Resistance Thermometers
Contents

Notes to the use of the catalogue ................................................................. 2
1. Resistance Thermometer ........................................................................ 2
  1.1 Introduction ....................................................................................... 2
  1.2 Overview Basic Measuring Resistors (M-XX) ..................................... 3
    In General ......................................................................................... 3
  1.2.1 Measuring Resistor, Type (M-OK) ................................................ 3
  1.2.2 Measuring Resistor, Type (M-MG) ................................................ 4
  1.2.3 Measuring Resistor Type (M-GL) ................................................. 5
  1.2.4 Measuring Resistor, Type (M-KK) ................................................ 6
  1.2.5 Measuring Resistor Type (M-MK) ................................................ 7
  1.3 Cable Resistance Thermometers ....................................................... 8
    In General ......................................................................................... 8
  1.3.1 Cable Resistance Thermometer Type (M-XX/ESH/DSH) .................. 9
  1.3.2 Cable Resistance Thermometer Type (M-XX/MH) .......................... 11
  1.3.3 Cable Resistance Thermometer Type (M-XX/KH) .......................... 13
  1.4 Chip-Slot Resistance Thermometers ............................................... 15
    In General ......................................................................................... 15
  1.4.1 Slot Resistance Thermometer Type (M-OK/ZS) .............................. 15
  1.4.2 Slot Type Resistance Thermometer, Type (M-OK/AK) ................. 16
  1.4.2 Slot Resistance Thermometer with Plastic Housing Type (M-OK/KS) 18
  1.4.3 Foil Resistance Thermometer Type (NWT-F) ................................ 19
  1.5 Screw-in Resistance Thermometers .................................................. 20
    In General ......................................................................................... 20
    Dimensions of Screw-in Thermometers with Connection Head .......... 20
  1.5.1 Screw-in Resistance Thermometer Type (M-OK/SGH) ................. 21
  1.5.2 Screw-in Resistance Thermometer Type (XESWT-Y) ................. 23
  1.5.3 Screw-in Resistance Thermometer Type (XESWT-MA) ................. 25
  1.5.4 Screw-in Resistance Thermometer Type (XESWT-EM24/38) .......... 27
  1.6 Bayonet Cap Resistance Thermometer Type XESWT-BV ................. 29
  1.7 Sheathed Resistance Thermometer (WT-MI) ..................................... 31
APPENDIX ................................................................................................. 33
  General guidelines for the cable confectioning ..................................... 33
  Clamp screw connections ..................................................................... 33
  Application temperatures of the used materials / insulations ............. 34
  Index of abbreviations ........................................................................ 35
Notes to the use of the catalogue

Products included in this catalogue represent a general overview of the principally deliverable resistance thermometers of EPHY-MESS. In every list, different variations and modifications of one product are separated by the sign "|". Please note that the variations and modifications are not always freely combinable; for instance a socket with a small diameter requires only a specific cable or a special measuring resistor. The specification sheets are general and specify normally only the benchmark figures. Based on the countless number of possible configurations, it is impossible to present all of these variants. If you have any special requirements or desires, please contact our sales department. We also gladly develop together with you a new temperature sensor according your very special requirements.

1. Resistance Thermometer

1.1 Introduction

Resistance thermometers use a sensor, whose resistance depends upon temperature and material used – a particular change in resistance serves as a measuring unit of temperature. Resistance thermometers generally show PTC characteristics. This means, the resistance of the used sensor material increases also with the growing temperature of. This relation is approximately linear, within the framework of a certain temperature interval depending on the material. This range is very suitable for temperature measurements. For instance, platinum is a linear material within a large temperature range. Platinum has a high temperature stability and reproducibility, as well as a low tendency to wear away. However, other materials can also be used to measure temperature, such as nickel or copper. These are currently on decline, and therefore almost all the thermometers in this catalogue use platinum resistors. Other sensors, as copper or nickel are available at special occasions. Due to the above mentioned reasons, platinum thermometers have become the standard in industry today. In this catalogue the various modifications of resistance thermometers are described. Our offer ranges from basic sensors to cable thermometers, screw-in thermometers and insulated resistance thermometers.
1.2 Overview Basic Measuring Resistors (M-XX)

In General

As has been mentioned above, platinum measuring resistors according to the standard EN 60751 have become prominent in contact temperature measurement with resistance thermometers. These sensors have a rated temperature of 0°C. The rated value usually is 100 Ω. Other rated values (such as 1000 Ω) may be supplied upon request. Sensors are divided into tolerance classes AA, A and B. The following table gives overview of the maximum acceptable deviations:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Rated Value</th>
<th>Class AA</th>
<th>Class A</th>
<th>Class B</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Ω]</td>
<td>100 Ω / 0°C</td>
<td>± 0.04 Ω/0°C</td>
<td>± 0.06 Ω/0°C</td>
<td>± 0.12 Ω/0°C</td>
</tr>
<tr>
<td>[°C]</td>
<td>0°C</td>
<td>± 0.10°C/0°C</td>
<td>± 0.15°C/0°C</td>
<td>± 0.30°C/0°C</td>
</tr>
</tbody>
</table>

Tab. 1: Classification of the tolerance classes according to EN 60751 for Pt100 measuring resistors

Following the 5 at EPHY-MESS usual basic measuring resistors are described. They are the basis of all deliverable resistance thermometers.

1.2.1 Measuring Resistor, Type (M-OK)

- Universell useable thin-film precision resistor
- Temperature range from -70°C ... max. +500°C
- Square shape, available in many different dimensions

Fig. 1: Thin-layer Measuring Resistor (M-OK)

Specification

Platinum thin-layer resistor M-OK

Construction

The platinum layer is applied by means of thin-layer technology onto ceramic substrate; it is fitted with contact wires and covered with a protective layer; rectangular shape

Measuring range

-70°C... 400°C | 500°C | 600°C

Rated value

100 Ω | 500 Ω | 1000 Ω / 0°C (other rated values upon request)
Tolerance class according to EN 60751

Resistance material

Contact wires

Dimensions

Response time

T (9/10) in air

1.2.2 Measuring Resistor, Type (M-MG)

- Thin-film precision resistor in a glass housing
- Temperature range from -50°C ... max. +500°C
- Mechanical protection of the thin-film sensor by a glass housing
- Circular shape

Fig. 2: Thin-layer Measuring Resistor in a glass housing (M-MG)

Specification

Construction

Measuring range

Rated value

Tolerance class according to EN 60751

Resistance material

Contact wires

Dimensions

Platinum thin-layer resistor in a glass housing M-MG

The platinum thin-layer resistor is fitted in a glass housing; it is fitted with contact wires; rectangular shape

-50°C... 400°C | 500°C

100 Ω | 1000 Ω / 0°C (other rated values upon request)

AA | A | B (other tolerances upon request)

Platinum

Pt/Ni, about 10 mm -15 mm long

from about 11.6 mm x 5 mm (please contact our sales department for the exact dimensions)
1.2.3 Measuring Resistor Type (M-GL)

- *Wire wound platinum glass resistor*
- *Temperature range from -200°C ... max. +400°C*
- *Shock resistant construction*
- *Circular shape*

![Wire-wound glass resistor (M-GL)](image)

**Fig. 3:** Wire-wound glass resistor (M-GL)

**Specification**

Wire-wound platinum glass resistor M-GL

**Construction**

**Model I)** Platinum wire wound around a glass spindle; it is fitted with contact wires and sealed in hardened glass, cylindrical shape

**Model II)** Platinum wire wound around a glass spindle; it is fitted with pull-relieved contact wires and sealed in soft glass, cylindrical shape

