application Examples for Cable Thermocouples and Cable Resistance Thermometers:

- Piping
- Machines and Devices
- Heating Units
- Ovens
- Freezers
- Liquids

#### 71-KFT / 72-KFW

#### Cable Thermocouples and Cable Resistance Thermometers

Sensors of this type are primarily used for temperature measurement in liquid and gaseous media. However, there is a broad palette of configuration and construction options that can be adapted to specific applications. Due to their make-up, these sensors may be used in temperature ranges between  $-200^{\circ}\text{C}$  and  $+400^{\circ}\text{C}$ .

#### Advantages of Cable Thermocouples and Cable Resistance Thermometers

- Reliable, Partly Watertight Construction
- Broad Selection of Configuration Options

At the point where the sheath meets the cable, the sensors may be equipped with a teflon coating (moisture protection) and/or springs (cable break protection).

Other Types of temperature sensors, similar to plug-in resistance thermometers, are referred to by their construction or mounting type, respectively their area of application. For example:

- Surface Sensors
- Contact Sensors
- Pipe or Tube Sensors
- Threaded Sensors
- Welding Sensors
- Acid- and Oil-Tight Versions are Possible

**Our resistance thermometers are also available in explosion protected ATEX models. (see page 50)**

**Further technical information for this product line is available to download on our website.**

**[www.guenther.eu/downloads](http://www.guenther.eu/downloads)**







① Sensor Tip

- Pt100 Class A
- Pt100 Class B
- Pt100 Class B 1/3
- Pt100 Class B 1/5
- Pt100 Class B 1/10
- Pt1000 Class A
- Pt1000 Class B
- NiCr-Ni/K
- Fe-CuNi/J
- Fe-CuNi/L
- Cu-CuNi / T
- Cu-CuNi / U
- Platinum
- Nickel (Ni 100, ...)
- NTC/PTC

② Configuration

- Room Sensor (Non-Watertight)
- Heat Shrunken Insulated Measuring Point (Watertight)
- ② Metal Sheath (Std.: High-Grade Steel)
- Metal Sheath with Threaded Socket
- Ceramic Sheath
- ① Pipe / Tube Clamp
- ③ Small Welding Plate
- ④ Touch Sensor
- ⑤ Screw Threaded Sensor
- ⑥ Non Standard Construction (e.g. Magnet)

③ End Termination

- Free Ended (Non Tin-Plated)
- Soldered Ends
- Ends with Cable End Sleeves
- Standard Plug / Socket Connector
- Miniature Plug / Socket Connector
- HT-Standard Plug / Socket Connector
- HT-Miniature Plug / Socket Connector
- Ceramic Standard Plug /Socket Connector
- LEMO Plug / Socket Connectors Sz. 0 to Sz. 3

Example of a common implementation in this product line



Special Temperature Sensors

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

## 74-WTH Resistance Thermometers with Machine Connectors



### Application Examples:

- Tanks and Containers
- Machine and Plant Construction
- Technological Processes
- Energy Production and Distribution
- Food and Beverage Industry

### 74-WTH

#### Resistance Thermometers with Machine Connectors

This type of resistance thermometers with threaded sockets are used for temperature measurement of liquids in regions with vibrations and challenging surrounding media up to a temperature of 200°C.

#### Advantages of Resistance Thermometers with Machine Connectors:

- Resistant to Vibrations
- Quick Connection of Cables and Sensors
- Constructed in High-Grade Steel (Sealed, Hygienic, etc.)

The most common application areas among others are machine construction, industrial, food and beverage systems. The electric machine connector M12x1 guarantees high-level protection (IP65) and comfortable connection of cables and sensors using a 4-pin plug.

Pt 100 2-wire measuring elements are standard implementation, tolerance class B pursuant to EN 60751. It is possible, however, to implement Pt 500, Pt 1000 or specialised sensors (also as double version). Also, a transducer may be fitted inside the connection head.

Further technical information for this product line is available to download on our website.

[www.guenther.eu/downloads](http://www.guenther.eu/downloads)





① Machine Connector

M12 without Transducer
Angled Plug pursuant to DIN EN 175301 without Transducer
Only 1xPt100 2-L Sensor:
M12 With Transducer
Angled Plug pursuant to DIN EN 175301 With Transducer

