

## EPIC® SENSORS

IMMERSIBLE THERMOCOUPLE SENSOR WITH CERAMIC WELL  
TYPE T-K, T-AK, T-AKK  
DATA SHEET 9



## INSTALLATION INSTRUCTIONS AND USER MANUAL

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## Product description and intended use

Sensor types T-K, T-AK and T-AKK (thermocouple, TC) are immersible thermocouple sensors with ceramic well. The construction is similar to DIN 43733. The code letters K, AK and AKK are referring to different well constructions, please see section *Code key*.

Sensors are intended for various industrial high temperature measuring applications, to be immersed to process and fastened by the neck pipe part, made of steel.

Installation is recommended to be done with weldable flange, adjustable flange or with gas tight compression fitting. Extra attention must be paid to handling the ceramic wells, especially when installation must be done to hot process. Please see extra recommendations and instructions in the section *Installation...*

Typical ceramic thermowell materials are gastight C610 (up to +1500 °C, medium to good thermal shock resistance) and C799 (up to +1600 °C, medium thermal shock resistance). Between neck pipe and ceramic well there is thermo-cement filling. Other materials can be chosen, and neck pipe / well / sensor element length can be produced according to customer needs.

NOTE! Ceramic wells are fragile components used in excessive temperature, chemical and mechanical loads. There is no way to estimate the lifetime of them installed into processes. That is why ceramic tubes are considered as wear parts, which are not covered by our warranty terms.

Measuring elements are mineral insulated (MI) elements, which can be changed on the fly. Elements are TC elements, typically R or S type thermocouples are used for measuring high temperatures.

Sensors are available with ceramic connection block (type designation: "-CB") or with open wire ends to be connected to temperature transmitter inside the sensor head (type designation: "-TR"). The latter can be delivered with a transmitter.

Also available as ATEX and IECEx approved protection type Ex i versions. Please see section *Ex i data*.

EPIC® SENSORS temperature sensors are measuring devices intended for professional use. They should be mounted by professionally capable installer who understands the installations surroundings. The worker should understand mechanical and electrical needs and safety instructions of the object installation. Suitable safety gear for each installation task must be used.

## Temperatures, measuring

Allowed measuring temperature range for sensor tip is:

- -200...+1700 °C, depending on TC type, thermowell material and neck pipe length.

## Temperatures, ambient

Allowed ambient temperature range for connection head, including connection wires, is:

- Without transmitter (element type -CB) -40...+135 °C
- With transmitter (element type -TR) according to transmitter manufacturers data

Make sure the process temperature is not too much for the connection head and/or to the transmitter inside.

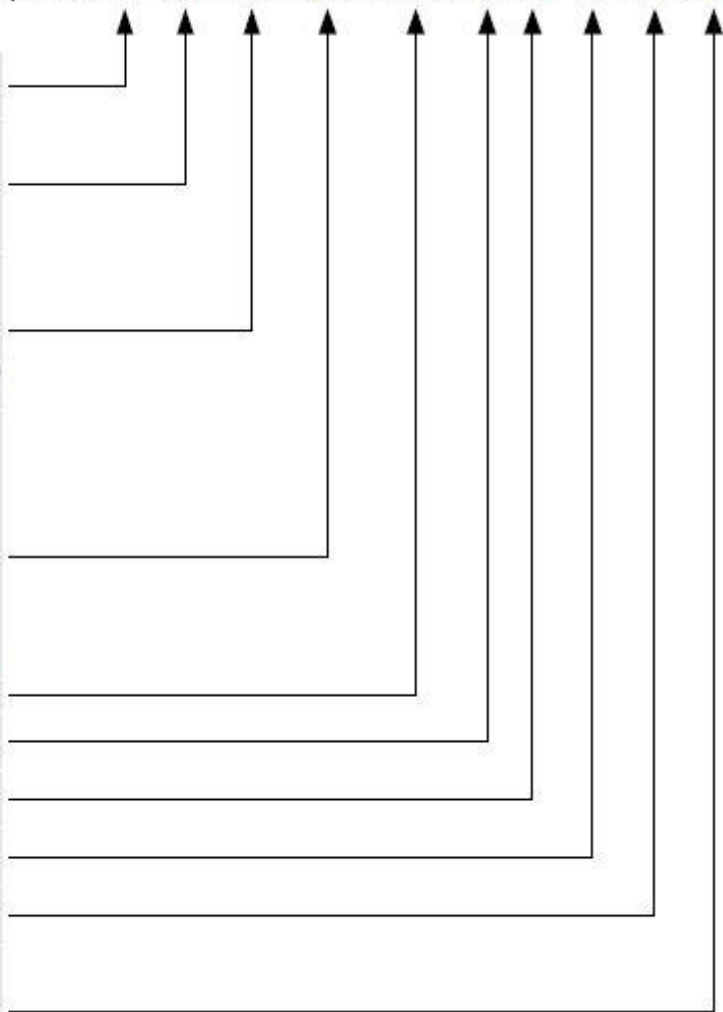
## Temperatures, Ex i versions

For Ex i versions only (type designations -EXI-), specific temperature conditions apply according to the ATEX and IECEx certificates. For more details, please see section: *Ex i data* (only for types with Ex i approval).

