ATEX/EAC Ex RTD temperature probes

Ex "e" for use in potentially explosive areas

Operating Manual

90282000T90Z004K000

V3.00/EN/00456135/2023-03-16

Table of contents

1 Object of these instructions and purpose of application

RTD temperature probes from JUMO are used as increased safety "e" equipment for temperature measurements in liquid and gaseous media as well as with dust. The thermometers consist of a protection fitting with various process connections, a terminal head or connecting cable, and, depending on the type, with an interchangeable measuring insert. All fittings (parts in contact with the process) are subjected to a leak test. Pt100 temperature sensors according to EN 60751 are used in the fittings in tolerance classes AA, A, or B in a two-wire, three-wire, or four-wire circuit (see chapter 8 "Connection types of RTD temperature probes"). The use of these sensors with a higher basic value (Pt500, Pt1000, Pt2000, or Pt5000) is possible. Similarly, NTCs, such as KTY, or other PTCs can also be used. Versions with two or three measuring circuits are also possible. For measurement transmission with a standard signal (e.g. 4 to 20 mA/0 to 10 V), a separate transmitter can be connected outside of the potentially explosive area.

They meet the requirements for explosion group II of the categories 2G and 1/2D. They are therefore suitable for use in the potentially explosive area of zones 1 and 2 in the case of **g**as, and zones 21 and 22 in the case of **d**ust. The probe tube is also permitted to extend into zone 20 (zone isolation) under certain conditions.

The relevant thermometer-specific features can be found on the corresponding data sheet/drawing (see annex) and/or on the label attached to the product.

Depending on the needs of the application and the measurement task, RTD temperature probes are available with different terminal heads, various process connections, matching thermowells, with or without interchangeable measuring inserts, or with the connecting cable mounted.

RTD temperature probes with the Ex "e" ignition protection type are certified for direct connection to associated equipment, which provides an increased level of certainty of preventing inadmissibly high temperatures from occurring and light arcs from arising in proper use or under set exceptional conditions through additional measures that have been taken.

When connecting to non-intrinsically safe electrical circuits, the power introduced must be restricted from the user side to ensure that the maximum surface heating – according to the temperature class minus the safety clearance –is not exceeded!
For this purpose, see also chapter 5 "Technical data, explanations, and case examples" in this operating manual.

Scope of application
This operating manual applies to the following type examination certificates:
SEV 18 ATEX 0209 X
EAC Ex RU C-CH.АЖ58.B.02110/21

This operating manual applies to the following product groups:
902820... Ex e RTD temperature probe with terminal head
902821... Ex e RTD temperature probe with connecting cable

Target group
Experienced skilled electricians according to the EU directive 1999/92/EC and instructed persons

2 Identification marking

The type of RTD temperature probe used is identified on the nameplate/terminal head. Each RTD temperature probe with an individual identification marking is assigned a probe-specific drawing/data sheet. All probes can be uniquely identified and traced through the relevant identification marking. The probe-specific values can be found on the relevant drawing, the data sheet and/or the label attached to the product.
For gas Ex:

II 2 G Ex eb IIC T6 to T1 Gb

For dust Ex:

II 2 D Ex tb IIIC T60 °C to T80 °C Db

II 1/2 D Ex ta/tb IIIC T60 °C to T80 °C Da/Db

3 Safety information

The relevant technical data for using the device in potentially explosive areas are listed in the relevant drawing, data sheet, and/or on the label attached to the product.

Operate all RTD temperature probes according to intended use, only when they are in an undamaged and clean condition!

No modifications may be made to the RTD temperature probes. Otherwise, it may no longer be possible to ensure error-free functioning. Moreover, all warranty claims are invalidated. When replacing interchangeable measuring inserts, only JUMO original parts of the same type should be used.

The national and international safety and accident prevention regulations must be observed during installation, during work on and with the RTD temperature probes, as well as during mounting at the installation location. Furthermore, the plant operator is responsible for compliance with the legal regulations. If connecting cable extensions are used, the specified (length-dependent) limits for capacitance and inductance must be observed.