**Measuring range**

-200°C ... +400°C

**Rated value**

1 or 2\(^*\) x 100 Ω / 0°C (other rated values upon request)

\(^*\) only for Model A

**Tolerance class**

AA | A | B (other tolerances upon request)

according to EN 60751

**Resistance material**

Platinum

**Contact wires**

Pt/Ni, about 10 mm -15 mm long

**Dimensions**

ø from about 1.3 mm, length depends on diameter

(please contact our sales department for the exact dimensions)

**Response time**

\(T_{90\%}\) in air

from about 23 sec, according to dimensions
1.2.4 Measuring Resistor, Type (M-KK)

- *Wire wrapped platinum ceramic resistor*
- *Temperature range from -200°C ... max. +800°C*
- *Circular shape*

![Wire-wound ceramic resistor (M-KK)](image)

**Fig. 4:** Wire-wound ceramic resistor (M-KK)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Wire-wound platinum resistor with ceramic coating M-KK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>Platinum wire wound around a glass spindle and insulated with ceramics; cylindrical shape</td>
</tr>
<tr>
<td>Measuring range</td>
<td>-200°C ... +600°C</td>
</tr>
<tr>
<td>Rated value</td>
<td>1 or 2 x 100 Ω / 0°C  (other rated values upon request)</td>
</tr>
<tr>
<td>Tolerance class</td>
<td>AA</td>
</tr>
</tbody>
</table>

** according to EN 60751**

<table>
<thead>
<tr>
<th>Resistance material</th>
<th>Platinum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact wires</td>
<td>Pt/Ni, about 10 mm - 20 mm long</td>
</tr>
<tr>
<td>Dimensions</td>
<td>ø from about 0.8 mm, length depends on diameter</td>
</tr>
<tr>
<td>Response time $T_{9/10}$ in air</td>
<td>from about 12 sec, according to dimensions</td>
</tr>
</tbody>
</table>
1.2.5 Measuring Resistor Type (M-MK)

- Thin-film precision resistor in a ceramic housing
- Temperature range from -50°C ... max. +400°C
- Mechanical protection of the thin-film sensor by a ceramic housing
- Cylindrical shape

Fig. 5: Thin-film precision resistor in ceramic housing (M-MK)

**Designation**
Thin-film precision resistor in ceramic housing M-MK

**Construction**
Thin-film resistor sealed in a ceramic housing, cylindrical shape

**Measuring range**
-50°C... +400°C

**Rated values**
1 or 2 x 100 Ω / 0°C (other rated values upon request)

**Tolerance class**
AA | A | B according EN 60751

**Resistance material**
Platinum

**Contact wires**
Ni/Pt wire, about 10 mm - 20 mm long

**Dimensions**
From about ø2 mm, length depending on the diameter
(please contact our sales department for the exact dimensions)

**Response time**
\( T_{(9/10)} \) in air
From about 20 sec, depending on the dimensions and construction
1.3 Cable Resistance Thermometers

In General

Cable resistance thermometers are frequently used and quite inexpensive solutions for various temperature measurement applications. They are mainly used to measure low and medium temperature ranges (-40°C ... 260°C). Moreover, there are even special models with an application temperature up to 400°C.

Measuring resistors Pt100 according to the standard IEC 60751 are used as basic sensors. Other rated values (500 Ω, 1000 Ω) or resistor materials (e.g. Ni, Cu) may be supplied upon request.

EPHY-MESS offers you a wide range of cable resistance thermometers. They are used mainly in these areas of application:

- Control of temperature in coil or slot of electric machines
- Measurements in laboratories and testing facilities
- Measurement of the temperature of air, water and solids
- Measurements of temperature in explosive environments

The requirements for these sensors are exceedingly manifold. For the above mentioned areas of application, e.g. also water-resistant cable thermometers for the use in liquids, as well as extra high-voltage-resistant sensors (up to 8 kV), for the direct use in high-voltage machines. Our company manufactures all temperature sensors on request of the customer. The following cable thermometers are available:

<table>
<thead>
<tr>
<th>Form</th>
<th>Typen- bezeichnung</th>
<th>Cylindrical design</th>
<th>Groove at-shape design</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESH (single shrink hose insulated)</td>
<td>PR-SPA-EX-WKF</td>
<td>M-XX / ESH</td>
<td></td>
</tr>
<tr>
<td>DSH (double shrink hose insulated)</td>
<td>PR-SPA-EX-WKF</td>
<td>M-XX / DSH</td>
<td></td>
</tr>
<tr>
<td>MH (metal sleeve)</td>
<td>PR-SPA-EX-WKF</td>
<td>M-XX / MH</td>
<td></td>
</tr>
<tr>
<td>KH (ceramic sleeve)</td>
<td>PR-SPA-EX-WKF</td>
<td>M-XX / KH</td>
<td></td>
</tr>
<tr>
<td>AK (AK case)</td>
<td>PR-SPA-EX-NWT</td>
<td>M-OK / AK</td>
<td></td>
</tr>
<tr>
<td>ZS (ZS case)</td>
<td>PR-SPA-EX-NWT</td>
<td>M-OK / ZS</td>
<td></td>
</tr>
<tr>
<td>KS (plastic case)</td>
<td>PR-SPA-EX-NWT</td>
<td>M-OK / KS</td>
<td></td>
</tr>
</tbody>
</table>

Tab. 2: Overview of the designs of cable resistance thermometers

Type PR-SPA-EX-WKF/NWT or LTH is the classification for ATEX, IECEx and TR certified products.

For most of the above mentioned thermometers are also versions with explosive protection certification according to ATEX available.
1.3.1 Cable Resistance Thermometer Type (M-XX/ESH/DSH)

- Cheap cable resistance thermometer for universal use
- Temperature range from -70°C ... max. +260°C
- Precision resistor crimped or soldered joined with the supply line
- High voltage resistant insulated, suitable for use inside the winding of electrical machines
- IECEx, ATEX and TR approval for the use in hazardous areas with the protection types:

IECEx: Ex eb IIC, Ex ta IIIC, Ex ia IIC Gb, Ex ia IIIC Gb
ATEX: II 2G Ex e IIC Gb, II 2D Ex ta IIIC Da, II 2G Ex ia IIC Gb, II 2D Ex ia IIIC Db
TR: Ex ia IIC U, Ex e II U, Ex ia IIIC Db U

Fig. 6: M-OK/ESH crimped, with PTFE insulated single wires

In General

This is a relatively simple cable thermometer, where a basic measuring resistor is assembled with a connection line and a shrinkable tubing cover. Mainly these sensors are used as sensors for the thermal protection of machines. Principally they are an inexpensive solution for all kind of temperature measurements.

