Resistance thermometers

Tailor-made sensors. Worldwide.
TAILOR-MADE SENSORS

EPHY-MESS SENSORS ADD EFFICIENCY AND SAFETY TO YOUR SYSTEM

Globally and loyalty to location

EPHY-MESS GmbH is a competent solution partner of all manufacturers of electrical machines and drive technology. As a medium-sized family owned company, we consult, develop and produce for our customers individual sensor solutions for safety and control requirements. As a premium manufacturer and distributor of tailor-made industrial measurement and sensor technology, the company has taken a leading position in Germany in its more than 60-year history through premium products and solutions, innovative engineering and continues exploratory urge. Always anchored in the vicinity of Wiesbaden, EPHY-MESS has, since the turn of the millennium, risen to become a global provider which now supplies markets in over 40 countries at an export ratio of 40 percent.
02. HOW TO CONTACT EPHY-MESS

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**Continuous improvement**

EPHY-MESS continuously monitors the workflow and production requirements. Our employees present their ideas on how to optimize processes to the product manager. The implementation improves and accelerates the production of our products while maintaining high quality standards.

**Relevant tests**

Different test criteria are being applied depending on the application. They all include a “relentless” test procedure. Only products that possess all required properties without any fault can pass the EPHY-MESS quality test. The quality-related measurement and test equipment is calibrated regularly and is subject to continuous documented monitoring.

- Temperature tests
- Thermal response times
- High voltage acceptance tests
- Insulation resistance tests
- Partial discharge tests
- Pressure and tensile tests
- Microscopic examinations
- Pressure and tensile tests
- Climate tests
- Leak tests
- Vibration characteristics

**Quality Assurance**

**Routine testing**

Our quality assurance monitors compliance with legal requirements (standards) and technical specifications. At EPHY-MESS such article- and group tests to control e.g. dimension, tension, pressure, tightness, functionality, insulation and dielectric strength at the final inspection section of the quality department.

In addition to the course of its compliance with standards, each sensor has to fulfill an optical inspection as well as in some cases additional mechanical testing. The system-optimized, automated and computer-based processes as well as high quality test and measurement equipment ensure accurate measurements and traceable documentation.
OUR MARKET SECTORS

EPHY-MESS supplies assembled temperature sensors especially for the focused market segments railway technology, renewable energies and the general industrial segment. Following find an overview of the products we offer for your industry.

Each measuring task is carried out under specific operating conditions. Each temperature sensor has a specific mounting situation. EPHY-MESS offers users of any sector and of different industries specific temperature sensors matching the specifications of the application. Customers benefit from continuous availability, individual development and production of optimal matching sensors.

In short: designed and made in Germany
Particularly the sensors in high-speed trains must work with absolute reliability under diverse operational conditions. EPHY-MESS temperature sensors, speed sensors and oil level gauges meet these requirements and have proven themselves in world-renowned international train projects.

Forces created by shocks require that the sensor elements possess a special internal structure to ensure the continuous capture of reliable measuring values. Over the years EPHY-MESS has gained valuable experience and a thorough knowledge of this technologically demanding field.

The modular concept - developed especially for rolling stock - enables quick and cost-effective integration of various sensors in a sensor system. Distance temperature sensors, speed sensors can also be integrated in the EPHY-MESS sensor concept. Single modules can be mounted to one completely assembled multi-arm harness.

In addition to high-speed trains, underground and suburban trains as well as buses and hybrid vehicles will also be equipped with EPHY-MESS sensors.
QUALITY AND PRECISION

PRODUCTS AND POINTS OF INSTALLATION

Slot Bearing Coil head Wheel-set
Brake Gear Pitch / Azimuth drive Control cabinet

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Resistance thermometers

Since 1871 platinum resistance thermometers have been used for industrial temperature measurement. Due to its chemical resistance and homogeneity, platinum has been established as basic material for industrial temperature measurement besides copper, nickel and silicon. The material guarantees long-term stability, high measuring accuracy and reproducible electrical properties and measured values.

Platinum sensors also show a positive temperature coefficient (PTC). This means that the resistance of the sensor increases with increasing temperature. This correlation is linear within a broad temperature range.