4 Compliance with standards

ATTENTION: this operating manual is only valid for the listed type examination certificates and the standards listed therein.

Inspection document number
SEV 18 ATEX 0209 X
EAC Ex RU C-CH.АЖ58.B.02110/21

Directives
2014/34/EU (ATEX)
2014/30/EU (EMC)

Standards applied (see EU declaration of conformity)
EN 60079-0
EN 60079-7
EN 60079-31
EN ISO/IEC 80079-34

The JUMO quality management system according to EN ISO 9001 is the basis for compliance with directive 2014/34/EU.

The RTD temperature probes are developed, produced, and examined in accordance with the state of the art and according to the relevant standards and regulations.

5 Technical data, explanations, and case examples

ATTENTION: specific data can be found on the data sheet/drawing and/or the label attached on the product.

5.1 Ignition protection type intrinsically safe Ex "i"

(same approach for ignition protection type increased safety Ex "e", see also chapter 5.2)

The equipment used in potentially explosive areas only contain intrinsically safe electrical circuits. An electrical circuit is intrinsically safe if no ignitable sparks occur in normal cases and in the case of malfunction due to a short circuit of the electrical circuit or the surface of the devices does not heat up above the specified temperature class (see table 1) due to the current flowing (see also EN 60079-11).

In order that an electrical circuit can be designated as intrinsically safe, all devices in the circuit must be designed to be intrinsically safe. Furthermore, it must be ensured that the interconnection of intrinsically safe devices meets the requirements for an intrinsically safe electrical circuit. **The interconnection of any intrinsically safe devices does not ensure an intrinsically safe circuit in itself.**

5.2 Ignition protection type increased safety Ex "e"

Measures are taken here in order to prevent, with an increased degree of certainty, the possibility of inadmissibly high temperatures
and the occurrence of sparks or light arcs in internal or
external parts of electrical equipment, in which they do not occur in normal operation or
in the event of malfunction.

The versions with increased safety must always be connected to an intrinsically safe electrical circuit; however,
it must be ensured in every operating state and in the event of malfunction that heating of the thermometer is limited, as described in detail and demonstrated with case examples.

The temperature classes and safety clearances apply similarly to all ignition protection types;
in addition, the temperature development in the terminal head should be considered when using a transmitter that may be installed and
separately certified (Ex "i").

The thermometer must only be connected to evaluation units which meet the conditions mentioned above.

The terminal head and/or the connection terminals must not be opened while live in a potentially explosive atmosphere, insofar as
the ignition protection type intrinsically safe (Ex "i") is not applied additionally.

5.3 General limit values

In an RTD temperature probe, the measuring current (or in the case of a malfunction the fault current) flow through the sensor element. Self-heating of the element occurs and, ultimately, a temperature increase on the surface of the protection fitting also occurs. It must be ensured that the limit of the specified temperature class is not exceeded.

Temperature class	Maximum surface temperature of the equipment	Ignition temperature of the combustible materials
T1	450 °C	> 450 °C
T2	300 °C	> 300 < 450 °C
T3	200 °C	> 200 < 300 °C
T4	135 °C	> 135 < 200 °C
T5	100 °C	> 100 < 135 °C
T6	85 °C	> 85 < 100 °C

Table 1: temperature classes

Surface heating is determined by the temperature probe design, by the environmental influences (thermal coupling to the measurement medium), as well as the power fed in. The self-heating characteristics of the thermometer are characterized by a protection tube constant (SK) [K/W], which specifies the surface heating in still air compared to the ambient temperature, depending on the power supplied. The protection tube constant (SK) is determined by JUMO and can be found on the data sheet/drawing and/or the label attached to the product. The operator must determine whether the thermometer is suitable for the measurement task for the relevant application and the connected equipment. The maximum admissible measurement temperature on the tip of the probe is determined using the following equation: $\mathbf{T_S = T_K - P_{max} \times SK}$.