Code key

Example code: T — AK — 24 — D/H — 1000 — S / 0.5 — 1 — CB — X

T	= thermocouple
2xT	= 2 x thermocouple
K	= gastight ceramic well
AK	= flame proof outer tube, internal well gastight
AKK	= gastight ceramic inner and outer tube
10	= gastight ceramic C799, Ø10 mm
15	= gastight ceramic C799, Ø15 mm
24	= flameproof ceramic outer tube C610, Ø24 mm and gas tight internal ceramic tube C799, Ø15 mm (only with DAA enclosure) (special versions with Ø24 can be customized)
B	= connection head B
D/H	= connection head with snap lock
D/H/D	= connection head with snap lock and double barrel (2x cable gland)
D/W/H	= high cover connection head with snap lock
D/W/H/D	= high cover connection head with snap lock and double barrel (2x cable gland)
HST	= acid-proof connection head
N	= connection head N
DAA	= connection head DAA (only with Ø24 ceramic)
1000	= immersion lenght [mm]
J, K, N, S, R, B	= thermocouple type
0.5	= platinum sensor wire diameter (0.5 mm diameter as standard delivery)
1,2,3	= thermocouple accuracy class (class 1 as standard delivery)
TR	= wires for transmitter connection
CB	= with ceramic terminal block
EXI	= Ex i certified sensor
X	= additional details on the text line



## Technical data

<b>Thermowell material</b>	Ceramic C610 max. temperature +1500 °C, gas-tight, medium to good thermal shock resistance Ceramic C799 max. temperature +1600 °C, gas-tight, medium thermal shock resistance Other materials on request
<b>Tolerances thermocouple (IEC 60584)</b>	Type J tolerance class 1 = -40...+375 °C ±1.5 °C, +375...+750 °C +/- 0.004 x t Type K and N tolerance class 1 = -40...+375 °C ±1.5 °C, +375...1000 °C ±0.004 x t Type R and S tolerance class 1 = 0...+1100 °C ±1 °C, 1100...1600 °C ±[1+0.003(t-1100)] °C
<b>Temperature range</b>	-200...+1700 °C, depending on thermocouple type, thermowell material and neck pipe length
<b>Approvals</b>	ATEX, IECEx, EAC EMC, METROLOGICAL PATTERN APPROVAL
<b>Quality certificate</b>	ISO 9001:2015 and ISO 14001:2015 issued by DNV
<b>IP rating</b>	IP65, higher IP rating on request

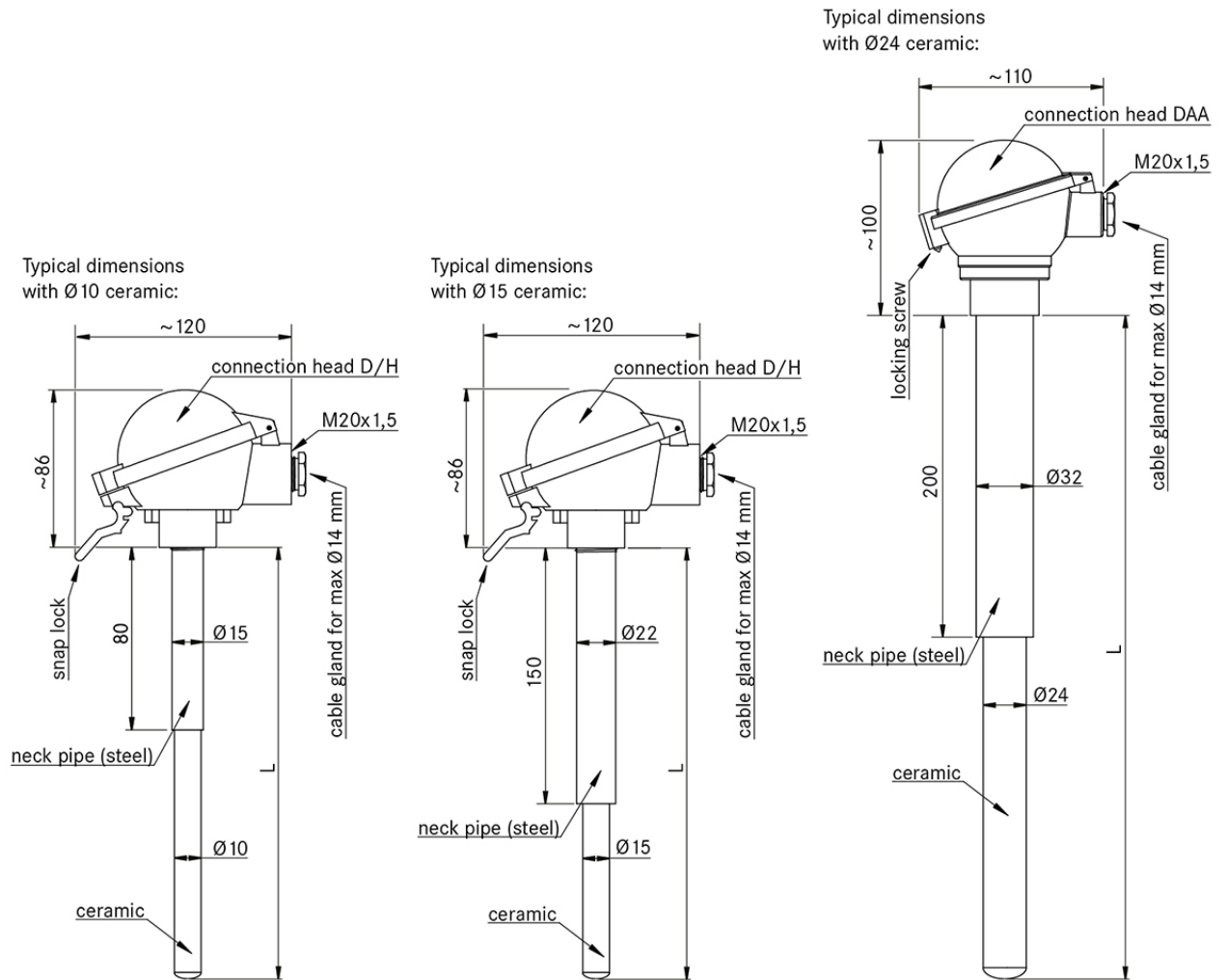
## Materials

These are the standard materials of components for the sensor types T-A, T-AK and T-AKK.