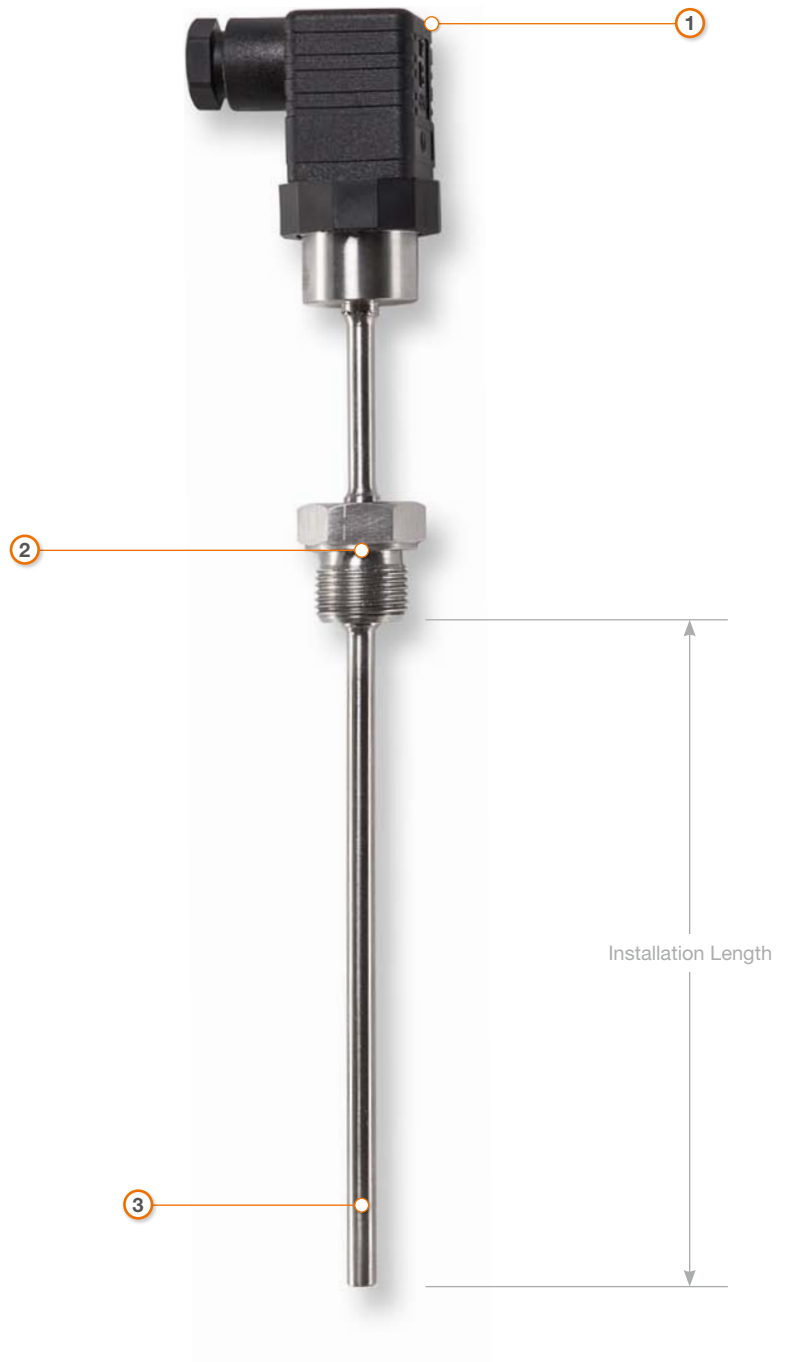
② Process Connector (Detachable)

Without
Threading G 1/2 A
Threading G 1/4 A
Threading G 3/8 A
Threading M18 x 1,5
Threading M20 x 1,5
Mantle DN 25 KF
Other

③ Gauge Slide

Pt100 Class A
Pt100 Class B
Pt100 Class B 1/3
Pt100 Class B 1/5
Pt100 Class B 1/10
Pt1000 Class A
Pt1000 Class B
Nickel (Ni 100, ...)
NTC/PTC
<b>Connection:</b>
1 x 2 Wire    1 x 4 Wire
1 x 3 Wire    2 x 2 Wire

Example of a common implementation in this product line



Special Temperature Sensors

Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

# Intrinsically Safe Thermocouple Assembly Pursuant to ATEX Directive 94/9/EG



## 45 Years of Passion and Precision

Early in 2012, we have begun manufacturing explosion resistant thermocouples and resistance thermometers for business and industry sectors utilizing flammable substances in either gaseous form, as mists or dust particles. These are available in a wide variety of make and design.

## Certified Production Facility

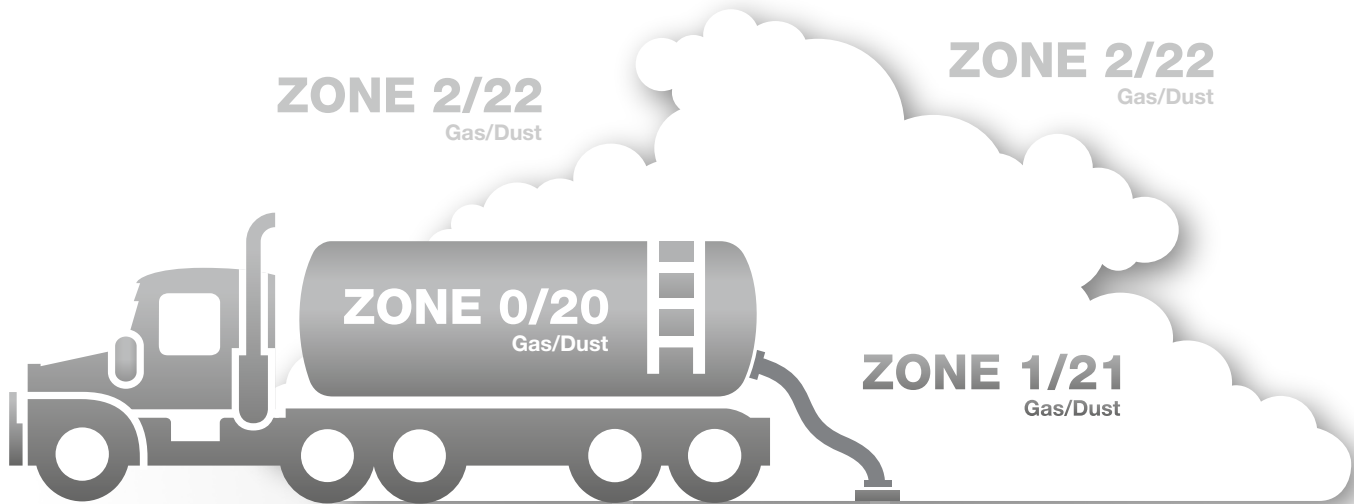
In 2011 the quality management system at both GÜNTHER GmbH production facilities was certified pursuant to ATEX (**A**Tmosphères **E**xplosibles) directive 94/9/EG, a requirement for the production of type-approved sensors.

To satisfy future requirements and technological variety, continuous development of our products, as well as their adaptation for individual application scenarios is a matter of course. As a result, our current product line was expanded to include a wide range of ATEX Sensors for **gas-Ex-** and **dust-Ex-areas**.





Application Areas for Our Intrinsically Safe Temperature Sensors



Series R1/T1



Series R2/T2



Series R3/T3



Series R4/T4



Series R5/T5



Series R6/T6

Special Temperature Sensors

Approved for zones / hazard areas:

0, 1 and 2 (Gas-Ex-Area)  
20, 21 and 22 (Dust-Ex-Area)

1 and 2 (Gas-Ex)  
21 and 22 (Dust-Ex)

1 and 2 (Gas-Ex-Area)  
No Application in Dust-Ex-Areas

## Function, Construction and Application



Our intrinsically safe sensors are implemented as resistance thermometers or thermocouples. They convert the temperature at the point of measurement into an electric variable (voltage, resistance) and, in combination with corresponding secondary devices, serve to measure, register and regulate temperatures in the region between - 200°C and approx. +1200°C.