T_S Maximum admissible temperature at the tip of the probe
T_K Maximum admissible surface temperature depending on the temperature class (cf. table minus safety clearance)
P_i Power of the certified, intrinsically safe electrical circuit (if a transmitter is used, the value of P_o of the relevant transmitter must be used for P_i.)
SK Protection tube constant (see data sheet/drawing)

Nominal values for measuring and supply circuit of Ex e thermometers:

For use in potentially explosive areas at a risk as a result of gas/steam/mist
Pmax ≤ 750 mW / Umax ≤ 30 V / Imax ≤ 100 mA

Dust Ex:
Max. temp. T60 °C
Pmax ≤ 30 mW / Umax ≤ 30 V / Imax ≤ 100 mA

Max. temp. T80°C
Pmax ≤ 70 mW* / Umax ≤ 30 V / Imax ≤ 100 mA

*
≥ 180 K/W to ≤ 220 K/W, Pmax ≤ 65 mW can be used for protection tube constants.

It must be ensured through suitable measures that the above values are not exceeded even in the case of malfunction of the measuring and supply circuits.

The heating characteristics must be considered similarly, independently of the ignition protection type for intrinsically safe, pressure-resistant encapsulated RTD temperature probes and those with increased safety.

5.4 Self-heating characteristics/protection tube constant

Generally, when using all other ignition protection types (e.g. Ex "d"), the self-heating characteristics of the equipment according to EN 60079-0 has to be specified and this has to be classified into the relevant temperature class.

The protection tube constant has been determined by measuring various thermometer setups. The applicable type-specific protection tube constant is specified on the nameplate and on the drawing/the data sheet.

The following diagram shows example self-heating characteristics of the probe surface of an RTD temperature probe depending on the power fed in and the temperature present in the inside of the probe here. **The heating characteristics must be considered similarly, independently of the ignition protection type for intrinsically safe, pressure-resistant encapsulated RTD temperature probes and those with increased safety.**

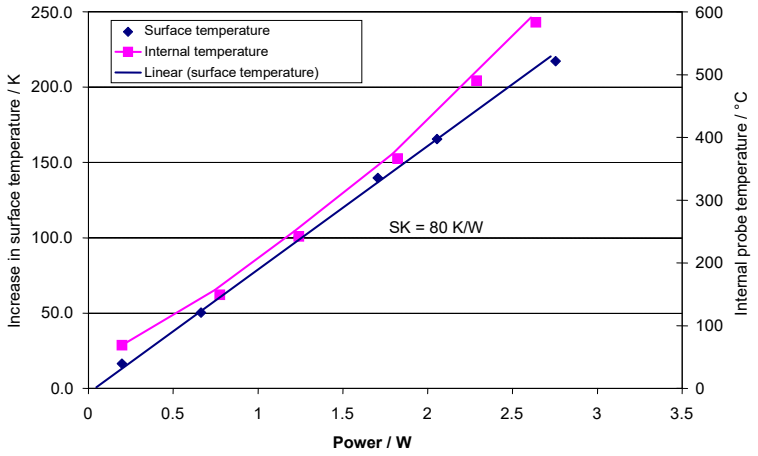


Figure 1: self-heating characteristics of a Pt100 RTD temperature probe

In addition, the following safety clearances must be adhered to:
In the case of temperature classes T1 and T2, a 10 K, and the case of temperature classes T3 to T6, a 5 K safety deduction must be applied for calculating the maximum surface temperature.

Example for gas Ex:
Temperature class T4 (maximum temperature 135 °C, according to IEC 60079-0:12; 5.3.2.2)
Max. temperature must be reduced by 5 K for safety
Protection tube constant (SK) = 80 K/W
Maximum power of the electrical circuit Pmax = 0.5 W
$T_S = T_K$ - (Pmax × SK); see above

T_S = 130 °C - (0.5 W × 80 K/W)
T_S = 130 °C - 40 K = 90 °C

The maximum temperature (measuring/medium temperature) on the tip of the probe must therefore not exceed a value of 90 °C, as an exceedance of the temperature class limit must be expected in the case of a malfunction. **EXPLOSION HAZARD!**

Example for dust Ex:
For thermometers for use in areas potentially subject to dust explosion, the same consideration and calculation bases always apply to calculating the maximum measuring/medium temperature on the tip of the probe as for use in areas potentially subject to gas/steam/mist explosion; however, they should be used with an additional multiplication of a dust Ex constant of 2.8.