The characteristics of platinum resistance thermometers and temperature sensors are specified in DIN EN 60751. This standard includes, e.g., specifications for the electrical resistance as a function of the temperature (basic evaluation table), permissible limit deviations (tolerance classes), characteristic curve and operating temperature range.

Platinum measuring elements

According to DIN EN 60751, the nominal value is 100 Ω at a nominal temperature of 0°C. We therefore speak of Pt100 temperature sensors. In addition, there are temperature sensors with different nominal values such as, for example, 200 Ω, 500 Ω or 1000 Ω. The higher the nominal resistance, the greater the changes in resistance due to temperature changes.

The sensors are divided into tolerance classes AA, A, B and C. The following table provides an overview of the maximum permissible deviations.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Rated value [Ω]</th>
<th>Tolerance [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Ω]</td>
<td>100 Ω / 0°C</td>
<td>± 0.04 Ω/0°C</td>
</tr>
<tr>
<td></td>
<td>200 Ω / 0°C</td>
<td>± 0.06 Ω/0°C</td>
</tr>
<tr>
<td></td>
<td>500 Ω / 0°C</td>
<td>± 0.12 Ω/0°C</td>
</tr>
<tr>
<td></td>
<td>1000 Ω / 0°C</td>
<td>± 0.24 Ω/0°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class</th>
<th>Tolerance [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>± 0.10°C</td>
</tr>
<tr>
<td>A</td>
<td>± 0.15°C</td>
</tr>
<tr>
<td>B</td>
<td>± 0.30°C</td>
</tr>
<tr>
<td>C</td>
<td>± 0.60°C</td>
</tr>
</tbody>
</table>
The following values and equations apply

The standard DIN EN 60751 defines two temperature ranges for platinum resistors and defines them by means of different polynomials. The first temperature range (-200°C to 0°C) is defined by

\[ R(t) = R(0) \times (1 + A \times t + B \times t^2 + C \times (t - 100°C) \times t^3) \]

The second temperature range (0°C to 850°C) by

\[ R(t) = R(0) \times (1 + A \times t + B \times t^2) \]

The coefficients are

\[ A = 3,9083 \times 10^{-3} °C^{-1} \]
\[ B = -5,775 \times 10^{-7} °C^{-2} \]
\[ C = -4,183 \times 10^{-12} °C^{-4} \]

The permissible limit deviation for Pt 100° thermometers are defined by DIN EN 60751. Deviations from this color code are possible on customer request.

\[ R_0 \times R(t) = (A + B + C \times (0°C - 850°C) \times t^3) \]

Limit deviation for Pt 100° thermometers

<table>
<thead>
<tr>
<th>Temperature °C</th>
<th>Class AA</th>
<th>Class A</th>
<th>Class B</th>
</tr>
</thead>
<tbody>
<tr>
<td>-200</td>
<td>±0.05</td>
<td>±0.08</td>
<td>±0.15</td>
</tr>
<tr>
<td>-100</td>
<td>±0.10</td>
<td>±0.15</td>
<td>±0.15</td>
</tr>
<tr>
<td>0</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>100</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>200</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>300</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>400</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>500</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>600</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>700</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>800</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>900</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
<tr>
<td>1000</td>
<td>±0.35</td>
<td>±0.40</td>
<td>±0.40</td>
</tr>
</tbody>
</table>

Legend

- \( R_0 \) [Ω] = resistance at nominal value of 0°C
- \( R(t) \) [Ω] = resistance at temperature t
- |t| [°C] = absolute value of the temperature

Characteristic curve Pt100

Limit deviation for Pt100 according to DIN EN 60751
10. VERSIONS OF PLATINUM MEASURING RESISTORS

Wire-wound platinum temperature sensors as well as platinum chip sensors manufactured in thin-film technology are installed as temperature-sensitive detectors inside the resistance thermometers.

In the following five common basic measuring resistors available from EPHY-MESS are being described. These platinum measuring resistors are assembled in various thermometer designs to meet different application requirements.