**Resistance thermometers in series R1 to R6, as well as thermocouple thermometers in series T1 to T6, are constructed so that they do not – and this includes provision for possible errors – provide a source of ignition.**



GÜNTHER Ex-sensors find application in many industry sectors as intrinsically safe equipment for temperature measurement in liquid and gaseous environments. The sensors in series R1/T1 to R4/T4 consist of a protective fitting with varying process connectors, a connector head and exchangeable gauge slide. The sensors in series R5/T5 and R6/T6 consist of gauge slides with connector head or connection box with various process connectors. They are implemented either with protective tubing or mineral-insulated wiring and cable connectors.



Depending on application and measurement requirements, our sensors may be fitted with a variety of process connectors. The devices may only be operated with the designated protective tubing, as all protective fittings (process contacting parts) are leakage tightness tested in our certified test laboratory. These sensors with the Ex ignition protection type “i”, are certified for connection to intrinsically safe category “ia” circuits. When connecting to an intrinsically safe circuit, the operator is required to limit the incoming power to the point where the maximum electric surface heat corresponding to the temperature class, minus the protection ratio distance, is not exceeded.

*GÜNTHER GmbH Ex-sensors find application in classic industry sectors such as chemical, petrochemical, and food sectors, in machine and equipment construction as well as gas and crude oil production.*





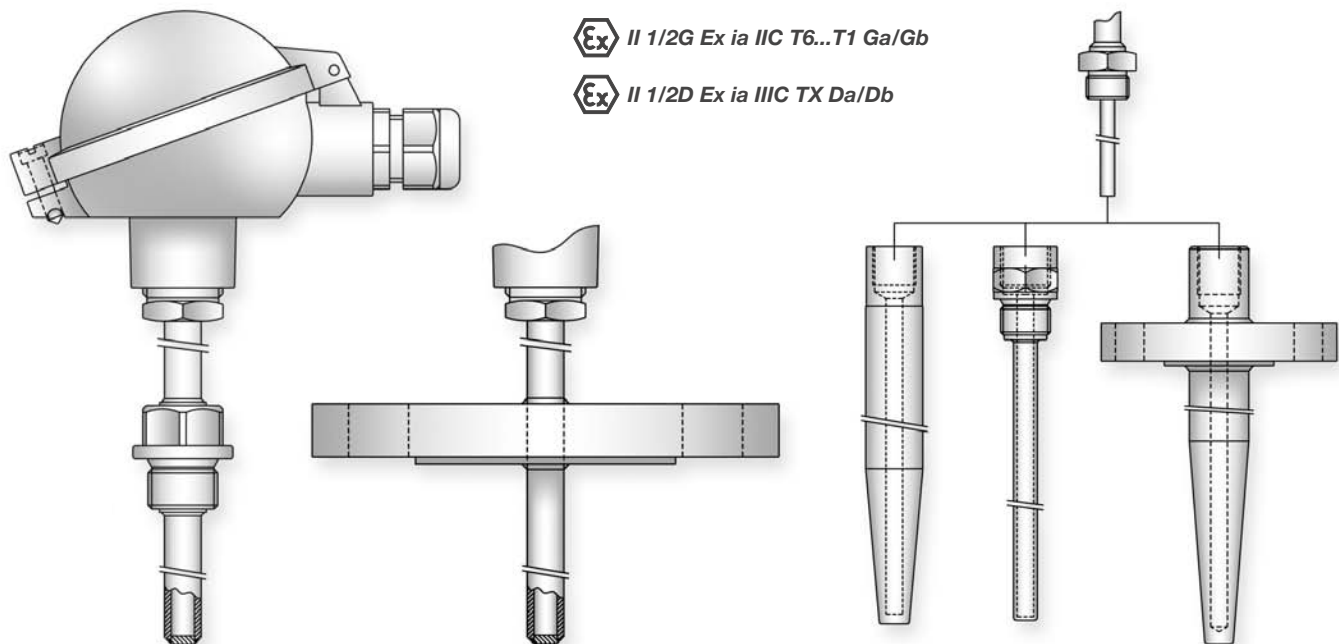
Common platinum and nickel resistors are used for these resistance thermometers (R1-R6). These sensors are manufactured pursuant to DIN EN 60 751 and are available in all prevalent tolerance classes, as two-, three- or four-wire systems. Models with two measurement circuits are also possible.

The thermocouple assemblies (T1-T6) are optionally fitted with thermocouples T, J, K, E and N pursuant to DIN EN 60584-1,

in tolerance class 1 or 2, as single or double measurement circuits.

They fulfill the requirements for explosion group II of categories 1/2G and/or 2G, several types also meet the requirements for categories 1/2D and/or 2D. As a result, they are suited for application in explosion hazard areas zone 1 for gas, zone 21 for dust.

### Product Series R1/T1 to R3/T3



*To meet requirements for any number of application scenarios, a wide range of materials (e.g. 1.4571, 1.4541, 1.4404, 2.4816, Hastelloy, etc.) and measurements (outer diameter, wall thickness, installation length, etc.) are available for the production of our temperature sensors.*

In series R1-R3 and T1- T3 temperature sensors, any protective tubing in contact with the measured substance (zone 0 or 20) are delivered with wall thickness  $\geq 1\text{mm}$  in order to assure zone separation.

These protective tubes serve to protect the gauge slides from chemical and physical attack. Additionally, the selection of appropriate protection tubes increases the required mechanical stability.

The process connectors installed in these series are screwed sockets with a diverse range of connecting threads or blank flanges, with measurements in accordance with national and international standard specifications. For welding sleeves, the customer must ensure that zone separation is professionally implemented as part of the welding process.

Tapered protective tube tips for increased reaction time at the point of measurement are available.