Protection tube constant (SK) = 80 K/W
Maximum power of the electrical circuit P_{max} = 70 mW
Max. heating = (Pi × SK × 2.8), see above

0.07 W × 80 K/W × 2.8

The **maximum heating** in the case of a malfunction is thus **15.7 K**; additional ambient temperature according to the standard of 40 °C = 55.7 °C.

The maximum temperature (measuring/medium temperature) on the tip of the probe thus falls below T80 °C.

5.5 Use in areas that are potentially explosive due to dust

Dust explosion protection: safe limitation of energy;
ignition protection type "protection through intrinsic safety"
For safe limitation of the energy fed to the probe element, including in the event of malfunction of the device supplying the power, use of an electrical circuit with the ignition protection type "intrinsic safety" is exceptionally suitable. The ignition protection type "protection through intrinsic safety" means that, in the area with an explosion hazard caused by dust, the only criterion is the characteristic of safe limitation of electrical variables in the intrinsically safe devices by means of the associated intrinsically safe devices. Head transmitters of the category 1G/2G are included in the terminal head in the ignition protection type "protection through housing". The relevant intrinsically safe device. which must be positioned outside of the potentially explosive area, does not have to fill requirements with regard to category 1D/2D. For the intrinsically safe devices/the associated intrinsically safe devices, the category identifications therefore are sufficient for the device requirements of areas that are potentially explosive due to gas 1G/2G.

For use in areas that are potentially explosive due to dust, the following temperature values must be considered:

The following applies for all zones:
The equipment's surface temperature must not reach the point at which clouds of dust or dust deposited on equipment could ignite. This is achieved through the following conditions:

Without dust deposits
The surface temperature must not exceed $^2/_3$ of the ignition temperature in °C of the respective dust/air mixture.

With dust deposits
Surfaces on which dangerous deposits of smolderable dust cannot be prevented must not have a surface temperature that is higher than 75 K below the smoldering temperature of the dust concerned. If layers thicker than 5 mm occur, a further reduction of the surface temperature is required.

Where a combination of swirling and deposited dust occurs, the lower of the temperature values derived above must be applied.
Note:
In this case, surface means the exterior surface of the equipment, see also 60079-14.

The ignition or smoldering temperature of the dust or dust/air mixture that is present must be defined or determined by the plant operator!