### Measuring resistor M-MK

**construction**
- Platinum layer applied by means of thin-film technology onto ceramic substrate, filled with contact wires and covered with a protective layer, rectangular shape

**measuring range**
- $-70°C \ldots +950°C$

**contact wires**
- Pt clad Ni-wire, length approx. 10 mm - 25 mm

**dimensions**
- From about 1.0 x 1.25 x 1.6 (thickness x width x length in mm)

**response time**
- From about 7 s, depending on dimensions and air stream ($v = 2\, \text{m/s}$): $t_{0.9} = 7.5\, \text{s} - 10.0\, \text{s}$

### Measuring resistor M-MG

**construction**
- Platinum thin-film resistor fitted in a glass housing with contact wires, cylindrical shape, round sensor tip

**measuring range**
- $-50°C \ldots +400°C$  │  $+500°C$

**contact wires**
- Pt clad Ni-wire, length approx. 10 mm - 20 mm

**dimensions**
- From about 1.6 mm, length depending on diameter

**response time**
- From about 10 s, according to dimensions and air stream ($v = 1\, \text{m/s}$): $t_{0.9} = 10.0\, \text{s}$

### Measuring resistor M-OK

**construction**
- Platinum layer applied by means of thin-film technology onto ceramic substrate, fitted with contact wires and covered with a protective layer; rectangular shape

**measuring range**
- $-70°C \ldots +500°C$

**contact wires**
- Pt clad Ni-wire, length approx. 10 mm - 15 mm

**dimensions**
- From about 1.0 x 1.25 x 1.6 (thickness x width x length in mm)

**response time**
- From about 7 s, according to dimensions and air stream ($v = 2\, \text{m/s}$): $t_{0.9} = 7.5\, \text{s} - 10.0\, \text{s}$

### Measuring resistor M-MK

**construction**
- Platinum thin-film resistor sealed in a ceramic housing, cylindrical shape, flat sensor tip

**measuring range**
- $-50°C \ldots +400°C$

**contact wires**
- Pt clad Ni-wire, length approx. 10 mm - 20 mm

**dimensions**
- From about 2 mm, length depending on diameter

**response time**
- From about 20 s, depending on the dimensions and construction and air stream ($v = 2\, \text{m/s}$): $t_{0.9} = 20.0\, \text{s}$

### Measuring resistor M-MG

**construction**
- Platinum thin-film resistor fitted in a glass housing with contact wires, cylindrical shape, round sensor tip

**measuring range**
- $-50°C \ldots +400°C$  │  $+500°C$

**contact wires**
- Pt clad Ni-wire, length approx. 10 mm - 15 mm

**dimensions**
- From about 1.6 mm, length depending on diameter

**response time**
- From about 10 s, according to dimensions and air stream ($v = 1\, \text{m/s}$): $t_{0.9} = 10.0\, \text{s}$

Basic measuring resistors

<table>
<thead>
<tr>
<th>Resistance thermometers</th>
<th>EPHY-MESS GmbH</th>
<th>Resistance thermometers</th>
<th>EPHY-MESS GmbH</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td></td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>
Measuring resistor M-KK

construction
Platinum wire wound around a spindle, insulated with ceramics; cylindrical shape, round sensor tip

measuring range
-200°C ... +600°C │ +800°C

contact wires
Pt clad Ni-foil, length approx. 20 mm - 20 mm

dimensions
ø from about 0.8 mm, length depending on diameter

response time
from about 12 s, according to dimensions

air stream (v = 2 m/s) \( \tau_{0.9} = 12.0 \) s

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Measuring resistor M-GL

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

measuring range
-200°C ... +400°C

contact wires
Pt clad Ni-foil, length approx. 10 mm - 15 mm

dimensions
ø from about 1.3 mm, length depending on diameter

response time
from about 23 s, according to dimensions

air stream (v = 2 m/s) \( \tau_{0.9} = 23.0 \) s
In general

Depending on the design, a distinction is made between slot resistance thermometers (NWT) with bifilar winding (carrier body with applied platinum wire winding) and chip slot resistance thermometers (with built-in thin-film measuring resistor). Depending on the application, the versions are designed as rigid, flexible or as highly flexible slot resistance thermometers.