## Product Series R4/T4

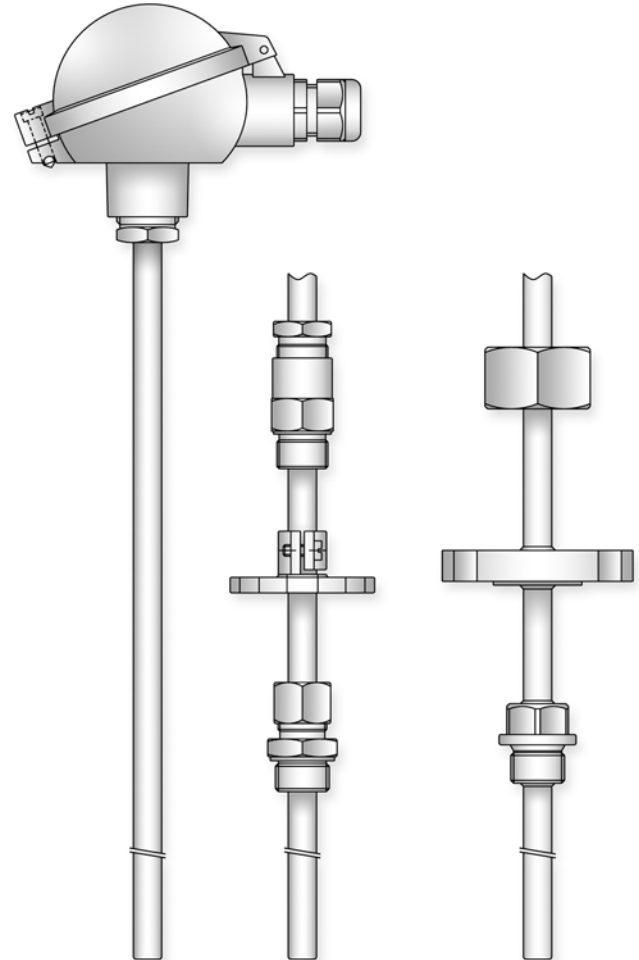
Temperature sensors of series R4/T4 are fitted with protective tubes of varying wall thickness. When custom fitting the protective tubes to the gauge slides short response times can be effected.

These devices are always closed protective tubes fitted either without, with moveable or with welded process connectors. Available standard process connectors include stop flanges, screw sockets and couplings, as well as welded blank flanges, sleeves and double-ended unions.

The process connectors in series R4/T4 do not constitute a zone separation. These temperature sensors can be applied in zone 1 (Gas-Ex) and zone 21 (Dust-Exs).

### Thermal Resistance $R_{TH}$ (in K/W) in relation to the Protective Tube Diameter (in mm):

Protective Tube Diameter	Thermal Resistance $R_{TH}$ (Protective Tube Surface at Point of Measurement for Zone 0)
6,0 / 8,0 / 9,0 mm	85 K/W
10,0 / 11,0 / 12,0 / 15,0 mm and larger	55 K/W



 II 2G Ex ia IIC T6...T1 Gb

 II 2D Ex ia IIIC TX Db



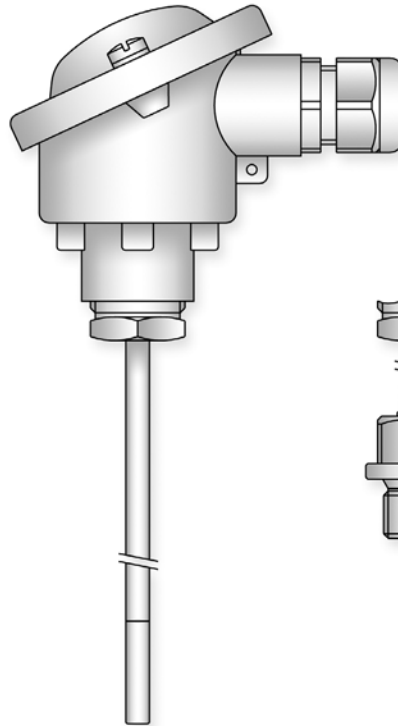




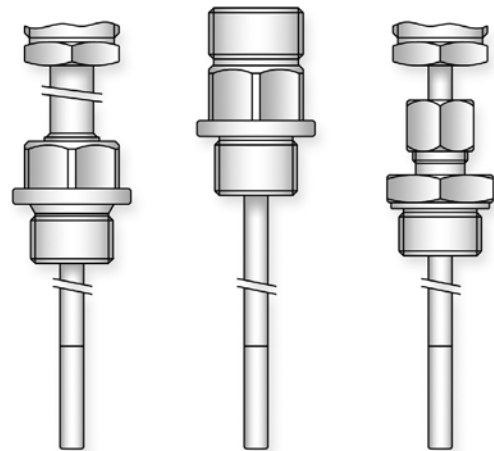
## Product Series R5/T5

The screw-in temperature sensors of series R5 (resistance thermometer) and T5 (thermocouple assembly) essentially consist of a gauge slide protruding from the connecting head. We deliver measurements of 3 mm, 4,5 mm and 6 mm diameters ex works. Moveable compression fittings, clamping ring couplings or fixed threaded connectors with or without neck pipe are used as process connectors.

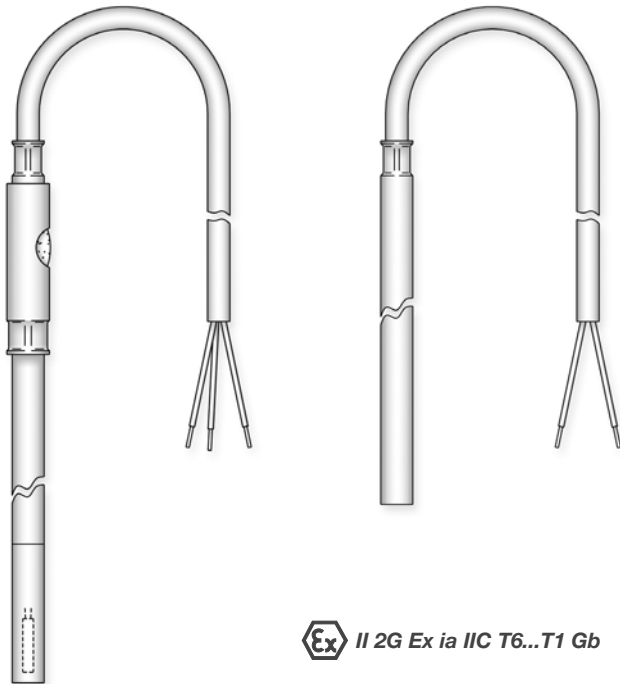
These process connectors do not serve as zone separation. This product series can only be applied in zone 1 (Gas-Ex).