Specification

Cable resistance thermometer M-XX/ESH/DSH
XX = OK | MG | GL | KK | MK | (see Basic Measuring Resistors)
ESH = simple shrinkable tubing insulated
DSH = double shrinkable tubing insulated

Construction

Measuring resistor, one- or two-layer insulation by shrinkable tubing with a fix connected inlet

Measuring range
-70°C ... +260°C
Measuring range ATEX
-60°C ... +180°C

Temperature sensor
1 passive measuring resistor

Resistance material
Platinum

Rated resistance
100 Ω / 0°C | 1000 Ω / 0°C (other rated values upon request)

Tolerance class
AA | A | B (other tolerances upon request)

According to EN 60751

Mode of connection
2- | 3- or 4- conductor connection

Shrinkage tube insulation
1) ESH single-layer insulation
2) DSH double-layer insulation

Dimensions
ø from about 2" mm, length from about 20 mm
1 round – GL, KK, MG, oval – OK
2) depends on the measuring resistor used

Material
Kynar® | Kynarflex® | PTFE
Connection line
1) PTFE hose conductor (Sx)
2) PTFE single litz wires
3) Teflon® flat hose line (FSx)

Cable cross-section*1
AWG 20 | 22 | 24 | 26 | 28 | 30*4 SL/FLS- depends on type

Cable length
upon customer’s request

Line terminal
bare conductor | tinned | cable end sleeves

Colour code
red / white, or upon customer’s request

Dielectric strength
$R_{(iso)}$ 500 V ≥ 200 MΩ | 1,5 kV / AC 50 Hz / 1 min. |
max. 2.5 kV / AC 50 Hz / 1 min.*5)

*) only with double flexible hose insulation

Special designs
water-resistant design (IP 66)
high-voltage-resistant design (up to 8 kV)
Ex e authorized design according to ATEX

Aid for product selection ESH/DSH

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>ESH</th>
<th>DSH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short response time</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Price</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>kV-strength</td>
<td>1.5 kV</td>
<td>2.5 kV</td>
</tr>
<tr>
<td>Mechanical solidity</td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>
1.3.2 Cable Resistance Thermometer Type (M-XX/MH)

- **Cable resistance thermometer with metal sleeve**
- **Temperature range from -70°C ... max. +260°C**
- **Humidity tight version possible (IP66)**
- **Multiple areas of use because of variable dimensions**
- **IECEx, ATEX and TR approval for use in hazardous areas with protection types:**
  
  **IECEx:** Ex eb IIC, Ex ta IIC, Ex ia IIC Gb, Ex ia IIIC Gb
  **ATEX:** II 2G Ex e IIC Gb, II 2D Ex ta IIIC Da, II 2G Ex ia IIC Gb, II 2D Ex ia IIIC Db
  **TR:** Ex ia IIC U, Ex e II U, Ex ia IIIC Db U, Ex tb IIIC Db U

**Fig. 7:**
- Top: M-OK/MH with press bead
- Middle: M-OK/MH with rolling bead
- Bottom: M-OK/MH with sealing

**Specification**
- Cable resistance thermometer with metallic capsule M-XX/MH
- XX = OK | MG | GL | KK, (see Basic Measuring Resistors)
- MH = metal capsule

**Construction**
- Measuring resistor with heat-conduction paste mounted into metallic protection capsule with fix connected inlet.

**Measuring range**
- -70°C ... +260°C
- -60°C ... +180°C

**Temperature sensor**
- 1 or 2 passive measuring resistors

**Resistance material**
- Platinum

**Rated resistance**
- 100 Ω / 0°C | 1000 Ω / 0°C (other rated values upon request)

**Tolerance class**
- AA | A | B (other tolerances upon request)

**Mode of connection**
- 2- | 3- or 4- conductor connection *)
  *) depending on ø of housing, number of sensors and connection line
Protection Capsule

Material
VA | Ms*)

*) not deliverable for all dimensions

Dimensions
ø from 3 mm, step value 1 mm
length from 20 mm, step value 5 mm

Cable connection
press bead | rolling bead *) | sealed-in
*) only for capsule ø=6 mm and Si-SL

Connection line
1) Teflon®, | silicone- | spun glass- hose line
2) Teflon®- single litz wires

Cable cross-section*)
AWG 20 | 22 | 24 | 26 | 28 | 30
*) SL – depends on type

Cable length
upon customer’s request

Line terminal
bare | tinned | cable end sleeves

Colour code
red / white, or upon customer’s request

Dielectric strength
max. 2.5 kV / AC 50 Hz / 1 min.

Assembly
VA- clamp screw connection (see appendix)
(optionally)

Special designs
- screened design
- water-resistant design (IP 65)
(only for ø 6 mm with silicone hose line and rolling bead)
1.3.3 Cable Resistance Thermometer Type (M-XX/KH)

- **Cable resistance thermometer with ceramic sleeve**
- **Temperature range from -70°C ... max. +400°C**
- **High voltage resistant insulated, suitable for use inside the winding of electrical machines**
- **IECEx, ATEX and TR approval for use in hazardous areas with protection types:**

**IECEx:**  
- Ex eb IIC, Ex ta IIIC, Ex ia IIC Gb, Ex ia IIIC Gb

**ATEX:**  
- II 2G Ex e IIC Gb, II 2D Ex ta IIIC Da, II 2G Ex ia IIC Gb, II 2D Ex ia IIIC Db

**TR:**  
- Ex ia IIC U, Ex e II U, Ex ia IIIC Db U, Ex tb IIIC Db U

![Cable resistance thermometer with ceramic sleeve](image)

**Specification**  
Cable resistance thermometer with ceramic protection capsule M-XX/KH  
XX = OK | MG | GL | KK, (see Basic Measuring Resistors)  
KH = ceramic capsule

**Construction**  
Measuring resistor in ceramic protection capsule sealed-in with fix connected inlet.

**Measuring range**  
-70°C ... +260°C

**Measuring range ATEX**  
-60°C ... +180°C

**Temperature sensor**  
1 passive measuring resistor

**Resistance material**  
Platinum

**Rated resistance**  
100 Ω / 0°C | 1000 Ω / 0°C (other rated values upon request)

**Tolerance class**  
AA | A | B (other tolerances upon request)

**Mode of connection**  
2- | 3- or 4- conductor connection *)

*) depends on the housing and the connection line

**Protection capsule**  
ceramic protection capsule

**Material**  
Al₂O₃ – ceramics

**Dimensions**

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>HÜ-KH-EFG</td>
<td>ø3 mm x 11 mm</td>
</tr>
<tr>
<td>HÜ-KH-EFG</td>
<td>ø3 mm x 15 mm</td>
</tr>
<tr>
<td>HÜ-KH-ERG**</td>
<td>ø4.9 mm x 16 mm</td>
</tr>
<tr>
<td>HÜ-KH-ERG</td>
<td>ø4.9 mm x 30 mm</td>
</tr>
</tbody>
</table>

*) EFG = single sided flat closed  
**) ERG = single sided round closed

Fig. 8: M-XX/KH, 4.9 mm x 30 mm  
M-XX/KH, 3 mm x 15 mm
| **Connection line** | 1) Teflon®- spun glass- hose line  
2) PTFE - single litz wires |
|---------------------|-------------------------------------------------------------------|
| **Cable cross-section** | AWG 20 | 22 | 24 | 26 | 28 | 30  
   * SL – depends on type |
| **Cable length** | upon customer’s request |
| **Cable ends** | bare | tinned | cable end sleeves |
| **Colour code** | red / white, or upon customer’s request |
| **Dielectric strength** | max. 2.5 kV / AC 50 Hz / 1 min. |
| **Special designs** | maximum application temperature up to 400°C (only with GS-hose line)  
maximum dielectric strength 5 kV, (only with Teflon® insulated supply line) |
1.4 Chip-Slot Resistance Thermometers

In General

Chip-slot resistance thermometers have become an inexpensive alternative to the bifilar coiled slot resistance thermometers (medium value sensors). At these types, a platinum thin-layer measuring resistor M-OK is used instead of a bifilar coiled platinum cable. The active measuring length is shortened to the active measuring length of the thin-layer sensor (point measurement). For most measurement applications this is completely sufficient, because the requirements mostly refer to the design (groove) and not to the active measuring length. Slot type resistance thermometers (NWT) offered by EPHY-MESS are mainly used in the grooves of the stator coiling of electric machines. Therefore, all the variations are also deliverable in an ex-certificated version according to ATEX. Principally these thermometers can be used also for all other kinds of measurements on surfaces, in grooves or on other hardly accessible measuring locations.