- Connection head Aluminum
- Gasket of the connection head cover Silicone
- Sensor element / MI cable sheath Inconel 600
- Neck pipe (steel) for pipe Ø 32 mm: AISI 304  
for other diameters: AISI 316L
- Filling between neck pipe and well Thermo-cement
- Thermowell for model K: Ceramics C610 or C799  
for model AKK: Ceramics C610 and C799.  
for model AK, Ø15 mm: Metallic flameproof outer tube 1.4841, Ceramics inside.  
for model AK, Ø22 mm: Metallic flameproof outer tube 1.4749 or 1.4841, Ceramics inside.

Other materials can be used on request.

Dimensional drawing



Examples in this drawing above are for models K or AKK.

For model AK the ceramic inner tube is protected with metallic flameproof outer tube.

## Installation instructions and example

Before any installation, make sure the target process/machinery and site are safe to work!

Make sure the thermowell material matches the requirements of the process medium and constructions.

### RECOMMENDATIONS!

1. Installation is recommended to be done with weldable flange, adjustable flange or with gas tight compression fitting. Please see section: Installation of the accessories.
2. Ceramic protection tubes must be protected from mechanical loads, which occur specially in case of horizontal mounting positions. An additional support for horizontal mounting must be provided, depending on the diameter, nominal length, and design. Generally, it is recommended to use vertical mounting positions with ceramic wells.

General installation phases are:

- Immerse the thermowell slowly - see instructions below - to desired depth into process medium.
- Tighten the connection round the neck pipe to keep the depth and tightness.

When immersing to hot process:

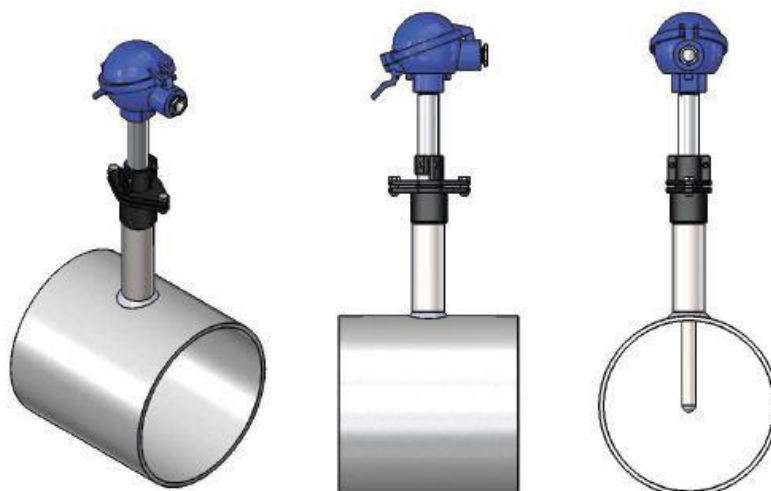
Specially pay attention to ceramic thermowells if immersion must be done into a hot process. Ceramic thermowell materials withstand only limited heat fluctuations. A temperature shock can cause stress cracks and damage the protection tube. Thermocouples with ceramic protection tubes should be preheated before installation, and only then slowly immersed.

### **A THUMB RULE: HIGHER PROCESS TEMPERATURE – LOWER INSERTING SPEED.**

Recommended immersion speeds for ceramic protection tubes (acc. to DIN 43724):

- 1 cm/min for protection tubes with diameters of 24/26 mm
- 50 cm/min for protection tubes with diameter of 15 mm
- 100 cm/min for protection tubes with diameter of 10 mm.

Image below: This example shows a sensor installed on a welded adjustable flange.



## Installation of accessories

### Adjustable and welded flanges:

As accessories there are adjustable flanges, without installation screws and without sealings, and welded flanges, with screws and fluoropolymer sealing ring (+300 °C, 1 bar), for occasions where the flange has to be welded to process structure. Welded and adjustable flanges are mainly used for installing different size wells. The structure of these flanges allows gliding immersion, i.e. well can be immersed to process precisely for the length needed. Flanges available are:

<b>Product number</b>	<b>Type - inner diameter</b>
<i>Adjustable</i>	<i>Only the <b>upper part</b> in image</i>
1027877	Adjustable flange 6mm, Ø 50mm
1018378	Adjustable flange 15mm
1018382	Adjustable flange 22mm
1018383	Adjustable flange 32mm
<i>Welded</i>	<i><b>Upper and lower parts</b> in image</i>
911984	Adjustable welded flange 15mm
911985	Adjustable welded flange 22mm
911986	Adjustable welded flange 32mm



Other sizes are quoted upon request.

Before any installation, make sure the target process/machinery and site are safe to work!

Also, make sure there are no obstacles to welding work.