Usually, the sensor designs are relatively tolerant to mechanical loads and deformation. The thermometers are resistant to vacuum impregnation and are insulated to high voltages. Therefore it is possible to integrate the thermometers in the assembly of the machines during the production process. By using additional insulating materials, the dielectric strength can be further increased. Finally, the motor winding is impregnated together with the integrated slot resistance thermometer.

All sensor dimensions can generally be customized. This ensures a perfect match with the slot sizes. The direct integration and installation of thermometers into the slots allows continuous temperature control and therefore the use of motors at optimized operating conditions close to the limit. The temperature control increases the optimal power efficiency.

All thermometers can be ordered in 3- or 4-wire circuit to avoid measurement errors due to long cables. The additional wires enable compensation of the cable resistances and increase the accuracy of the measurement. To fulfill measuring redundancy, two independent thermometer wirings can be used. Certified configurations are available for use in hazardous areas.

11. SLOT RESISTANCE THERMOMETERS NWT

To ensure safe operation and a long service life, electrical machines must be protected against permanent thermal overload. Protective systems based on thermometers, such as slot resistance thermometers and the corresponding actuating devices, are used for this purpose.

Slot resistance thermometers (NWT) are installed in the winding slots of electric motors and generators. Special versions can also be used on planar and curved surfaces due to their flexibility and shape.

Slot resistance thermometers

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Slot resistance thermometers with bifilar measuring winding allow the determination of temperature over the entire active length of the measuring winding. Optimum measurement results are obtained by adapting the dimensions to the respective slot design of electric motors or generators. The low heat capacity guarantees an almost instantaneous thermal coupling. For technical reasons, the platinum wire itself is wound with glass fibre twice.

Customized configurations

The different versions of bifilar wound slot resistance thermometers support particularly the special requirements of high-voltage machines. The wide range of possible thermometer sizes allows the adaptation to almost any engine size. The measuring winding is fed with the lowest possible measuring current. The bifilar winding prevents the occurrence of induced voltages, which could lead otherwise to measurement errors. The thermometers are usually designed as Pt100.

Slot resistance thermometers with bifilar measuring winding made of platinum wire (alternatively Ni or Cu wire) allow the temperature detection over the complete length of the detector whereas slot resistance thermometers with chip sensors determine the temperature locally at the point of their installation in the slot. As a result, the temperature within the slot is monitored as a whole. The thermometers can be designed as single (1x Pt100) or double slot thermometers (2x Pt100).

Versions of bifilar wound NWT’s

NWT-4H
flexible slot resistance thermometer made of hard glass fibre

NWT-ST
rigid slot resistance thermometers with mica insulation made of Phlogopit

NWT-ST / ZS
rigid slot resistance thermometer stabilized by glass fibre

NWT-A
shielded, rigid slot resistance thermometers (with Cu-braid)

NWT-DSH / A
shielded, flexible slot resistance thermometer with shrinking tube insulation (with Cu-braid)

NWT-FLEX
highly flexible slot resistance thermometer (without carrier body)

NWT-F
extremely thin foil resistance thermometer (without bifilar winding)

The respective technical specifications and special features are described in detail in the following sections.
**Features**

- Flexible slot allows adaptation to slot unevenness
- Bending radius > 100 mm
- As single or double PTMEG version available
- Patented strain relieved between sensor and supply line
- Pressure released measuring winding
- Vacuum impregnation resistant

**General technical data**

- **measuring range:** -60°C ... +200°C // Ex: +180°C
- **mode of connection:** 2-, 3-, 4- wire circuit
- **tolerance class:** AA, A, B (acc. DIN EN 60751)
- **sensor insulation:** silicon or epoxy hard glass fibre, single Teflon® (PTFE / FEP) shrinking tube (ESH), double shrinking tube (DSH)
- **dielectric strength:** 0.5 kV to 3.2 kV / AC 50 Hz / 1 min. (ESH)
  0.5 kV to 5 kV / AC 50 Hz / 1 min. (DSH)
- **material:** PTFE / FEP or airtight connection line
- **cross section:** AWG24 to AWG20
- **dimensions:**
  - thickness: from 2 mm ± 0.3 mm
  - width: from 7 mm ± 0.5 mm
  - length: from 80 mm ± 5 mm