1.4.1 Slot Resistance Thermometer Type (M-OK/ZS)

- Measuring resistor sealed into an Epoxyd inter-slider (ZS)
- Temperature range from -65°C ... max. +200°C
- For mounting direct in the slots of electrical motors/generators
- Adjustable to almost each slot dimension
- IECEx, ATEX and TR approval for use in hazardous areas with protection types:

  **IECEx:**  Ex eb IIC, Ex ta IIC, Ex ia IIC Gb, Ex ia IIC Gb
  **ATEX:**   II 2G Ex e IIC Gb, II 2D Ex ta IIC Da, II 2G Ex ia IIC Gb, II 2D Ex ia IIC Db
  **TR:**     Ex e II U, Ex tb IIC Db U, Ex ia IIC U, Ex ia IIC Db U

![Fig. 9: M-OK/ZS in 2-wire line connection with ribbon cable hose line](image)

**Specification**
- Slot type resistance thermometer, inter-slider M-OK/ZS
  - ZS = inter-slider

**Construction**
- Pt-thin-layer measuring resistor with fix connected inlet, fixed by bridges and directly sealed into epoxy inter-slider housing

**Measuring range**
- -65°C ... +200°C
- Measuring range ATEX
  - -60°C ... +180°C
Temperature sensor

passive Pt-thin-film measuring resistor, active measuring length about 2 mm

Rated resistance

100 Ω / 0°C | 1000 Ω / 0°C, (other rated values upon request)

Mode of connection

2- | 3-*) or 4-*) conductor connection

*) depends on the line cross-section and on the width of the part

Tolerance class

AA | A | B (other tolerances on request)

Housing

Epoxy inter-slider, non-flexible

Material

epoxy resin

Dimensions (min.)

thick (min.) = 2 mm x width (min.) = 8 mm x length (min.) = 20 mm

Standard dimensions

<table>
<thead>
<tr>
<th>thick [mm]</th>
<th>width [mm]</th>
<th>length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>30</td>
</tr>
</tbody>
</table>

Connection line

PTFE – single litz wires | ribbon cable hose line

Colour code

red / white, or upon customer’s request

Cable cross-section

AWG20 | AGW24 | AWG26 | AWG28; FSL - depends on type

Cable length

upon customer’s request

Cable ends

bare | tinned | cable end sleeves

Dielectric strength

max. 2.5 kV / AC 50 Hz / 1 min.

Special designs

Ex - approved versions

1.4.2 Slot Type Resistance Thermometer, Type (M-OK/AK)

- Measuring resistor pressure free sealed into a housing (AK)
- Temperature range from -65°C ... max. +200°C
- For mounting direct in the slots of electrical motors/generators
- Adjustable to almost each slot dimension
- IECEx, ATEX and TR approval for use in hazardous areas with protection types:

IECEx: Ex eb IIC, Ex ta IIIC, Ex ia IIC Gb, Ex ia IIIC Gb
ATEX: II 2G Ex e IIC Gb, II 2D Ex ta IIIC Da, II 2G Ex ia IIC Gb, II 2D Ex ia IIIC Db
TR: Ex e II U, Ex tb IIIC Db U, Ex ia IIIC U, Ex ia IIIC Db U

Fig. 10: M-OK/AK with 4-wire connection and flat hose line
Specification
Slot type resistance thermometer, housing M-OK/AK
AK = Housing

Construction
Mounted and sealed Pt-thin-layer measuring resistor in HGW housing with a cover plate. Insulated by PTFE shrinkable tubing and fix connected inlet.

Measuring range
-65°C ... +200°C
Measuring range ATEX
-60°C ... +180°C

Temperature sensor
1 passive Pt-thin film measuring resistor,
active measuring length about 2 mm

Rated resistance
100 Ω / 0°C  |  1000 Ω / 0°C (other rated values upon request)

Mode of connection
2- | 3-*) or 4-*) conductor connection
*) depends on the line cross-section and on the width of the part

Tolerance class
AA  |  A  |  B (other tolerances upon request)

according to EN 60751

Housing
HGW Housing, slight flexible

Material
silicone glass fabric base laminate

Dimensions (min.)
\[ \text{thick}_{(\text{min})} = 2^{ \pm 0.3} \text{ mm\;} \text{width}_{(\text{min})} = 5^{ \pm 0.3} \text{ mm\;} \text{length}_{(\text{min})} = 15^{ \pm 0.5} \text{ mm} \]

Standard dimensions

<table>
<thead>
<tr>
<th>thick [mm]</th>
<th>width [mm]</th>
<th>length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6</td>
<td>63</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>100</td>
</tr>
</tbody>
</table>

Connection line
PTFE-single litz wires  |  PTFE ribbon cable hose line (FSL)

Colour code
red / white, or upon customer’s request

Cable cross-section
AWG20  |  AGW24  |  AWG26  |  AWG28; FSL - depends on type

Cable length
upon customer’s request

Cable ends
bare  |  tinned  |  cable end sleeves

Dielectric strength
max. 3 kV / AC 50 Hz / 1 min.

Special designs
- Ex e / Ex i authorized version
- Dielectric strength up to 5 kV
1.4.2 Slot Resistance Thermometer with Plastic Housing Type (M-OK/KS)

- **Measuring resistor sealed in a plastic housing (KS)**
- **Temperature range from -60°C ... max. +180°C**
- **For direct mounting in the slots of electrical motors / generators**
- **IECEx, ATEX and TR approval for use in hazardous areas with protection types:**

**IECEx:** Ex eb IIC, Ex ta IIIC, Ex ia IIC Gb, Ex ia IIIC Gb  
**ATEX:** II 2G Ex e IIC Gb, II 2D Ex ta IIIC Da, II 2G Ex ia IIC Gb, II 2D Ex ia IIIC Db  
**TR:** Ex e II U, Ex tb IIIC Db U, Ex ia IIC U, Ex ia IIIC Db U

**Fig. 11:** M-OK/KS with PTFE single litz wires

### Specification
- Slot resistance thermometer, plastic housing M-OK/KS
  
  *) KS = plastic housing

### Construction
- Pt-thin-layer measuring resistor, sealed in plastic housing (moulded), with fix connected inlet

### Measuring range
- **-60°C ... +180°C**

### Measuring range ATEX
- **-60°C ... +180°C**

### Temperature sensor
- 1 passive thin-layer measuring resistor, active measuring length about 2 mm

### Resistance material
- Platinum

### Rated resistance
- 100 Ω / 0°C | 1000 Ω / 0°C (other rated values upon request)

### Mode of connection
- 2- | 3- conductor connection

### Tolerance class
- AA | A | B (other tolerances upon request)  
  according to EN 60751

### Housing
- Plastic moulded housing, sealed, stiff

### Dimensions

<table>
<thead>
<tr>
<th>thick [mm]</th>
<th>width [mm]</th>
<th>length [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>65</td>
</tr>
</tbody>
</table>

### Connection line
- PTFE-single litz wires | PTFE-ribbon cable hose line
- Colour code: red / white, or upon customer’s request
- Cable cross-section: AGW24 *) | AWG26 | AWG28
  
  *) not with the 3-wire connection
- Cable length: upon customer’s request
- Cable ends: bare conductor | tinned | cable end sleeve

### Dielectric strength
- max. 2.5 kV / AC 50 Hz / 1 min.
1.4.3 Foil Resistance Thermometer Type (NWT-F)

- *Platinum resistance wire between a Kapton foil*
- Temperature range from -60°C … max. +200°C
- Flexible, very thin construction
- On request also available with a glue layer
- Short response time
- Easy assembly

![Foil Resistance Thermometer Type](image)

**Fig.:12:** Top: NWT-form A  
Middle: NWT-form B  
Below: NWT-F form C

**Construction:**
The Pt100 foil thermometers consist of a wrapped platinum wire between a Kapton foil. For some versions, the foil is also available with a adhesive tape on the back. Wire length and connection type (2-, 3- or 4-wire) are build regarding customer demand.