Installation phases for welded flange are:

- Weld the lower part of the adjustable welded flange securely to the process structure.
- After welding work and inspections (if needed), immerse the thermowell to desired depth into process medium.
- Tighten the horizontal bolts on the steel neck pipe part of a ceramic well, to keep the depth.
- Tighten the vertical bolts to make the flange installation tight enough.
- To tighten the bolts, use necessary force only. Excess force may affect the tightness of immersion point. Allowed maximum tightening forces are given on applicable standards for each thread size and sealing material.



### Gas-tight threaded couplings:

Gas-tight threaded couplings are used with Ø 15 mm or 22 mm wells, when the immersion depth has to be adjusted on thread installation. Gas-tight couplings have fluoropolymer ferrules inside. By screwing the cap down, the ferrule is pressed on the neck pipe of ceramic well. This connection is gas-tight, but not pressure resistant.

Gas-tight threaded couplings available are:

<b>Product number</b>	<b>Type - thread - inner diameter</b>
917347	Gas-tight threaded coupling G1"- 15mm
999562	Gas-tight threaded coupling G1"- 22mm

Other types are quoted upon request.

Before any installation, make sure the target process/machinery and site are safe to work!

Also, make sure there are no obstacles to welding work.

Installation phases are:

- Screw the lower part nut of the adjustable threaded coupling securely to the process structure.
- Immerse the thermowell to desired depth into process medium.
- Tighten the upper part nut round the steel neck pipe, to keep the depth and tightness.
- To tighten the nuts, use necessary force only. Excess force may damage the ceramic well or affect the tightness of immersion point. Allowed maximum tightening forces are given on applicable standards for each thread size.



### Tightening torques

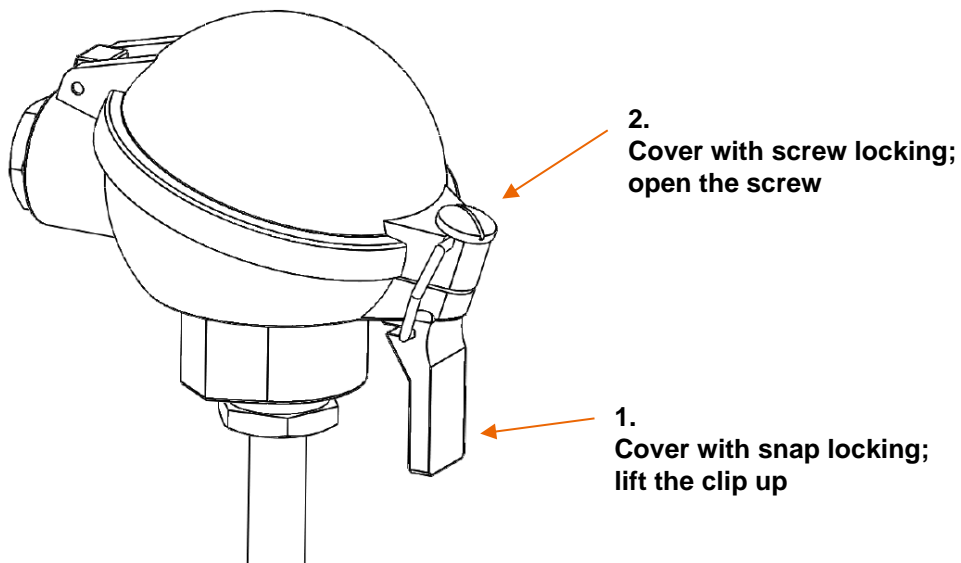
Use only tightening torques allowed in applicable standards of each thread size and material.

## Opening the connection head, standard and Ex i versions

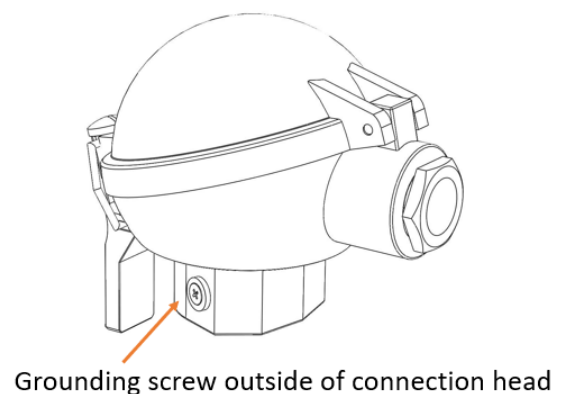
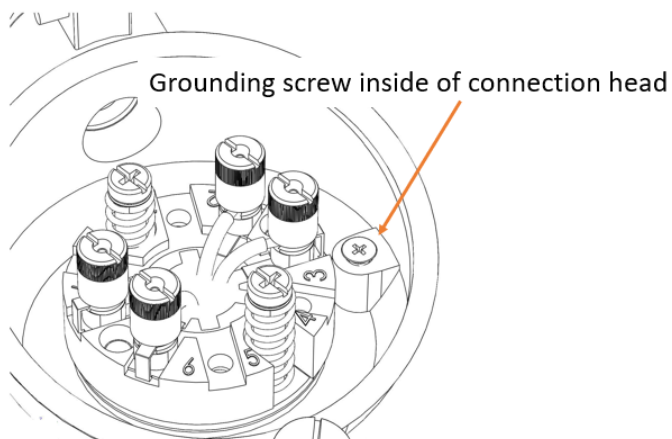
Before any connection work, the connection head has to be opened. Do not open the connection head cover if there is a risk of dirt or moisture/liquids entering the wiring space inside!

Image below: Opening the cover, when using a connection head...

1. with snap lock (quick release clip), connection head type designation -D/H-; lift the clip up.
2. with screw lock; open the screw by twisting it counter-clockwise.