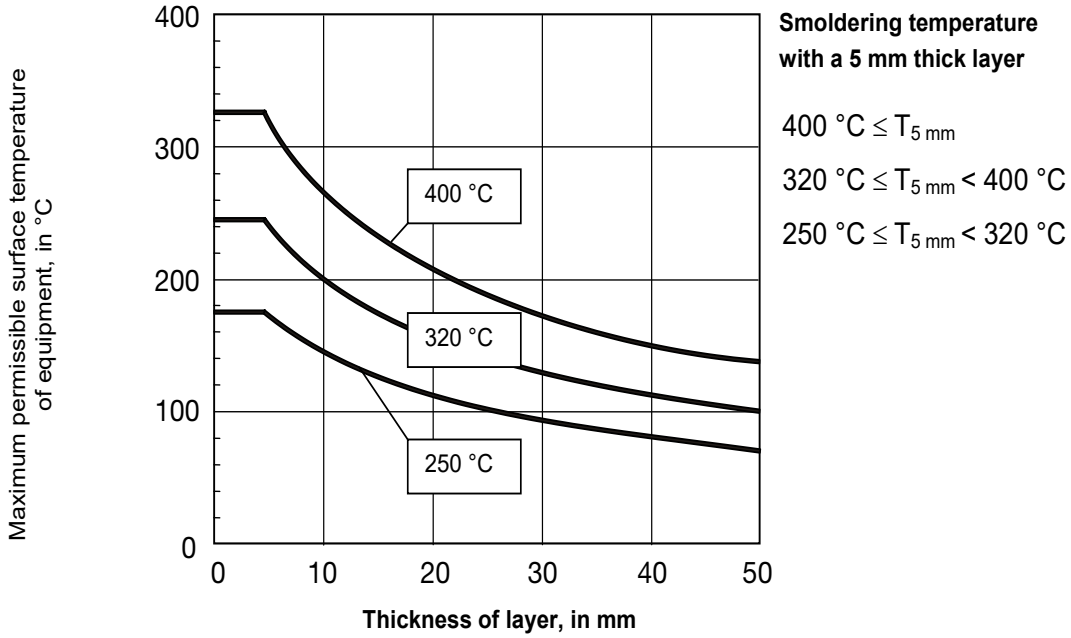


Figure 2: Reduction of the maximum admissible surface temperature with increasing thickness of the dust layer

6 Special conditions

The following special conditions apply during installation, during operation, and when replacing the thermometers.

RTD temperature probes from JUMO are intended for measuring the temperature within potentially explosive areas in which flammable or non-flammable liquids, gases, or gas/air mixtures, as well as explosive dusts may be present.

During installation, the special requirements of the standard EN 60079 must be observed!

The relevant valid European and international provisions must be adhered to for setup/operation. The generally accepted rules of engineering and this operating manual are authoritative.

The instructions for use from the manufacturer for all components in the measuring circuit for potentially explosive areas with regard to the admissible process conditions must be observed and adhered to.

The temperature class T6 to T1 must be determined specific to the application. The required specifications for the potential applications are listed on the drawing/data sheet.

The calculation of the self-heating characteristics depending on the protection tube constant is described with calculation examples under chapter 5.4 and must be calculated accordingly by the user in the application.

The RTD temperature probes are attached with the process connection on the mounting site. Depending on the process connection, the RTD temperature probe can or must be installed in an additional screw-in or weld-in sleeve. If a thread is attached as a process connection, the full thread length of the RTD temperature probe must be in use.

The supply of the RTD temperature probe must be routed in a fixed manner if the RTD temperature probe is mounted on containers or pipes in which an explosive gas/air mixture (zone 0, 1G, or EPL Ga) or dust (zone 20, 1D ,or EPL Da) is present continuously or for long periods.

The potential equalization (system grounding) must include all cable routing in the measuring circuit.

Metallic connector housings must be grounded for potential equalization via the connecting cable.
Non-metallic connector housings must not exceed the maximum surface according to EN 60079-0.
Insulated metallic parts must be integrated in the potential equalization.

The screw-in or weld-in sleeve is intended for, amongst other things, zone separation and is made from steel, stainless steel, or HASTELLOY®, etc.

In particular, equipment used in potentially explosive areas where hybrid mixtures are present must be checked. Hybrid mixtures are explosive mixtures of flammable gases, vapors, or mists with flammable dusts. The operator is responsible for checking that the equipment is suitable for such uses.

Surface temperature for dust area
According to IEC 60079-0: 2017, chapter 5.3.2.3.2, in compliance with IEC 60079-14: 2013, chapter 5.6.3.1, the maximum admissible (and to be expected) dust thickness is less than 5 mm. No additional test therefore has to be carried out for the surface temperature.

Attention:
The plant operator and not the manufacturer/supplier of the equipment always has responsibility for zone classification.