**Certificates**

- Features:
  - Flexible design allows adaptation to slot unevenness
  - Bending radius > 100 mm
  - As single or double PTMEG version available
  - Patented strain relieved between sensor and supply line
  - Pressure released measuring winding
  - Vacuum impregnation resistant

**Features**

- Good dielectric strength through mica insulation
- Construction height starting with 1 mm thickness
- Single and double versions available
- Optionally with platinum, copper or nickel mica insulation
- Vacuum impregnation resistant

**General technical data**

- **measuring range:** -60°C ... +200°C // Ex: +180°C
- **mode of connection:** 2-, 3-, 4- wire circuit
- **tolerance class:** A, B, C (acc. DIN EN 60751)
- **sensor insulation:** single Pt100 or copper or nickel mica
- **dielectric strength:** 0.5 kV to 2.5 kV / AC 50 Hz / 1 min.

**Certificates**

- Features:
  - Good dielectric strength through mica insulation
  - Construction height starting with 1 mm thickness
  - Single and double versions available
  - Optionally with platinum, copper or nickel mica insulation
  - Vacuum impregnation resistant

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- **measuring range:** -60°C ... +200°C // Ex: +180°C
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- **tolerance class:** A, B, C (acc. DIN EN 60751)
- **sensor insulation:** single Pt100 or copper or nickel mica
- **dielectric strength:** 0.5 kV to 2.5 kV / AC 50 Hz / 1 min.
**NWT - ST/ZS**

Rigid slot resistance thermometer stabilized by glass fibre. For this sensor a platinum wire is bifilar wound around a hard glass fibre carrier body to form a measuring winding. The special strain relieved metal connection line is available in 2-, 3- or 4-wire circuit. The inner carrier body is insulated by several layers of mica paper.

The intrinsically thermistor is laminated with woven glass fibre which is inserted in resin to increase the mechanical stability. This design provides greater rigidity to the carrier body. Therefore the sensor can be inserted into the slot without damage – even at increased pressure.

**General technical data**
- **measuring range**: -60°C ... +200°C // Ex: +180°C
- **mode of connection**: 2-, 3-, 4-wire circuit
- **tolerance class**: B (acc. DIN EN 60751)
- **sensor insulation**: mica, glass fibre
- **dielectric strength**: 0.5 kV to 3 kV / AC 50 Hz / 1 min.

**Supply line**
- E1: single litzes
- Sx: hose line with single litzes
- Fn: stranded litzes
- Gx: stranded hose line
- FSx: flat hose line
- VL: stranded line

**Material**
- PTFE / FEP
- Cross section: AWG20

**Dimensions**
- Thickness: from 2.3 mm ± 0.3 mm
- Width: from 8 mm ± 0.3 mm
- Length: from 100 mm ± 5 mm

**Certificates**

**Features**
- Rigid, mechanically extremely robust design
- Suitable for “hammering” the thermometer into the slot
- Wedge design available
- Particularly suitable for subsequent mounting
- Single and double thermometers available

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**NWT - A**

Shielded slot resistance thermometers. A platinum wire is bifilar wound around a hard glass fibre carrier body. The connection lines are attached in strain relieved manner in a 2-, 3- or 4-wire circuit. The carrier body is insulated by mica paper. A copper plate protects the inner body and is again insulated by mica paper towards the outside. The shielding of the connection line as well as the ground wires are fixed on the copper plate.

The ground shielding of the connecting wire is strong enough to withstand currents of up to 50 A in case of system malfunction. Thus the motor protection gains time to shut down safely. The slot thermometer NWT-A with the certification “intrinsically safe” (Ex i), warrants a potential-free installation. In this case, the grounding wire serves as an earthing. If the high current capacity is not needed the cross section of the wires can be reduced accordingly.

**General technical data**
- **measuring range**: -60°C ... +200°C // Ex: +180°C
- **mode of connection**: 2-, 3-, 4-wire circuit
- **tolerance class**: A, B (acc. DIN EN 60751)
- **sensor insulation**: phlogopit mica
- **shielding**: sensor: copper braid, wire: silver-plated copper braid
- **max. current intensity**: 50 A
- **dielectric strength**: 0.5 kV to 2.5 kV / AC 50 Hz / 1 min.