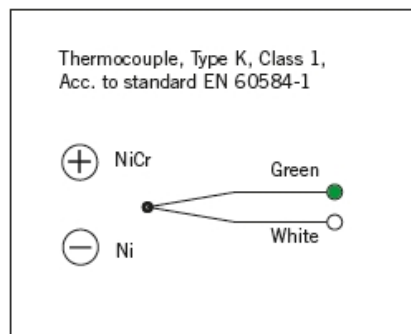
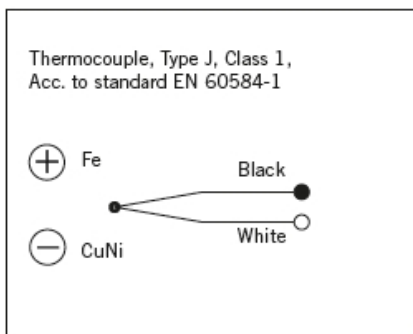
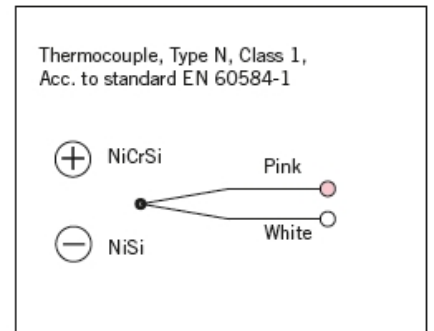
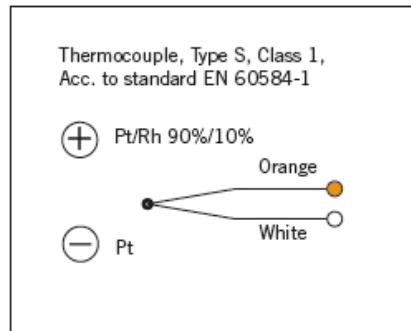
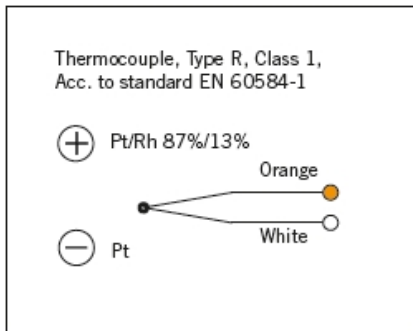


After releasing the locking, lift the cover up.










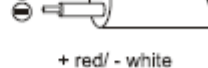


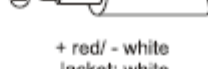
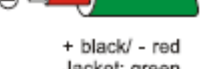
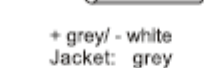
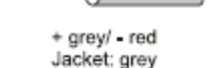
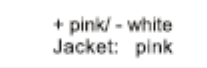

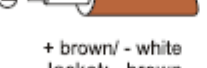
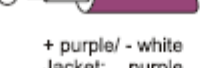
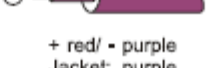
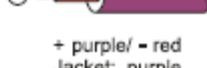
## TC; connection wiring

Image below: These are the connection colors of TC types R, S, N, J and K.



Other types on request.

TC; thermocouple cable standards (color table)

Thermo Type	IEC 60584-3 IEC 584	DIN EN 60584 DIN 43714	ISA MC 96.1 ANSI MC 96.1
NiCr-Ni / K KCA: Fe-CuNi	 + green/ - white Jacket: green	 + red/ - green Jacket: green	 + yellow/ - red Jacket: yellow
Fe-CuNi / L		 + red/ - blue Jacket: blue	
Fe-CuNi / J	 + black/ - white Jacket: black		 + white/ - red Jacket: black
Pt10Rh-Pt / S SCA: E-Cu/A-Cu	 + orange/ - white Jacket: orange	 + red/ - white Jacket: white	 + black/ - red Jacket: green
Pt13Rh-Pt / R RCA: E-Cu/A-Cu	 + orange/ - white Jacket: orange	 + red/ - white Jacket: white	 + black/ - red Jacket: green
Pt30Rh-Pt6Rh / B BC: S-Cu/E-Cu	 + grey/ - white Jacket: grey		 + grey/ - red Jacket: grey
NiCrosil-Nisil / N NC: Cu-CuNi	 + pink/ - white Jacket: pink		
Cu-CuNi / U		 + red/ - brown Jacket: brown	
Cu-CuNi / T	 + brown/ - white Jacket: brown		
NiCr-CuNi / E	 + purple/ - white Jacket: purple	 + red/ - purple Jacket: purple	 + purple/ - red Jacket: purple

## TC; non-grounded or grounded types

Normally the thermocouple sensors are non-grounded, which means the MI cable sheath is not connected to the thermo material hot junction, where two materials are welded together.

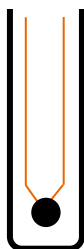
In special applications also grounded types are used.

NOTE! Non-grounded and grounded sensors cannot be connected to same circuits, make sure you are using the right type.

NOTE! Grounded TCs are not allowed for Ex i certified sensor types.

Image below: Non-grounded and grounded structures in comparison.

**Non-grounded TC**



Thermo material hot junction and MI cable sheath are galvanically isolated from each other.