**Areas of use:**
Foil resistance thermometers are recommended for measurement on small and inaccessible places and on flat or slightly curved surfaces. Furthermore it is also suitable for the measurement on surfaces of pipes (surface thermometer).

**Technical specification Pt100:**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Connection line</th>
<th>Nominal value / tolerance</th>
<th>Insulation</th>
<th>Response time $T_{0.63}$ in H2O</th>
<th>Tmax</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.6 x 7.6 x 0.7 mm$^*$</td>
<td>2x AWG28 600 mm</td>
<td>100 Ω± 0.12 Ω</td>
<td>Kapton</td>
<td>0.15s</td>
<td>200°C</td>
<td>A</td>
</tr>
<tr>
<td>7.6 x 7.6 x 0.7 mm$^*$</td>
<td>4x AWG28 600 mm</td>
<td>100 Ω± 0.12 Ω</td>
<td>Kapton</td>
<td>0.15s</td>
<td>200°C</td>
<td>A</td>
</tr>
<tr>
<td>101 x 9.5 x 1.7 mm</td>
<td>3x AWG26 900 mm</td>
<td>100 Ω± 0.12 Ω</td>
<td>Kapton</td>
<td>0.20s</td>
<td>200°C</td>
<td>B</td>
</tr>
<tr>
<td>50 x 21 x 0.2 mm</td>
<td>Flat line, blank</td>
<td>100 Ω± 0.12 Ω</td>
<td>Kapton</td>
<td>T0.5 &lt; 3s</td>
<td>200°C</td>
<td>C</td>
</tr>
</tbody>
</table>

*) optional with adhesive tape on the backside
1.5 Screws-in Resistance Thermometers

In General
The group of screw-in resistance thermometers includes the various thermometers with fix screw connection or shiftable clamping screw connection. They are deliverable with or without connection head. The group of screw-in thermometers with fix connected inlet includes the relatively small thermometers of the M-OK/SGH series. They are often used in narrow spaces, as well as on front surfaces of machine cases and for control of surface temperatures, e.g. in switchboards. At this construction a basic sensor with fix connected inlet is sealed in screw housing.

The group of the compact screw-in thermometers with connection head includes the thermometers of the type EM24. They are often used for control of the bearing temperature of electric motors and generators and for this they are also deliverable in a certified Ex-version according to IECEx, ATEX and TR (ignition protection system, type Ex i resp. Ex e).

In chemical industry and plant engineering, mainly the large screw-in thermometers with DIN connection head form A or B are used. These are deliverable in various constructions, e.g. with an exchangeable measuring insert or with MI insulated protection tubes and application temperatures up to 600°C.

Dimensions of Screw-in Thermometers with Connection Head

Fig. 13: Relevant dimensions of screw-in thermometers with connection head

Neck tube length (HL)
=> length from the bottom edge of the head to the seal

Installation length / Nominal length (EL/NL)
=> length from the seal to the bottom edge of the protection tube

Total length (GL)
=> length from the bottom edge of the protection tube to the bottom edge of the connection head
1.5.1 Screw-in Resistance Thermometer Type (M-OK/SGH)

- Measuring sensor sealed in a screw-housing
- Temperature range from 40°C ... max. +260°C
- Easy assembly, suitable to screw in housings and surfaces
- Different screws made of messing, aluminium or stainless steel
- Electively with fix supply line or connection plug
- IECEx, ATEX and TR approval for use in hazardous areas with protection types:
  - IECEx: Ex eb IIC, Ex ta IIIC, Ex ia IIC Gb, Ex ia IIIC Gb
  - ATEX: II 2G Ex e IIC Gb, II 2D Ex ta IIIC Da, II 2G Ex ia IIC Gb, II 2D Ex ia IIIC Db
  - TR: Ex e II U, Ex tb IIIC Db U, Ex ia IIIC Db U

Fig. 14: Left: M-OK/SGH type A (without protection tube) screw-in housing made of brass with PTFE-single braid wires
Middle: M-OK/SGH type A (without protection tube) screw-in housing with sealed connection plug
Right: M-OK/SGH type B (with protection tube) stainless steel housing with fix connected hose line.

Specification
Screw-in resistance thermometer, screw housing (M-OK/SGH), model A or B

Construction
Model: (A) measuring resistor sealed in a brass or aluminium housing, with fix connected inlet
Model: (B) measuring resistor sealed in VA – capsule with fix screw connection and connected inlet

Measuring range
-40°C ... +260°C

Measuring range ATEX
-60°C ... +180°C

Temperature sensor
1 passive measuring resistor

Resistance material
Platinum

Rated resistance
1) 100 Ω / 0°C  | 1000 Ω / 0°C (other rated values upon request)

Tolerance class
AA  |  A  |  B (other tolerances upon request)

according to EN 60751

Mode of connection
2:  |  3-*) or 4-*) conductor connection
*) depending on the size of SGH
Screw housing for model (A)

<table>
<thead>
<tr>
<th>material</th>
<th>thread x mounting length</th>
<th>SW x height</th>
</tr>
</thead>
<tbody>
<tr>
<td>brass</td>
<td>M4 x 7.5 mm</td>
<td>SW 7x10 mm</td>
</tr>
<tr>
<td>brass</td>
<td>M4 x 6.0 mm</td>
<td>SW 7x10 mm</td>
</tr>
<tr>
<td>brass</td>
<td>M5 x 7.5 mm</td>
<td>SW 8x10 mm</td>
</tr>
<tr>
<td>brass</td>
<td>M6 x 7.5 mm*</td>
<td>SW 10x10 mm</td>
</tr>
<tr>
<td>brass</td>
<td>M8 x 8.0 mm*</td>
<td>SW 19x24 mm*</td>
</tr>
<tr>
<td>brass</td>
<td>M8 x 7.5 mm*</td>
<td>SW 13x10 mm</td>
</tr>
<tr>
<td>aluminium</td>
<td>M4 x 6.0 mm</td>
<td>SW 8x8 mm</td>
</tr>
<tr>
<td>aluminium</td>
<td>M5 x 6.0 mm</td>
<td>SW 8x12 mm</td>
</tr>
</tbody>
</table>

* sensor in the screw base
**with fix sealed connection sleeve (4-pole) see Fig. 13) Middle

VA-capsules and screw connections for model (B)

<table>
<thead>
<tr>
<th>Ø-VA-capsule [mm]</th>
<th>EL [mm]</th>
<th>VA-VSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 mm</td>
<td>from 20</td>
<td>M10x1</td>
</tr>
<tr>
<td>5 mm</td>
<td></td>
<td>G1/4&quot;</td>
</tr>
<tr>
<td>6 mm (standard)</td>
<td></td>
<td>G1/2&quot;</td>
</tr>
<tr>
<td>8 mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Input

1) PTFE- or spun glass hose line*)