**Ex** II 2G Ex ia IIC T6...T1 Gb



Special Temperature Sensors



**Ex** II 2G Ex ia IIC T6...T1 Gb

## Product Series R6/T6

Series R6/T6 temperature sensors were developed as cable sensors with varying diameters for zone 1 (Gas-Ex) and are available as pipe constructions or as mineral-insulated wiring.

Their small dimensions, a broad spectrum of possible process connectors and high flexibility allow for temperature measurement at inaccessible locations.

Sheath Diameter	Thermal Resistance $R_{TH}$ (Measuring Point Surface of Gauge Slide for Zone 1)
3,0 mm	165 K/W
4,5 mm	110 K/W
6,0 mm	90 K/W

**Pipe Construction**  
(not related to diameter) 300 K/W



## Thermoelectric and Compensation Cables

### Compensation Cables

Compensation cables are the link from thermocouple assembly to reference junction. The wires consist of alternative materials, not identical to the individual appendant thermocouples, yet possessing the same thermoelectric properties within the permissible temperature range pursuant to DIN 43722.

Following the law of homogenous circuits, the material between measurement and reference junctions must not vary.

In theory, the thermocouple could lead all the way to the reference junction, which, mainly due to cost reasons, is not practised.

Compensation cables have either solid or litz wires and are produced with various strand counts, shielding and insulation.

They are marked with code letter C, which is placed after the code letter for the appendant thermocouple, e.g. SC for a platinum thermocouple type S.

### Thermoelectric Cables

Thermoelectric cables are made of the same material as the appendant element.

By joining the wire at one end, thermoelectric cables become thermocouples, something that is practiced in drag measurement, for example.

Thermoelectric cables are available as litz or solid wires with various types of insulation. They are marked with the letter "X", which is placed after the code letter of the thermocouple, e.g. "KX" thermocouple for NiCr-Ni-element, type K.





### Coding of Thermoelectric and Compensation Cables

Colour coding of thermoelectric and compensation cables is standardised in DIN EN 60584-3. Standardisation contributes to minimising the danger of confusion and current reversal.

The maximum operating temperature is defined by the insulating material, therefore the corresponding data sheets should be observed.

#### Temperature resistances for different insulating materials of compensation and thermoelectric cables

PVC	105°C	MFA	235°C
TPE-0	130°C	PFA	260°C
ECTFE	135°C	E-Glass Fibre	400°C
ETFE	155°C	R-Glass Fibre	700°C
Silicone	180°C	Silica	1000°C
FEP	205°C	Nextel	1200°C

### Tolerances and Limiting Deviations

Wires for thermoelectric and compensation cables are standardised in DIN 43713. Thermoelectric voltages within the permissible temperature range correspond to the thermoelectric voltages of thermocouples pursuant to DIN EN 60584-1.

Tolerances for thermoelectric and compensation cables are defined in DIN 43722 (see "Tolerances pursuant to EN 60584-2, page 67).

There are two classes of accuracy:

The narrower class 1 is for thermoelectric cables only, meaning only those cables with the original materials.

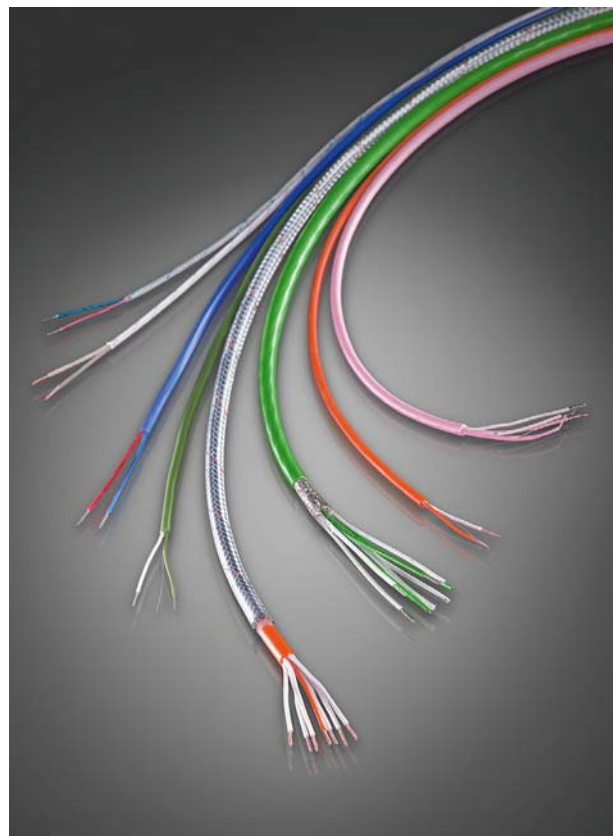
Class 2 is for thermoelectric and compensation cables made from alternative materials.

GÜNTHER thermoelectric and compensation cables are consistent with the colour coding of DIN 43722, with the exception of thermoelectric cables type U and type L, which are colour coded pursuant to DIN 43714. Tolerances are consistent with accuracy class 2 pursuant to DIN 43722 (see Colour Coding for Thermoelectric and Compensation Cables, page 66).

For thermocouples type U and type L, the tolerance pursuant to DIN 43719 of  $\pm 3^\circ\text{C}$  applies.



We have over 200 types of compensation and thermoelectric cables available from stock.