**Supply line**
- E1: single litzes
- Sx: hose line with single litzes
- Gx: screened hose line with single litzes
- Vx: stranded line

**Material**
- PTFE / FEP connection line
- Cross section: AWG20 to AWG20

**Ground wire**
- a) standard ground wire on the same side as connection line
- b) special ground wire on the opposite side of connection line

**Dimensions**
- Thickness: from 2.5 mm ± 0.3 mm
- Width: from 8 mm ± 0.5 mm
- Length: from 150 mm ± 3 mm

**Certificates**

**Features**
- Completely shielded design (sensor and cable)
- Content carrying capacity of the shield up to 50A
- With ground line
- Copper braid shielding
- Vacuum impregnation resistant
Slot resistance thermometer with shielding braid and slotting tube insulation. For NWT-DSH/A an insulated platinum wire is wound around a carrier body in a bifilar manner. The carrier body is insulated and seated in a relatively flexible carrier housing made of hard glass fibre. This entire device is protected by a tinned copper braid which is connected to the shielding of the connection line as well as to the ground line. Subsequently, the thermometer is insulated by two layers of shrinking tube for increased dielectric strength. The strain-relieved insulated connection line in 2-, 3- or 4-wire circuit and fixed connected to the measuring winding.

Features
- flexible design, allows adaption to slot unevenness
- patented strain relief between sensor and cable
- pressure-compensated measuring winding

General technical data
- measuring range: -60°C ... +180°C // Ex: +180°C
- mode of connection: 2-, 3-, 4- wire circuit
- tolerance class: A, B (acc. DIN EN 60751)
- sensor insulation: Teflon® shrinking tube (PTFE / FEP)
- shielding: silver-plated copper braid
- max. current intensity: 6 A
- dielectric strength: 0.5 kV to 3 kV / AC 50 Hz / 1 min.

Supply line
- D1: shielded single litz wires, fixed connected, copper silver plated (PTFE)
- Six screened hose line with a single litz wires
- hose line with a single litz wires

Material
- sensor insulation: Teflon® shrinking tube (PTFE / FEP)
- Kynar® shrinking tube (PVDF)
- dielectric strength: 0.5 kV to 1.5 kV / AC 50 Hz / 1 min.
- material: PTFE / FEP connection line
- cross section: AWG22 to AWG20
- material: PTFE / FEP connection line
- cross section: AWG22 to AWG20
- dimensions: thickness from 2.7 mm ± 0.5 mm, width from 9 mm ± 0.5 mm, length from 150 mm ± 2 mm

Features
- highly flexible design, extremely adjustable to slot unevenness
- very thin insulation height from approx. 1.2 mm thickness available
- simple, optimized cost structure
- must be installed with absolutely no tensile and pressure loading

Certification

Slot resistance thermometer EPHY-MESS GmbH

NWT-DSH/A

Slot resistance thermometer with shielding braid and slotting tube insulation. For NWT-DSH/A an insulated platinum wire is wound around a carrier body in a bifilar manner. The carrier body is insulated and seated in a relatively flexible carrier housing made of hard glass fibre. This entire device is protected by a tinned copper braid which is connected to the shielding of the connection line as well as to the ground line. Subsequently, the thermometer is insulated by two layers of shrinking tube for increased dielectric strength. The strain-relieved insulated connection line in 2-, 3- or 4-wire circuit and fixed connected to the measuring winding.

Features
- flexible design, allows adaption to slot unevenness
- patented strain relief between sensor and cable
- pressure-compensated measuring winding

General technical data
- measuring range: -60°C ... +180°C // Ex: +180°C
- mode of connection: 2-, 3-, 4- wire circuit
- tolerance class: A, B (acc. DIN EN 60751)
- sensor insulation: Teflon® shrinking tube (PTFE / FEP)
- shielding: silver-plated copper braid
- max. current intensity: 6 A
- dielectric strength: 0.5 kV to 3 kV / AC 50 Hz / 1 min.