*) hose line depends on the size of the screw housing

2) PTFE – single litz wires

Cable length

upon customer's request

Cable ends

bare | tinned | cable end sleeves

Colour code

red / white, or upon customer’s request

Dielectric strength

\[ R_{\text{iso}} \geq 500 \, \text{V} \geq 200 \, \text{M\Omega} \]

max. 2 kV / AC 50 Hz / 1 min.*

*) not at spun glass line
1.5.2 Screw-in Resistance Thermometer Type (LTH-Y)

- **Screw-in thermometer with connection head form B**
- **Temperature range from -70°C ... max. +600°C**
- **Robust construction for the use in rough industrial environments**
- **Electively with fix or changeable measuring insert**
- **Optional with head transmitter**
- **IECEx, ATEX und TR approval for the use in hazardous areas with protection types:**
  
  **IECEx:** Ex e IIC T6...T3 Gb, Ex ia IIIC T80°C/T95°C/T130°C/T180°C Db  
  Ex ia IIC T6...T3 Gb, Ex ia IIIC T80°C/T95°C/T130°C/T180°C Db  

  **ATEX:** II 2G Ex e IIC T6...T3 Gb, II 2D Ex ia IIIC T80°C/T95°C/T130°C/T180°C Da  
  II2G Ex ia IIC T6...T3 Gb, II 2D Ex ia IIIC T80°C/T95°C/T130°C/T180°C D  

  **TR:** 2 Ex e II T6 ... T3 Gb, Ex tb IIIIC T80°C/T95°C/T130°C/T180°C Db  
  1 Ex ia IIC T6 ... T3 Gb, Ex ia IIIIC T80°C/T95°C/T130°C/T180°C Db

**Fig. 15:** LTH-B with DIN head form B, and exchangeable measuring insert in a 4-wire connection

**Specification**

- Screw-in resistance thermometer with DIN connection head (X) LTH-Y  
- X = E for single-sensor / X = D for double-sensor  
- Y = A for head form A / Y = B for head form B

**Construction**

- VA-protection tube with optional fix mounted measuring resistor or exchangeable measuring insert and DIN connection head form A or B

**Measuring range**

- -70°C ... +600°C

**Measuring range ATEX**

- -60°C ... +180°C

**Temperature sensor**

- 1 or 2 passive measuring resistors fix mounted  
- 1 or 2 passive measuring resistors with exchangeable measuring insert

**Resistance material**

- Platinum

**Rated resistance**

- 100 Ω / 0°C  |  1000 Ω / 0°C (other rated values upon request)

**Tolerance class**

- AA  |  A  |  B (other tolerances upon request)

**Mode of connection**

- 2-  |  3- or 4-conductor connection

**Connection head**

- form A  |  form B

**Material**

- aluminium

**Interior construction**

- ceramic clamp socket, 2 / 3 / 4 / 6 / 8 –pole

**Cable outlet**

- PG16
**Protection tube**
1) with measuring resistor insulated by shrinkable tubing
2) with mineraly insulated measuring resistor
3) with exchangeable measuring insert and fix connected clamp socket

**Material**
VA-steel

**Dimensions**
Ø 9 mm | 11 mm, other Ø upon request, GL from 50 mm

**Neck tube length**
0* | 30 mm | 40 mm other stem lengths upon request
*) only with a fixed screwing neck

**Rated length**
from 20 mm to 1000 mm, longer upon request

**Dielectric strength**
R\(_{\text{iso}}\) 500V ≥ 200 MΩ | max. 2.5 kV / AC 50 Hz / 1 min.

**Assembly**
1) VA-clamp screw connection, fix or shiftable*, with Teflon or steel clamping ring*) only with PTFE-clamping ring
2) VA-screw-in adapter, fix

thread for 1), 2): M10x1 | G1/4" | G3/8" | G1/2" | G3/4" | G1"

**Accessories**
silicone- and Teflon® hose line pre-assembled upon customer’s request
Optional with head transmitter 4-10 V or 4-20 mA
1.5.3 Screw-in Resistance Thermometer Type (LTH-MA)

- **Screw-in thermometer with connection head form MA**
- **Temperature range from -70°C … max. +260°C**
- **Electively with fix or shiftable screw connection**
- **Optional with head transmitter (4-20mА)**
- **IECEx, ATEX und TR approval for the use in hazardous areas with protection types:**

**IECEx:** Ex e IIC T6...T3 Gb, Ex ta IIIC T80°C/T95°C/T130°C/T180°C Db  
Ex ia IIC T6...T3 Gb, Ex ia IIIC T80°C/T95°C/T130°C/T180°C Db  
IE2G Ex ia IIC T6...T3 Gb, II 2D Ex ia IIIC T80°C/T95°C/T130°C/T180°C Da  
II2G Ex ia IIC T6...T3 Gb, II 2D Ex ia IIIC T80°C/T95°C/T130°C/T180°C D

**ATEX:** II 2G Ex e IIC T6...T3 Gb, II 2D Ex ta IIIC T80°C/T95°C/T130°C/T180°C Da  
II2G Ex ia IIC T6...T3 Gb, II 2D Ex ia IIIC T80°C/T95°C/T130°C/T180°C D

**TR:** 2 Ex e II T6 ... T3 Gb, Ex tb IIIC T80°C/T95°C/T130°C/T180°C Db  
1 Ex ia IIC T6 … T3 Gb, Ex ia IIIC T80°C/T95°C/T130°C/T180°C Db

Fig. 16: Screw-in Resistance Thermometer LTH-MA with shiftable screw connection

| Specification | Screw-in resistance thermometer with MA-head (X)LTH-MA  
X = E for single-sensor  
X = D for double-sensor |
| Construction | VA-protection tube with fix mounted measuring resistor and connection head type MA, optionally with or without connection line. Fix or shiftable screw connection optionally available as accessory |
| Measuring range | -70°C … +260°C |
| Measuring range ATEX | -60°C … +180°C |
| Temperature sensor | 1 or 2 passive measuring resistors fix mounted |
| Resistance material | Platinum |
| Rated resistance | 100 Ω / 0°C  | 1000 Ω / 0°C (other rated values upon request) |
| Tolerance class | AA  | A  | B (other tolerances upon request)  
according to EN 60751 |
| Mode of connection | 2-  | 3-*) and 4-*) conductor connection  
*) not with double measuring resistor |
<p>| Connection head | form MA with cover |
| Material | aluminium |
| Interior construction | ceramic clamp socket, 2 /4 -pole |
| Cable outlet | PG9 |
| IP-Protection class | 54 |</p>
<table>
<thead>
<tr>
<th>Protection Tube</th>
<th>with measuring resistor insulated by shrinkable tubing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>VA-steel</td>
</tr>
<tr>
<td>Dimensions</td>
<td>ø 6 mm</td>
</tr>
<tr>
<td>Neck tube length</td>
<td>0</td>
</tr>
<tr>
<td>Rated length</td>
<td>from 20 mm to 1000 mm, longer rated lengths upon request</td>
</tr>
<tr>
<td>Dielectric strength</td>
<td>$R_{(iso)}$ 500V ≥ 200 MΩ</td>
</tr>
<tr>
<td>Assembly</td>
<td>1) VA-clamp screw connection, fix or shiftable clamping ring:</td>
</tr>
<tr>
<td>(optional)</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>2) VA-screw-in adapter fix</td>
</tr>
<tr>
<td></td>
<td>thread for 1),2): M10x1</td>
</tr>
<tr>
<td>Accessories</td>
<td>silicone and PTFE-hose line pre-assembled upon customer's request or already connected</td>
</tr>
</tbody>
</table>
1.5.4 Screw-in Resistance Thermometer Type (LTH-EM24/38)