For thermocouple type B, copper wires may be used within a temperature range of up to 100°C. For this reason, DIN 43722 contains no tolerance values for these compensation cables. If compensation cables for type B are required for temperatures above 100°C, the application of specialised compensation cables is necessary. These cables are available upon request.

## Individual Parts



## Individual Parts

GÜNTHER GmbH has in excess of 40.000 individual and building components available from stock. As a result, we are able to respond precisely to the application scenarios and requests of our customers and internationally deliver our products quickly and reliably.

On the following pages, we will offer a small overview of the most common individual parts from our product line, alongside the corresponding technical information. Individual Solutions such as, for example materials, process connectors, accessories, etc. not listed here, are often viable.

Please contact us for further information!

Note: Apart from buying and trading precious metals for our sensors, we offer our customers the option of opening a precious metals account.





## Connection Heads



### Head Type A

Large, slanted head with unsecured, removable cover (bolted)

Matching Fit: Connection Socket Type A

Tube Connection	Protection Rating
Threading M24 x 1,5	IP 54
Bore Hole (in mm): 22,8 / 24,8 / 26,8 / 28,8 / 32,8	IP 53



### Head Type AUZ / AUS

Spherical head with hinged cover and cylinder-head screw / quick-release fastener

Matching Fit: Connection Socket Type A

Tube Connection	Protective Rating
Threading M24 x 1,5	IP 65
Bore Hole (in mm): 22,8 / 24,8 / 26,8 / 28,8 / 32,8	IP 54



### Head Type AUZH / AUSH

Elevated hinged cover for inclusion of a transducer with cylinder-head screw / quick-release fastener

Matching Fit: Connection Socket Type A

Tube Connection	Protective Rating
Threading M24 x 1,5	IP 65
Bore Hole (in mm): 22,8 / 24,8 / 26,8 / 28,8 / 32,8	IP 54



### Head Type B

Small, slanted head with with unsecured, removable cover (bolted)

Matching Fit: Connection Socket Type B

Tube Connection	Protective Rating
Threading M24 x 1,5	IP 54
Bore Hole (in mm): 10,8 / 15,8	IP 53



## Head Type BUZ / BUS

Spherical head with hinged cover and cylinder-head screw / quick-release fastener

Matching Fit: Connection Socket Type B

Tube Connection	Protection Rating
Threading M24 x 1,5	IP 65
Bore Hole (in mm): 12,8 / 15,8	IP 54



## Head Type BUZH / BUSH

Elevated hinged cover for inclusion of a transducer with cylinder-head screw / quick-release fastener

Matching Fit: Connection Socket Type B

Tube Connection	Protection Rating
Threading M24 x 1,5	IP 65
Bore Hole (in mm): 12,8 / 15,8	IP 54



## Head Type DL

Small spherical head with screw cap

Matching Fit: Connection Socket Type S

Tube Connection	Protection Rating
Inner Threading M10 x 1	IP 54
Outer Threading M20 x 0,75	IP 54
Bore Hole (in mm): 6,1	IP 54



## Head Type NA

Small spherical head with hinged cover

Matching Fit: Connection Socket Type B

Tube Connection	Cable Inlet
Threading M24 x 1,5	M20 x 1,5 mm
Bore Hole (in mm): 15,8	M20 x 1,5 / M22 x 1,5 mm





### Head Type L

Cylindrical head with slip lid

Matching Fit: Connection Socket Type S

Tube Connection	Cable Inlet
Clamp Socket Ø 8,2 mm	PG 7

## Transducers



These universal temperature transmitters (transducers) are mounted inside the Connection Head of a thermocouple assembly. Their purpose is to convert different incoming signals from measuring points in thermocouple assemblies or resistance thermometers into stable and standardised signals. Depending on the outgoing signal, the amperage lies between 4 – 20 mA.

In the past, transmitters were constructed with analogue technology. Today, digital technology has established itself, because it offers better measurement precision along with increased flexibility. Additionally, digital transmitters support expanded surrounding temperatures, typically in the range between -40°C and +85°C.



Every version is manually adjustable or computer programmable and is also consistent with the HART® protocol. Furthermore, all transducers meet the certification requirements for GL, UL, SIL2 and ATEX.

## Socket Connectors



Socket connectors (plugs, sockets) are applicable in thermocouple assemblies and resistance thermometers. The contacts consist of the same material as the respective thermocouple or compensation material.

### Advantages of the Mechanical Structure of Plug-and-Socket Connectors

- Contact pins and sockets are free of thermoelectric current
- Protection from voltage reversal due to different sized pins
- solid contact pins and spring mounted sockets
- Central cover attachment eases installation
- internally separated wire channels prohibit short circuiting
- Screw Terminals facilitate quick connection

We differentiate plug-and-socket connectors (of different sizes) into three categories:



#### ① Standard Plug / Socket

Plastic casing filled with glass fibre

**Maximum Thermal Load:** 200°C

**Colour Coding of the Casing:**

Every international colour coding is available

DIN IEC, DIN 43710, ANSI, NFE, BS, JIS, etc.



#### ② Standard High-Temperature Plug / Socket

Special temperature-resistant plastic casing for high ambient temperatures

**Maximum Thermal Load:** 350°C

**Colour Coding of the Casing:**

Casing colour brown with element identification mark



#### ③ Standard Ceramic Plug / Socket

Ceramic casing for extremely high ambient temperatures

**Maximum Temperature Load:** 650°C

**Colour Coding of the Casing:**

Casing colour white with element identification mark







## Stop and Counter Flanges



Flanges are used for the attachment of the thermal sensor to the wall of the installation location. The counter flange is welded to the wall of the installation location and so offers an uncomplicated and gas tight mounting point for the stop flange.

GÜNTHER GmbH offers a broad variety of flanges in different sizes (for protective tubes with diameters 15, 22, 26 and 32 mm) and materials (e.g. cast iron, steel, etc.).

**We are frequently able to fulfil requests for individualised shapes, respectively materials upon request.**

**Please contact us for further information!**



### Threaded Sockets



Threaded sockets are used for gas-tight installation of thermocouple assemblies and resistance thermometers, usually with a larger protective tube diameter.