Supply line
- D1: shielded single litz wires, fixed connected, copper silver plated (PTFE)
- Six screened hose line with a single litz wires
- hose line with a single litz wires

Material
- sensor insulation: Teflon® shrinking tube (PTFE / FEP)
- Kynar® shrinking tube (PVDF)
- dielectric strength: 0.5 kV to 1.5 kV / AC 50 Hz / 1 min.
- material: PTFE / FEP connection line
- cross section: AWG22 to AWG20
- dimensions: thickness from 2.7 mm ± 0.5 mm, width from 9 mm ± 0.5 mm, length from 150 mm ± 2 mm

Features
- highly flexible design, extremely adjustable to slot unevenness
- very thin insulation height from approx. 1.2 mm thickness available
- simple, optimized cost structure
- must be installed with absolutely no tensile and pressure loading

Certification

Slot resistance thermometer EPHY-MESS GmbH

NWT-FLEX

Highly flexible slot resistance thermometer. In a slot resistance thermometer of the type NWT-FLEX an insulated platinum wire is applied on a very thin, flexible silicone hard glass fibre carrier body to a bifilar measuring winding and insulated with PTFE (FEP) slotting tube (no intake body). The connection line is available in 2-, 3- or 4-wire circuit, connected to the measuring winding (no strain relief). A pressure-relieved installation is mandatory required.

General technical data
- measuring range: -60°C ... +180°C // Ex: +180°C
- mode of connection: 2-, 3-, 4- wire circuit
- tolerance class: B (acc. DIN EN 60751)
- sensor insulation: Teflon® shrinking tube (PTFE / FEP)
- shielding: silver-plated copper braid
- max. current intensity: 6 A
- dielectric strength: 0.5 kV to 3 kV / AC 50 Hz / 1 min.

Supply line
- E1: single litz wires
- Six hose line with a single litz wires
- Six screened hose line with x single litz wires

Material
- material: PTFE / FEP connection line
- cross section: AWG22 to AWG20
- dimensions: thickness from 2.7 mm ± 0.5 mm, width from 9 mm ± 0.5 mm, length from 150 mm ± 2 mm

Features
- highly flexible design, extremely adjustable to slot unevenness
- very thin insulation height from approx. 1.2 mm thickness available
- simple, optimized cost structure
- must be installed with absolutely no tensile and pressure loading

Certification

Slot resistance thermometer EPHY-MESS GmbH
Foil resistance thermometers. The Pt100 foil thermometers consist of a platinum wire applied on a very thin, flexible polyimide carrier body between a Kapton® foil (no carrier housing). For some versions, the foil is also available with a adhesive tape on the back. We deliver these sensors without adhesive film as standard.

**Features**
- Flexible, very thin construction
- Very short response time
- Easy assembly also single-sided adhesive
- For small and inaccessible places
- For slightly curved surfaces
- Various cable versions can be soldered to the single litzes for extension

**General technical data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>-200°C ... +200°C // -20°C ... +177°C</td>
</tr>
<tr>
<td>Mode of connection</td>
<td>2-, 3-, 4-wire circuit</td>
</tr>
<tr>
<td>Sensor insulation</td>
<td>Kapton® foil</td>
</tr>
<tr>
<td>Insulation resistance R$_0$</td>
<td>&gt; 10 MD / 500 V DC</td>
</tr>
<tr>
<td>Supply line</td>
<td>E1 single litzes</td>
</tr>
<tr>
<td>Hose line with n single litzes</td>
<td>Gx screened hose line with n single litzes</td>
</tr>
<tr>
<td>Material</td>
<td>PTFE / FEP connection line</td>
</tr>
</tbody>
</table>

**Technical data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions A</td>
<td>thickness: 0.7 mm / 0.8 mm (with adhesive)</td>
</tr>
<tr>
<td></td>
<td>width: 8 mm ± 0.8 mm</td>
</tr>
<tr>
<td></td>
<td>length: 8 mm ± 0.8 mm</td>
</tr>
<tr>
<td>Dimensions B</td>
<td>thickness: 2 mm ± 0.5 mm</td>
</tr>
<tr>
<td></td>
<td>width: 10 mm ± 0.8 mm</td>
</tr>
<tr>
<td></td>
<td>length: 102 mm ± 0.8 mm</td>
</tr>
</tbody>
</table>