- **Screw-in thermometer with connection head form EM24/38**
- **Temperature range from -70°C … max. +260°C**
- **Compact connection head, electively with clamping socket or fix sealed supply line**
- **Optional with head transmitter (4-20mA)**
- **IECEx, ATEX and TR approval for use in hazardous areas with protection types:**

  **IECEx:** Ex e IIC T6…T3 Gb, Ex ta IIIC T80°C/T95°C/T130°C/T180°C Db
  Ex ia IIC T6…T3 Gb, Ex ia IIIC T80°C/T95°C/T130°C/T180°C Db

  **ATEX:** II 2G Exe IIC T6…T3 Gb, II 2D Ex ta IIIC T80°C/T95°C/T130°C/T180°C Da
  II2G Ex ia IIC T6…T3 Gb, II 2D Ex ia IIIC T80°C/T95°C/T130°C/T180°C D

  **TR:** 2 Ex e II T6 … T3 Gb, Ex tb IIIC T80°C/T95°C/T130°C/T180°C Db
  1 Ex ia IIC T6 … T3 Gb, Ex ia IIIC T80°C/T95°C/T130°C/T180°C Db

---

**Fig. 17:** Screw-in Thermometer DESWT-EM24, brass bare, VA-protection tube, PG9 cable gland, shiftable VSB. Optionally also with head transmitter (4-20mA)

### Specification

Screw-in resistance thermometer with EM24/38 head

(X)LT-EM24/38

X = E for single-sensor / X = D for double-sensor

24 = connection head EM24 / 38 = connection head EM38

### Construction

Measuring resistor insulated mounted into a VA-protection tube with fix connection head type EM24 or EM38, optionally with or without connection line. Fix or shiftable screw connection optionally available as accessory

### Measuring range

- **-70°C … +260°C**
- **-60°C … +180°C**

### Temperature sensor

1 or 2 passive resistance sensors (thin-layer or wire coiled, M-OK / M-MK / M-GL / M-KK)

### Material

Platinum

### Rated resistance

- **100 Ω / 0°C**
- **1000 Ω / 0°C** (other rated values upon request)

### Tolerance class

- AA
- A
- B (other tolerances upon request)

### Mode of connection

1. 2- / 3- / 4- conductor connection
2. 3- and 4-conductor connection - not with double sensor and EM24 head
**Connection head**
EM24 + cover | EM38 + cover

**Material**
brass bare | brass – nickel-coated

**Dimensions**
EM24: ø24 mm, height approx. 31 mm
EM38: ø38 mm, height approx. 33 mm

**Interior construction**
clamp socket | sealed

**Cable outlet**
PG9*) | PG11*) | PG with additional traction relief | Opel-VSB | sealed
*) upon request with additional traction relief

**Protection tube**
VA, bare | insulated by shrinkable tubing *)
*) max. protection tube temperature is reduced to 120°C at Elastomer

**Dimensions**
ø 6 | 8 mm, total length from 50 mm (other ø upon request)

**Neck tube length**
30 mm | 40 mm

**Rated length**
from 20 mm - 1000 mm, longer rated lengths upon request

**Input**
with or without hose line

**Insulation**
Silicone | PTFE*)
*) only upon explicit customer's request

**Colour code**
red / white, or upon customer’s request

**Cable cross-section**
AWG20 | AWG24

**Cable connection**
fixed (sealed) | clamped | no connection

**Dielectric strength**
$R_{(iso)} 500V \geq 200 \, M\Omega$ | max. 2.5 kV / AC 50 Hz / 1 min.

**Assembly**
1) VA- fitting, fix or shiftable*), clamping ring: PTFE / steel
*) only with PTFE-clamping ring
2) VA-screw-in adapter, fix thread for 1),2): M10x1 | G1/4" | G3/8" | G1/2" | G3/4" | G1"

**On request**
- with head transmitter 4-20mA

**Connector plan**
EM24 head

---

RD = red    BK = black
WH = white  YE = yellow
w = wires
1.6 Bayonet Cap Resistance Thermometer Type LTH-BV

- **Plug-in thermometer with bayonet lock**
- **Temperature range from -70°C ... max. +260°C**
- **Easy and quick assembly / disassembly**
- **Especially suitable for monitoring the bearing temperature of electrical motors**
- **IECEx, ATEX and TR approval for use in hazardous areas with protection types:**
  - **IECEx:** Ex eb IIC, Ex ta IIC, Ex ia IIC Gb, Ex ia IIC Db
  - **ATEX:** II 2G Ex e IIC Gb, II 2D Ex ta IIC Da, II 2G Ex ia IIC Gb, II 2D Ex ia IIC Db
  - **TR:** Ex e II U, Ex tb IIC Db U, Ex ia IIC Db U

![Bayonet Cap Resistance Thermometer in 4-wire connection, front surface of the protection housing is flat closed](image)

**Fig. 18:** Bayonet Cap Resistance Thermometer in 4-wire connection, front surface of the protection housing is flat closed

**Specification**
- Jay-Slot Thermometer (X)LTH-BV
  - X = E for single-sensor
  - X = D for double-sensor
  - BV = jay-slot

**Construction**
- Measuring resistor insulated mounted into a VA-housing with fix connected hose line. Tension spring mounted on adapter with shiftable jay-slot hood for adjustment of the required pre-tension.

**Measuring range**
- -70°C ... +260°C

**Measuring range ATEX**
- -60°C ... +180°C

**Temperature sensor**
- 1 or 2 Pt thin-layer measuring resistors

**Rated resistance**
- 100 Ω / 0°C | 1000 Ω / 0°C

**Tolerance class**
- AA | A | B (other tolerances upon request)

**Mode of connection**
- 2- | 3- and 4-conductor connection
  - 3- and 4-conductor connection - not with double sensor

**Protection capsule**
- VA-capsule, φ6xNL=47/GL=60, beveled,
  - front surface: flat closed | drill angle 118°

**Dimensions**
- φ6xNL=47/GL=60

**Cable outlet**
- fix, capsule beaded

**Assembly**
- jay-slot cover VA 1.4305,φ=14 mm | 12.4, length = 24 mm adjustable upon pressure spring

**Spring length**
- 175 mm | 210 mm | 250 mm
<table>
<thead>
<tr>
<th><strong>Connection line</strong></th>
<th>screened PTFE-hose line</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cover</strong></td>
<td>inside</td>
</tr>
<tr>
<td><strong>Cable length</strong></td>
<td>from 170 mm</td>
</tr>
<tr>
<td><strong>Cross-section</strong></td>
<td>0.23 mm²</td>
</tr>
<tr>
<td><strong>Conductors</strong></td>
<td>bare / tinned / end sleeves</td>
</tr>
<tr>
<td><strong>Colour code</strong></td>
<td>according to EN 60751, or upon customer’s request</td>
</tr>
<tr>
<td><strong>Dielectric strength</strong></td>
<td>$R_{(iso)} \geq 200 \ \text{MΩ} \</td>
</tr>
<tr>
<td><strong>Accessories</strong></td>
<td>screw-in nipples ø12/7 mm, Ms nickel-plated M10x1 SW14 length = 60 mm</td>
</tr>
<tr>
<td></td>
<td>screw-in nipples ø12/7 mm, Ms nickel-plated M10x1 SW14 length = 30 mm</td>
</tr>
</tbody>
</table>
1.7 Sheathed Resistance Thermometer (WT-MI)

- Sheathed resistance thermometer with flexible mineral insulated-line
- Temperature range from -200°C ... max. +800°C
- Mineral insulated line diameter from 1 mm possible
- Water tight (IP68)

Fig. 19: Sheathed resistance thermometer with cable junction capsule and fix connected line

**Specification**

| WT-MI, Sheathed resistance thermometer |
| MI = mineral insulated |
| WT= resistance thermometer |

**Construction**

Measuring resistor, mineral insulated mounted into a VA-capsule, welded with mineral insulated sheathed line and different types of connections.