			Equipment protection level (EPL)	
Gases, mist, vapors	**Dust**	**Potentially explosive atmosphere present**	**Gases**	**Dust**
Zone 0	Zone 20	Continuously, long-term, or frequently > 1000 hr/yr	Ga	Da
Zone 1	Zone 21	Occasionally > 10 hr/yr, ≤ 1000 hr/yr	Ga + Gb	Da + Db
Zone 2	Zone 22	Rarely and briefly > 0 hr/yr, ≤ 10 hr/yr	Ga, Gb + Gc	Da, Db + Dc

Table 2: zone classification

1. The device must be adapted to the minimum environmental influences. The protection fitting is adapted to the medium temperature. The terminal heads or the connecting cables are selected with regard to the ambient temperature.

- Ambient temperatures of the connecting cables are:

Material	**Temperature range [°C]**	**also for dust**	**Remarks**
PVC	-5 to +80	X	Standard
PVC	-5 to +105	X	High temperature PVC
PUR	-5 to +80	X	
PUR	-5 to +105	X	
Silicone	-50 to +180	X	
PTFE	-190 to +260	X	Sealed with silicone and/or glued
Glass fibre	-20 to +350		
RADOX®	-40 to +120	X	Halogen-free
Polyolefin (BETAflam®)	-40 to +120	X	Halogen-free
PEEK	-60 to +260	X	Sealed with silicone and/or glued
FPM	-50 to +180	X	Chemical resistant
FEP	-70 to +200	X	Sealed with silicone and/or glued
PFA	-190 to +260	X	Sealed with silicone and/or glued
PI (Kapton)	-190 to +260	X	Sealed with silicone and/or glued

- Ambient temperature of the terminal head is:

Part no.	**Terminal head**	**Tamb (°C)**	**Comment**	**Drawing number**
00626681	BUZ	-20 to +100	SIL, yellow	90.9715.905885.M.--
00387717	BUZH	-20 to +100	none	90.9715.Ex9956.Z.--

- The ambient temperature of the RTD temperature probe is:
  - 70 to 260 °C: for a standard measuring insert with platinum chip sensors in heat-conducting paste
  - -200 to +600 °C: with measuring insert composed of mineral-insulated RTD temperature probe
- In the case of the thermocouple, the ambient temperature observes the following:
  - Mineral-insulated thermocouples
  - Thermocouple wire

The maximum ambient temperature is recorded according to the standards EN 60584.

2. The maximum current, the maximum voltage, and the maximum power, which are specified in the conditions below, must not be exceeded:

	Umax.	**Imax.**	**Pmax.**
	[V]	**[mA]**	**[mW]**
For gas in the specific device temperature area	30	100	750
For dust temperature sensors at maximum total temperatures of T80 °C			100

3. If no measured internal structure is available, the following protection tube constants for two-wire, three-wire, and four-wire technology can generally be used:

Protection tube diameter		**Protective tube constant**
Minimum	**Maximum**	
[mm]	**[mm]**	**[K/W]**
3	3.3	220
> 3.3	4	180
> 4	5	110
> 5	-	80

These values apply to sensor elements that are larger than or equal to an equivalent surface of 2 × 3 mm.

4. Protection tube constants for mineral-insulated thermocouples from a diameter of ≥ 1 mm with an insulated or non-insulated structure (element welded with the protection fitting) and for thermocouples with a ceramic protection tube and thermocouple wires used with a diameter of ≥ 0.35 mm are specified as follows:

Element length	**Protective tube constant**
[mm]	**[K/W]**
≥ 25 to 50	120
> 50 to 330	70
> 330	20

5. The terminal head/metal body must be connected with the potential equalization system of the plant.

7 Maintenance

The European and national regulations applicable to maintenance/repair/inspection must be adhered to. During maintenance, the parts upon which the ignition protection type depends must be checked in particular.

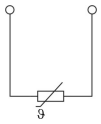
Furthermore, thermometers with a plastic terminal head and all plastic parts (e.g. plug connectors, etc.) must only be cleaned with a damp cloth in order to prevent electrostatic charge.

8 Connection types of RTD temperature probes

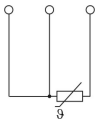
(applies similarly to RTD temperature probes with a terminal head/connecting cable from JUMO)

Combinations of the following electrical circuits can also be implemented (e.g. 2× three-wire circuit and 1× two-wire circuit).