Sockets with nominal diameters between 15 and 32 mm, with connecting threads of G ½ A up to G 1 ¼ A, as well as various construction materials are always available from stock.

### Clamp Connectors



Clamp connectors are also used for gas-tight installation of thermocouple assemblies and resistance thermometers.

Normally, these will have smaller dimensions, usually clamping nominal diameters between 1 and 12 mm, with connecting threads from G ½ A to G 1 ¼, or with metric fine thread.

For these, we also always have various materials, as well as different designs with additional teflon pressure ring or high-grade steel cutting ring, available from stock.





Certificates

**CERTIFICATE**

This is to certify that

**Günther GmbH**  
Temperaturmesstechnik  
Werk 1  
Bauhofstraße 12  
90571 Schwaig

**Günther GmbH**  
Temperaturmesstechnik  
Werk 2  
Gewerbehain Birkenhain 30  
63589 Linsengericht

with the following business unit

has implemented and maintains a **Quality Management System**.

Scope:  
Production and Marketing of Thermocouples and Resistance Thermometers,  
Trading with all Convenues

Through an audit, documented in a report, it was verified that the management system fulfills the requirements of the following standard:

**ISO 9001 : 2008**

Certificate registration no. 316880 QM08  
Valid from 2014-06-16  
Valid until 2017-06-07  
Date of certification 2014-06-16

**DQS GmbH**  
*G. Blohm*  
DQS Branch/Head  
Managing Director

Accredited Body: DQS GmbH, August-Scharn-Strasse 21, 60433 Frankfurt am Main

**IBExU Institut für Sicherheitstechnik GmbH**  
An-Institut der TU Bergakademie Freiberg

**Mitteilung über die Anerkennung der Qualitätssicherung Produktion**  
gemäß Richtlinie 94/9/EG, Anhang III

**IBExU13ATEX Q022**

**Widerstandsthermometer und Thermoelemente**  
Kategorie 1/2 G, 1/2 D, 2 G und 2 D, Zündschutzart I

Hersteller: Günther GmbH Temperaturmesstechnik  
Bauhofstraße 12, 90571 Schwaig, Deutschland

Fertigungsstätten:  
Günther GmbH Temperaturmesstechnik, Werk 1  
Bauhofstraße 12, 90571 Schwaig, Deutschland  
Günther GmbH Temperaturmesstechnik, Werk 2  
Gewerbehain 30, 63589 Linsengericht, Deutschland

IBExU Institut für Sicherheitstechnik GmbH, BENANNTE STELLE Nr. 0637 nach Artikel 9 der Richtlinie 94/9/EG des Europäischen Parlamentes und des Rates vom 22. März 1994, bestätigt dem Hersteller, dass er unter [7] aufgeführten Fertigungsstätten ein Qualitätssicherungssystem unterhält, das dem Anhang IV dieser Richtlinie genügt.

Diese Mitteilung basiert auf dem Auditbericht Nr. IB-13-G-036 vom 20.01.2014. Sie ist gültig bis 26.11.2016. Diese Mitteilung kann zurückgezogen werden, wenn der Hersteller die Anforderungen des Anhangs IV nicht mehr erfüllt. Die Ergebnisse des Überwachungsaudits des Qualitätssicherungssystems sind Bestandteil dieser Mitteilung.

Gemäß Artikel 10 (1) der Richtlinie 94/9/EG ist hinter der CE-Kennzeichnung die Kennnummer 0637 von IBExU als die benannte Stelle anzugeben, die in der Produktionsüberwachungsphase tätig wird.

IBExU Institut für Sicherheitstechnik GmbH  
Fuchsmühlweg 7, 09599 Freiberg, Deutschland  
Tel: +49 (0) 3731 3805-0, Fax: +49 (0) 3731 23650

Zertifizierungsstelle Explosionschutz  
Im Auftrag  
(Dipl. Ing. Wilkowsky)

Freiberg, 29.01.2014

Seite 1 von 1  
IBExU13ATEX Q022

**Physikalisch-Technische Bundesanstalt**  
Braunschweig und Berlin

Mitgliedschaft im Deutschen Kalibrierdienst

**DKD**  
als Gremium der PTB

Das Kalibrierlaboratorium

**Günther GmbH**  
Bauhofstraße 12  
90571 Schwaig

wird hiermit als ordentliches Mitglied in den Deutschen Kalibrierdienst (DKD) aufgenommen.

Die DKD Geschäftsstelle in der PTB Braunschweig, vertreten durch den Vorsitzenden des DKD Vorstands im Auftrag der PTB

*Peter Ulbig*  
(Dr.-Ing. Peter Ulbig)

Braunschweig, 31.05.2012

Hauptadresse: Löhrenschrift, Bundesallee 100, 38116 Braunschweig, DEUTSCHLAND  
Telefon: +49 531 932-0, Telefax: +49 531 932-2932, E-Mail: metro@ptb.de, Internet: http://www.ptb.de

Anhang - neue Bankverbindung ab 28. März 2011: Deutsche Bundesbank, Freie Ludwigstr. 10, D-10117 Berlin  
Kto-Nr.: 880 210 40, BIC: 25120330  
IBAN: DE39 2512 0330 0001 0010 0001 00  
BIC: MARDEF33HAN, VAT Nr.: DE 811 245 912, DEUTSCHLAND

PTB Berlin-Calibration: Altkönig 2-12, 10587 Berlin, DEUTSCHLAND

**Deutsche Akkreditierungsstelle GmbH**

Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleG  
Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition

**Accreditation**

The Deutsche Akkreditierungsstelle GmbH attests that the calibration laboratory

**Günther GmbH Temperaturmesstechnik**  
Bauhofstraße 12, 90571 Schwaig

is competent under the terms of DIN EN ISO/IEC 17025:2005 to carry out calibrations in the following fields:

**Thermodynamic quantities**  
Temperature quantities  
- Resistance thermometers  
- Thermocouples

The accreditation certificate shall only apply in connection with the notice of accreditation of 09.04.2014 with the accreditation number D-K-15220-01 and is valid until 08.04.2019. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 2 pages.