**Measuring range**

-200°C ... +500°C | +600°C

**Temperature sensor**

1 or 2 Pt-measuring resistors, wire coiled

**Rated resistance**

100 Ω / 0°C | 1000 Ω / 0°C

**Tolerance class**

AA | A | B

according to EN 60751

**Mode of connection**

2- | 3- | 4-conductor connection

**Protection capsule**

VA-capsule

**Dimensions**

from ø = 1 mm in 0.5 mm steps, length from 20 mm

**Sheathed line**

Mineral insulated VA-line

**Dimensions**

ø 1 | 1.5 | 2 | 3 | 4.5 | 6 mm³ | 6 mm³*) length upon customer’s request

*) ø from 3 mm – double measuring resistor

**Connection type**

- Cable junction capsule with fix connected inlet
- Lemos-plug
- connection head form B
- bare connection wires
Connection line: hose line
Case insulation: PVC | Silicone | PTFE
Tmax.= 90°C / 180°C / 260°C
Cable length: upon customer’s request
Cross-section: AWG 20 | 22 | 24 | 26 | 28
Cable ends: bare | tinned | cable end sleeves
Colour code: according to EN 60751, or upon customer’s request

Assembly (optional): shiftable clamp screw connection | fix screw adapter
Thread: M10x1 | G1/4” | G3/8” | G1/2” | G1”
Clamping Ring *: Steel | PTFE

*) only at clamp screw connection
APPENDIX

General guidelines for the cable confectioning
The cable lengths of the single sensors are usually free selectable. Standard all cable ends are stripped and
tin-coated. If required, also cable ends are deliverable with cable end sleeves, with flat or pin contacts, as
well as with Lemosa-plugs / clutches in 2-, 3- or 4-pole version. Upon request, we also mount plugs supplied
by you.

Clamp screw connections
The screw connections listed in the table are optionally deliverable for cable resistance thermometers M-
XX/MH, as well as for all screw-in thermometers without fix screw connection from a diameter of 4 mm.

<table>
<thead>
<tr>
<th>VA-screw connections</th>
<th>G thread</th>
<th>D [mm]</th>
<th>L [mm]</th>
<th>L1 [mm]</th>
<th>SW1 [mm]</th>
<th>SW2 [mm]</th>
<th>claming ring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M10x1</td>
<td>13,8</td>
<td>33</td>
<td>8</td>
<td>14</td>
<td>14</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>G ¼&quot;</td>
<td>18</td>
<td>38</td>
<td>12</td>
<td>19</td>
<td>14</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>G 3/8&quot;</td>
<td>22</td>
<td>40</td>
<td>12</td>
<td>22</td>
<td>14</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>G ½&quot;</td>
<td>26</td>
<td>43</td>
<td>14</td>
<td>27</td>
<td>17</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>G ¾&quot;</td>
<td>32</td>
<td>43</td>
<td>20</td>
<td>32</td>
<td>17</td>
<td>PTFE</td>
</tr>
</tbody>
</table>
Application temperatures of the used materials / insulations

The values listed in the table are normative values. They may vary according to the conditions of use and composition of the material.

<table>
<thead>
<tr>
<th>Material</th>
<th>$T_{\text{min}}$ [°C]</th>
<th>$T_{\text{max}}$ [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC</td>
<td>-40</td>
<td>105</td>
</tr>
<tr>
<td>Polyolefin</td>
<td>-40</td>
<td>135</td>
</tr>
<tr>
<td>Kynar</td>
<td>-40</td>
<td>175</td>
</tr>
<tr>
<td>Silicone</td>
<td>-40</td>
<td>180</td>
</tr>
<tr>
<td>HGW Isoval11</td>
<td>-50</td>
<td>180</td>
</tr>
<tr>
<td>Kynar Flex</td>
<td>-40</td>
<td>195</td>
</tr>
<tr>
<td>FEP</td>
<td>-70</td>
<td>200</td>
</tr>
<tr>
<td>HGW Isoval200</td>
<td>-50</td>
<td>200</td>
</tr>
<tr>
<td>LGLS</td>
<td>-40</td>
<td>230</td>
</tr>
<tr>
<td>PTFE</td>
<td>-200</td>
<td>260</td>
</tr>
<tr>
<td>PFA</td>
<td>-70</td>
<td>260</td>
</tr>
<tr>
<td>Kapton foil</td>
<td>-40</td>
<td>180</td>
</tr>
<tr>
<td>Glass Silk</td>
<td>-60</td>
<td>400</td>
</tr>
<tr>
<td>Mica</td>
<td>-60</td>
<td>600</td>
</tr>
<tr>
<td>VA-Steel</td>
<td>-200</td>
<td>800</td>
</tr>
<tr>
<td>Rude GlassSilk</td>
<td>-40</td>
<td>600</td>
</tr>
<tr>
<td>Al$_2$O$_3$-Ceramics</td>
<td>-70</td>
<td>1000</td>
</tr>
<tr>
<td>Inconel</td>
<td>-200</td>
<td>1100</td>
</tr>
</tbody>
</table>
### Index of abbreviations

<table>
<thead>
<tr>
<th>Letter</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>EFG</td>
<td>single side flat closed</td>
</tr>
<tr>
<td></td>
<td>EL</td>
<td>installation length</td>
</tr>
<tr>
<td></td>
<td>ERG</td>
<td>single side round closed</td>
</tr>
<tr>
<td>F</td>
<td>FSL</td>
<td>ribbon cable hose line</td>
</tr>
<tr>
<td>G</td>
<td>GL</td>
<td>total length</td>
</tr>
<tr>
<td></td>
<td>GS</td>
<td>spun glass</td>
</tr>
<tr>
<td>H</td>
<td>HGW</td>
<td>hard-glass fibre</td>
</tr>
<tr>
<td></td>
<td>HL</td>
<td>neck tube length</td>
</tr>
<tr>
<td>K</td>
<td>KL</td>
<td>cable length</td>
</tr>
<tr>
<td></td>
<td>KÜH</td>
<td>connection sleeve</td>
</tr>
<tr>
<td>M</td>
<td>MI</td>
<td>mineral insulated</td>
</tr>
<tr>
<td></td>
<td>Ms</td>
<td>brass</td>
</tr>
<tr>
<td>N</td>
<td>NL</td>
<td>rated length</td>
</tr>
<tr>
<td></td>
<td>NWT</td>
<td>slot resistance thermometer</td>
</tr>
<tr>
<td>P</td>
<td>Pt</td>
<td>platinum</td>
</tr>
<tr>
<td></td>
<td>PTFE</td>
<td>poly-tetra-fluorine-ethylene</td>
</tr>
<tr>
<td>S</td>
<td>SL</td>
<td>hose line</td>
</tr>
<tr>
<td></td>
<td>Si</td>
<td>silicone</td>
</tr>
<tr>
<td></td>
<td>SGH</td>
<td>screw housing</td>
</tr>
<tr>
<td></td>
<td>SW</td>
<td>spanner size</td>
</tr>
<tr>
<td>V</td>
<td>VSB</td>
<td>screw connection</td>
</tr>
</tbody>
</table>