**Grounded TC**

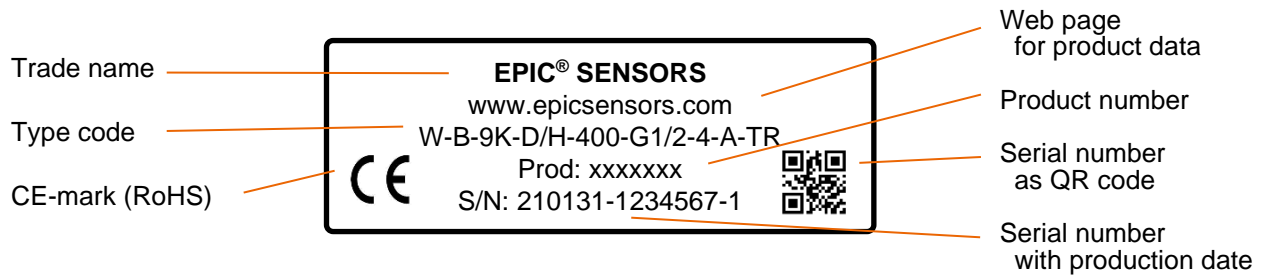


Thermo material hot junction has galvanic connection with MI cable sheath.

## Type label of standard versions

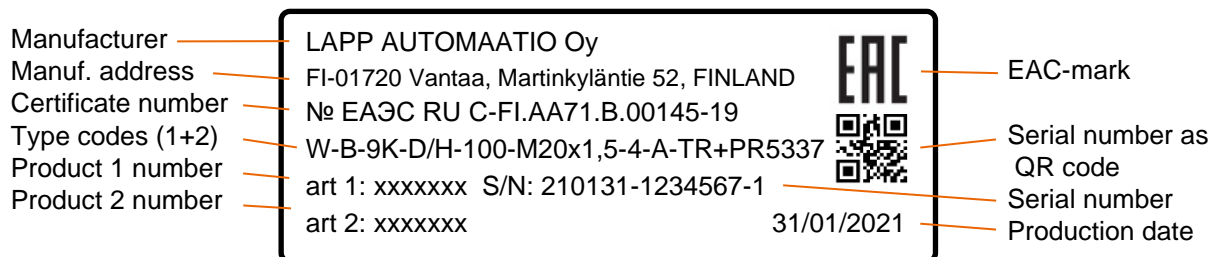
Each sensor has a type label attached to it. It is a moisture and wear proof industrial grade sticker, with black text on white label. This label has printed information of trade name, web page, type code, CE-mark, product number and serial number, including production date. For these sensors manufacturer contact information is printed on a separate label.

Image below: Example of a non-Ex sensor type label.



For EAC EMC-approved, sensor+transmitter combination versions, exported to Eurasian Customs Union area, there is a special type label.

Image below: Example of an EAC EMC-approved product type label, including sensor (1) and transmitter (2).



## Serial number information

Serial number S/N is always printed on type label in the following form: yymmdd-xxxxxxx-x:

- yymmdd            production date, e.g. “210131” = 31.1.2021
- -xxxxxxx        production order, e.g. “1234567”
- -x                sequential ID number within this production order, e.g. “1”

## Ex i data (only for types with Ex i approval)

This sensor type is available also with ATEX and IECEx Ex i approvals. Assembly consists of a temperature sensor connected to a transmitter or ceramic terminal block in an enclosure (sensor type designation -EXI-). All relevant Ex data is given below.

## Ex i – Special Conditions for Use

There are special specifications and conditions for use defined in certificates. These include e.g. Ex data, allowed ambient temperatures, and self-heating calculation with examples. These are presented in **Annex A: Specification and special conditions for use - Ex i approved EPIC®SENSORS temperature sensors.**

## Ex i certificates and Ex markings

Certificate - Number	Issued by	Applicable area	Marking
<b>ATEX –</b> EESF 21 ATEX 043X	Eurofins Electric & Electronics Finland Oy, Finland, Notified Body Nr 0537	Europe	Ex II 1G Ex ia IIC T6...T3 Ga Ex II 1/2G Ex ib IIC T6...T3 Ga/Gb Ex II 1D Ex ia IIIC T135 °C Da Ex II 1/2D Ex ib IIIC T135 °C Da/Db
<b>IECEx –</b> IECEx EESF 21.0027X	Eurofins Electric & Electronics Finland Oy, Finland, Notified Body Nr 0537	Global	Ex ia IIC T6...T3 Ga Ex ib IIC T6...T3 Ga/Gb Ex ia IIIC T135 °C Da Ex ib IIIC T135 °C Da/Db

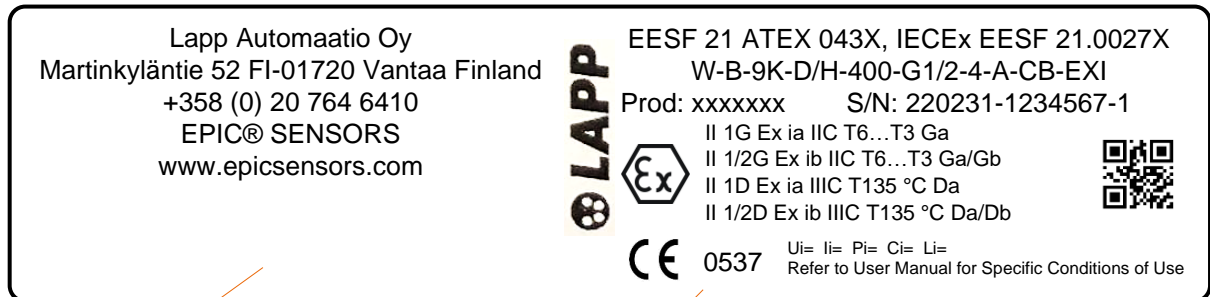
Note! Name change of the Notified Body Nr 0537:

- Until 31.3.2022, the name was: Eurofins Expert Services Oy
- As of 1.4.2022, the name is: Eurofins Electric & Electronics Finland Oy.