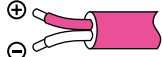



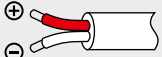




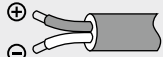









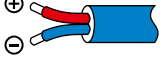




Registration number of the certificate: **D-K-15220-01-00**

Braunschweig, 08.04.2014  
Signed: Dr. Michael Wolf, Head of Division

This document is a translation. The definitive version is the original German accreditation certificate.

Technical Information

Colour Coding for Thermoelectric and Compensation Cables, as well as Thermal Socket Connectors

Thermocouple Type	DIN EN 60584	DIN 43714	ANSI MC 96.1
NiCr-Ni / K	 <p>+ green / - white Mantle: green</p>	 <p>+ red / - green Mantle: green</p>	 <p>+ yellow / - red Mantle: yellow</p>
NiCrosil-Nisil / N	 <p>+ pink / - white Mantle: pink</p>		
Pt10Rh-Pt / S	 <p>+ orange / - white Mantle: orange</p>	 <p>+ red / - white Mantle: white</p>	 <p>+ black / - red Mantle: green</p>
Pt13Rh-Pt / R	 <p>+ orange / - white Mantle: orange</p>	 <p>+ red / - white Mantle: white</p>	 <p>+ black / - red Mantle: green</p>
Pt30Rh-Pt6Rh / B	 <p>+ grey / - white Mantle: grey</p>		 <p>+ grey / - red Mantle: grey</p>
Fe-CuNi / J	 <p>+ black / - white Mantle: black</p>		 <p>+ white / - red Mantle: black</p>
Cu-CuNi / T	 <p>+ brown / - white Mantle: brown</p>		
Fe-CuNi / L		 <p>+ red / - blue Mantle: blue</p>	
Cu-CuNi / U		 <p>+ red / - brown Mantle: brown</p>	





### Tolerances Pursuant to EN 60584-2 (Reference Junction 0°C)

	Range	Class 1	Range	Class 2
<b>K</b>	-40 ... 1000°C	± 1,5°C or 0,004*(t)	-40 ... 1200°C	± 2,5°C or 0,0075*(t)
<b>J</b>	-40 ... 750°C	± 1,5°C or 0,004*(t)	-40 ... 750°C	± 2,5°C or 0,0075*(t)
<b>S / R</b>	0 ... 1600 °C	± 1,0°C or [1,0+0,003(t-1100)]°C	0 ... 1600 °C	± 1,5°C or 0,0025*(t)
<b>B</b>	---	---	600 ... 1700°C	± 1,5°C or 0,0025*(t)
<b>N</b>	-40 ... 1000°C	± 1,5°C or 0,004*(t)	-40 ... 1200°C	± 2,5°C or 0,0075*(t)
<b>T</b>	-40 ... 350°C	± 0,5°C or 0,004*(t)	-40 ... 350°C	± 1,0°C or 0,0075*(t)
<b>E</b>	-40 ... 800°C	± 1,5°C or 0,004*(t)	-40 ... 900°C	± 2,5°C or 0,0075*(t)

The higher value is valid (t = Numerical Temperature Value in °C)

### Properties of the Most Prevalent Ceramic Types

	Unit	porous Ceramic	TE-Porcelain	Aluminium Oxide
Type Pursuant DIN	-	C530	C610	C799
Thermal Shock Resistance	-	Very Good	Moderate to Good	Moderate
Impermeability	-	Porous	Gas-Tight	Gas-Tight
Maximum Constant Temperature	°C	1650	1600	1850
Al <sub>2</sub> O <sub>3</sub> -Content	%	73-75	60	99,7
Volume Weight	g*cm <sup>3</sup>	2,35	2,6	3,8-3,93
3-Point Bending Strength	MPa	35	120	300
C-Module	GPa	60	110	370



## **GÜNTHER GmbH**

**Temperature Measurement Technology**

Bauhofstraße 12  
90571 Schwaig  
Germany



## **GÜNTHER GmbH - Plant II**

**Temperature Measurement Technology**

Gewerbepark Birkenhain 30  
63589 Linsengericht  
Germany



## **GUENTHER Polska Sp. z o.o.**

**Technologie Pomiaru Temperatury**

ul. Wroclawska 24B  
55-090 Długołęka  
Poland



## **Langkamp Technology**

**Temperature Sensors**

Postbus 153  
3960 BD Wijk bij Duurstede  
Netherlands





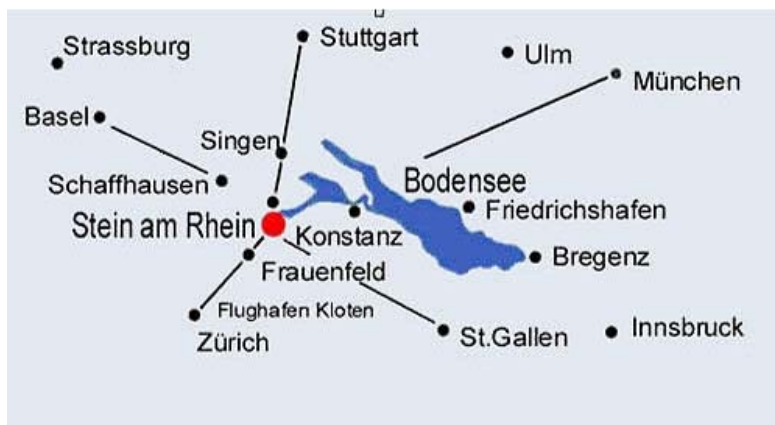
**MTS**

**Messtechnik Schaffhausen GmbH**

Mühlenstrasse 4, CH-8260 Stein am Rhein  
Telefon +41 52-672 50 00  
Telefax +41 52-672 50 01  
www.mts.ch, e-mail: info@mts.ch



Messen Prüfen Automatisieren [www.mts.ch](http://www.mts.ch)





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