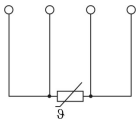
Two-wire circuit



Three-wire circuit

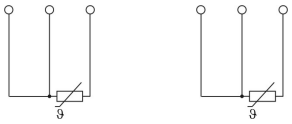


Four-wire circuit

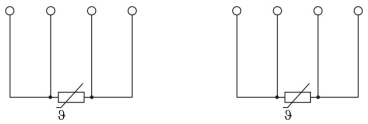


2× two-wire circuit

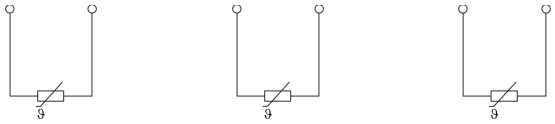
2× three-wire circuit



2× four-wire circuit



3× two-wire circuit



9 Declaration of conformity

The EU declaration of conformity is part of the scope of delivery.

The CE identification marking is part of the nameplate. The product corresponds to the state of the art, as well as the applicable safety regulations at the time of placement on the market within the scope of its intended use

The JUMO quality management system according to EN ISO 9001 is the basis for compliance with directive 2014/34/EU.

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More than sensors + automation

EU-Konformitätserklärung

EU declaration of conformity / Déclaration UE de conformité

Produkt *Product / Produit*	**Typ** *Type / Type*	**Typenblatt** *data sheet / fiche technique*
Widerstandsthermometer Ex e *Resistance thermometer Ex e / Thermomètre à résistance Ex e*	**90.2***.******	**9028****

Hersteller / Adresse
Manufacturer / Etabli par / Adress / Adresse

JUMO Mess- und Regeltechnik AG
Laubisrütistrasse 70, 8712 Stäfa, Switzerland

Wir erklären in alleiniger Verantwortung, dass das bezeichnete Produkt die Anforderungen der Europäischen Richtlinien erfüllt.
We hereby declare in sole responsibility that the designated product fulfills the requirements of the European Directives.
Nous déclare sous notre seule responsabilité que le produit remplit les Directives Européennes.

Richtline
Directive / Directive

ATEX Richtlinie 2014/34/EU
ATEX Directive 2014/34/EU / Directive ATEX 2014/34/UE

Angewendete Normen
Standards applied / Normes appliqués
EN 60079-0:2018
EN 60079-7:2015/A1:2018
EN 60079-31:2014
EN ISO/IEC 80079-34:2018

Die Konformität wird durch die Einführung der neuen harmonisierten Norm EN 60079-7:2015/A1:2018 nicht beeinflusst
Conformity is not affected by the introduction of the new harmonised standard EN 60079-0:2018
La conformité n'est pas affectée par l'introduction de la nouvelle norme harmonisée EN 60079-0:2018

EU-Baumusterprüfbescheinigung
Type examination Certificate / Attestation d'examen de Type

SEV 18 ATEX 0209 X

Benannte Stelle
Notified body / Organisme notifié

Eurofins Electrosuisse Product Testing AG

Kennnummer
Identification no. / N° d'identification

1258

Anerkannte Qualitätssicherungssyteme der Produktion
Recognized quality assurance systems of production
Systèmes de qualité reconnus de production

SEV 18 ATEX 4120

Benannte Stelle
Notified body / Organisme notifié

Eurofins Electric and Electronic Product Testing AG

Kennnummer
Identification no. / N° d'identification

1258

Aussteller
Issued by / Etabli par

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Laubisrütistrasse 70, 8712 Stäfa, Switzerland

Ort, Datum
Place, date / Lieu, date

Stäfa, 30.01.2023

Rechtsverbindliche Unterschrift
Legally binding signature /
Signature juridiquement valable

CEO
Schlittler René

10 Type examination certificate

The type examination certificate can be viewed and downloaded on the homepage under the relevant product group number.

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