## Ex i type label

For ATEX and IECEx Ex i approved versions there is more information on the label, according to applicable standards.

Image below: Example of an ATEX and IECEx Ex i approved sensor type label.



Manufacturer contact information.  
 For some sensor types, this may also be printed on a separate label for practical reasons.

Ex certificate number(s)  
 Type code  
 Product number      Serial number with production date  
 Ex-mark (ATEX)      Ex markings  
 CE-mark (ATEX and RoHS)      Serial number as QR code  
 Notified body number  
 Special technical values (if needed)



## EU Declaration of Conformity

The EU Declaration of Conformity, declaring products' conformance to the European Directives, is delivered with products or sent on request.

## Manufacturer contact information

### Manufacturer HQ main office:

**Lapp Automaatio Oy**  
Street address Martinkyläntie 52  
Postal address FI-01720 Vantaa, Finland

### Production site and logistics:

**Lapp Automaatio Oy**  
Street address Varastokatu 10  
Postal address FI-05800 Hyvinkää, Finland

Phone (sales) +358 20 764 6410

Email [epicsensors.fi.lav@lapp.com](mailto:epicsensors.fi.lav@lapp.com)  
Https [www.epicsensors.com](http://www.epicsensors.com)

## Document history

Version / date	Author(s)	Description
20230707	LAPP/VeTe	Ex i ground connection and some corrections for the text.
20220822	LAPP/JuPi	Telephone number update
20220815	LAPP/JuPi	Material name text corrections
20220401	LAPP/JuPi	Original version

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## ANNEX A - Specification and special conditions for use - Ex i approved EPIC® SENSORS temperature sensors

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### Ex data for RTD (resistance temperature sensor) and TC (Thermocouple temperature sensor)

Sensor Ex data, maximum interface values, without transmitter or / and display.

Electrical values	For Group IIC	For Group IIIC
Voltage $U_i$	30 V	30 V
Current $I_i$	100 mA	100 mA
Power $P_i$	750 mW	550 mW @ $T_a +100\text{ °C}$
		650 mW @ $T_a +70\text{ °C}$
		750 mW @ $T_a +40\text{ °C}$
Capacitance $C_i$	Negligible, *	Negligible, *
Inductance $L_i$	Negligible, *	Negligible, *

Table 1. Sensor Ex data.

\* For sensors with long cable part, the parameters  $C_i$  and  $L_i$  must be included in the calculation.  
Following values per meter can be used according to EN 60079-14:  
 $C_{\text{cable}} = 200\text{ pF/m}$  and  $L_{\text{cable}} = 1\text{ μH/m}$ .

### Allowed ambient temperatures - Ex i temperature class, without transmitter and/or display.

Marking, Gas Group IIC	Temperature class	Ambient temperature
II 1G Ex ia IIC T6 Ga II 1/2G Ex ib IIC T6-T3 Ga/Gb	T6	-40...+80 °C
II 1G Ex ia IIC T5 Ga II 1/2G Ex ib IIC T6-T3 Ga/Gb	T5	-40...+95 °C
II 1G Ex ia IIC T4-T3 Ga II 1/2G Ex ib IIC T6-T3 Ga/Gb	T4-T3	-40...+100 °C
Marking, Dust Group IIIC	Power $P_i$	Ambient temperature
II 1D Ex ia IIIC T135 °C Da II 1/2D Ex ib IIIC T135 °C Da/Db	750 mW	-40...+40 °C
II 1D Ex ia IIIC T135 °C Da II 1/2D Ex ib IIIC T135 °C Da/Db	650 mW	-40...+70 °C
II 1D Ex ia IIIC T135 °C Da II 1/2D Ex ib IIIC T135 °C Da/Db	550 mW	-40...+100 °C

Table 2. Ex i temperature classes and allowed ambient temperature ranges

#### Note!

The temperatures above are without cable glands.

The compatibility of cable glands must be according to the application specifications.

If the transmitter and/or display will be inside the transmitter housing, the specific Ex requirements of the transmitter and/or display installation must be noted.

The used materials must comply the needs of application, e.g., abrasion, and the temperatures above.

For EPL Ga Group IIC the aluminium parts in connection heads are subject to sparking by impacts or friction.

For Group IIIC the maximum input power  $P_i$  shall be observed.

When the sensors are mounted across boundary between different Zones, refer to standard IEC 60079-26 section 6, for ensuring the boundary wall between different hazardous areas.

## ANNEX A - Specification and special conditions for use - Ex i approved EPIC® SENSORS temperature sensors

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### Considering sensor self-heating

Self-heating of the sensor tip shall be considered in respect with Temperature Classification and associated ambient temperature range and manufacturer's instructions for calculating tip surface temperature according to thermal resistances stated in the instructions shall be observed.

Allowed ambient temperature range of sensor head or process connection for Groups IIC and IIIC with different temperature classes are listed in Table 2. For Group IIIC the maximum input power  $P_i$  shall be observed.

The process temperature shall not adversely affect ambient temperature range assigned for Temperature Classification.

### Calculation for self-heating of the sensor at the tip of sensor or the thermowell tip

When the sensor-tip is located at environment where the temperature is within  $T_6...T_3$ , it is needed to consider the self-heating of the sensor. Self-heating is of particular significance when measuring low temperatures.

The self-heating at the sensor tip or thermowell tip depends on the sensor type (RTD/TC), the diameter of sensor and structure of sensor. It is also needed to consider the Ex i values for the transmitter. The table 3. shows the  $R_{th}$  values for different type of sensors structure.

Sensor type	Thermal resistance $R_{th}$ [°C / W]					
	Resistance thermometer (RTD)			Thermocouple (TC)		
Measuring insert diameter	< 3 mm	3...<6 mm	6...8 mm	< 3 mm	3...<6 mm	6...8 mm
Without thermowell	350	250	100	100	25	10
With thermowell made from tube material (e.g. B-6k, B-9K, B-6, B-9, A-15, A-22, F-11, etc)	185	140	55	50	13	5
With thermowell – solid material (e.g. D-Dx, A-Ø-U)	65	50	20	20	5	1

Table 3. Thermal resistance based on Test report 211126

#### Note!

If the measuring device for RTD-measuring is using measuring current  $> 1$  mA, the maximum surface temperature of the temperature sensor tip should be calculated and taken to account. Please see next page.

If sensor type has multiple sensing elements included, and those are used simultaneously, note that the maximum power for all sensing elements should not be more than the allowed total power  $P_i$ . Maximum power must be limited to 750 mW. This must be guaranteed by process owner. (Not applicable for Multi-point temperature sensor types T-MP / W-MP or T-MPT / W-MPT with segregated Exi circuits).

## ANNEX A - Specification and special conditions for use - Ex i approved EPIC® SENSORS temperature sensors

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### Calculation for maximum temperature:

The self-heating of the sensor tip can be calculated from formula:

$$T_{max} = P_o \times R_{th} + MT$$

- (T<sub>max</sub>) = Maximum temperature = surface temperature at the sensor tip
- (P<sub>o</sub>) = Maximum feeding power for the sensor (see the transmitter certificate)
- (R<sub>th</sub>) = Thermal resistance (K/W, Table 3.)
- (MT) = Medium temperature.

### Calculate the maximum possible temperature at the tip of sensor:

#### Example 1 - Calculation for RTD-sensor tip with thermowell

Sensor used at Zone 0

RTD sensor type: W-M-9K . . . (RTD-sensor with head-mounted transmitter).

Sensor with thermowell, diameter of Ø 9 mm.

Medium temperature (MT) is 120 °C

Measuring is made with PR electronics head mounted transmitter 5437D and isolated barrier PR 9106 B.

Maximum temperature (T<sub>max</sub>) can be calculated by adding the temperature of the medium that you are measuring and the self-heating. The self-heating of the sensor tip can be calculated from the Maximum power (P<sub>o</sub>) which is feeding the sensor and R<sub>th</sub>-value of used sensor type. (See the Table 3.)

Supplied power by PR 5437 D is (P<sub>o</sub>) = 23,3 mW (from the transmitter Ex-certificate)

Temperature class T4 (135 °C) must not be exceeded.

Thermal resistance (R<sub>th</sub>) for the sensor is = 55 K/W (from Table 3).

Self-heating is 0.0233 W \* 55 K/W = 1,28 K

Maximum temperature (T<sub>max</sub>) is MT + self-heating: 120 °C + 1,28 °C = 121,28 °C

The result in this example shows that, the self-heating at the sensor tip is negligible.

The safety margin for (T<sub>6</sub> to T<sub>3</sub>) is 5 °C and that must be subtracted from 135 °C; means that up to 130 °C would be acceptable. In this example the temperature of class T4 is not exceeded.

#### Example 2 - Calculation for RTD-sensor tip without the thermowell.

Sensor used at Zone 1

RTD sensor type: W-M-6/303 . . . (RTD-sensor with cable, without head-mounted transmitter)

Sensor without thermowell, diameter of Ø 6 mm.

Medium temperature (MT) is 40 °C

Measuring is made with rail-mounted PR electronics PR 9113D isolated transmitter/barrier.

Maximum temperature (T<sub>max</sub>) can be calculated by adding the temperature of the medium that you are measuring and the self-heating. The self-heating of the sensor tip can be calculated from the Maximum power (P<sub>o</sub>) which is feeding the sensor and R<sub>th</sub>-value of used sensor type. (See the Table 3.)

Supplied power by PR 9113D is (P<sub>o</sub>) = 40,0 mW (from the transmitter Ex-certificate)

Temperature class T3 (200 °C) must not be exceeded.

Thermal resistance (R<sub>th</sub>) for the sensor is = 100 K/W (from Table 3).

Self-heating is 0.040 W \* 100 K/W = 4,00 K

Maximum temperature (T<sub>max</sub>) is MT + self-heating: 40 °C + 4,00 °C = 44,00 °C

The result in this example shows that, the self-heating at the sensor tip is negligible.

The safety margin for (T<sub>6</sub> to T<sub>3</sub>) is 5 °C and that must be subtracted from 200 °C; means that up to 195 °C would be acceptable. In this example the temperature of class T3 is not exceeded.

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**Additional information for Group II devices:** (acc. to EN IEC 60079-0: 2019 section: 5.3.2.2 and 26.5.1)

Temperature class for T3 = 200 °C

Temperature class for T4 = 135 °C

Safety margin for T3 to T6 = 5 K

Safety margin for T1 to T2 = 10 K.

**Note!**

This ANNEX is an instructional document on specifications.

For original regulatory data on specific conditions for use, always refer to ATEX and IECEx certificates:

**EESF 21 ATEX 043X**  
**IECEx EESF 21.0027X**