**Features**
- Flexible, very thin construction
- Very short response time
- Easy assembly also single-sided adhesive
- For small and inaccessible places
- For slightly curved surfaces
- Various cable versions can be soldered to the single litzes for extension

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</tr>
<tr>
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<td>thickness: 2 mm ± 0.5 mm</td>
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</tr>
<tr>
<td></td>
<td>length: 102 mm ± 0.8 mm</td>
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<tr>
<td></td>
<td>length: 102 mm ± 0.8 mm</td>
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13. SLOT RESISTANCE THERMOMETERS NWT CHIP

In chip slot resistance thermometers a platinum thin-film resistor is used instead of a bifilar wound platinum wire. The temperature-sensitive length is shortened to the length of the thin-film sensor itself (point measurement).

Customized configurations

Chip slot resistance thermometers (Chip-NWT) offered by EPHY-MESS are used in the slot of the stator winding of electric machines. Besides bifilar wound resistance thermometers, chip slot resistance thermometers have become an alternative to measure the temperature of constructively known hotspots (point measurement).

In this product, a platinum thin-film measuring resistor type M-OK is used instead of a bifilar wound platinum wire. Normally Pt100 and Pt1000 chip measuring resistors are used. For most measurement applications this is completely sufficient, because requirements mostly refer to the design (slot) and not to the active measuring length. Their low net weight and small dimensions allow very fast response times. In addition, high nominal values can also be achieved concurrent with the smallest dimensions. Alternatively, thermocouples, PTC or NTC thermistors as well as KTY silicon sensors can be used as measuring elements.

Almost every thermometer version (except NTC) is also deliverable in certified versions according to IECEx and ATEX or according to TR-, UL/CSA regulations. Generally these thermometers can be also used for all measurements on surfaces or in measuring locations difficult to access.

Versions of Chip-NWTs

M-OK / AK
Flexible chip-type NWT contained in silicone carrier housing

M-OK / ZS
Rigid, extremely solid chip-type NWT cast into an epoxy intermediate slider case

M-OK / KS
Flexible, extremely thin chip-type NWT in moulded PESU housing

Multispot thermometer with multiple chip measuring resistors

The respective technical specifications and special features are described in detail in the following sections.

Resistance thermometers

EPHY-MESS GmbH

Slot resistance thermometers

EPHY-MESS GmbH 34

Resistance thermometers

EPHY-MESS GmbH 35
Flexible chip slot resistance thermometer in carrier housing. For this temperature sensor type M-OK/A a platinum thin-film resistor is directly connected to the supply line and is mounted pressure-compensated in a carrier housing made of silicon hard glass fibres. Covered with a small plate and sealed with cold curing silicone the sensor can be insulated with a PTFE shrinking tube and Kaptontm foil.

### General technical data

- **measuring range:** -60°C … +180°C // Ex: +180°C
- **mode of connection:** 2-, 3-, 4- wire circuit
- **tolerance class:** AA, A, B (acc. DIN EN 60751)
- **sensor insulation:** silicone hard glass fibre carrier body, Teflon® shrinking tube (PTFE / FEP), Kynar® shrinking tube (PVDF), Kapton® foil
dielectric strength: 0.5 kV to 5 kV / AC 50 Hz / 1 min.

### Features

- adjustable to almost each slot dimension
- bending radius > 100 mm at a length starting from 150 mm
- resistant to loads such as shock, vibration and pressure
- resistant against standard impregnating, curing or drying processes

### Certificates

- adjustable to almost each slot dimension
- bending radius > 100 mm at a length starting from 150 mm
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### Certificate

- adjustable to almost each slot dimension
- bending radius > 100 mm at a length starting from 150 mm
- resistant to loads such as shock, vibration and pressure
- resistant against standard impregnating, curing or drying processes

Chip slot resistance thermometer with intermediate-older case. This temperature sensor type M-OK/ZS consists of a platinum thin-film resistor with a permanently connected supply line. Using clamp arches the cable is strain relieved and subsequently sealed with a thermosetting casting compound in an epoxy intermediate-older case. In addition, the sensor can be insulated with PTFE shrinking tube and Kaptontm foil.

### General technical data

- **measuring range:** -60°C … +250°C // Ex: +180°C
- **mode of connection:** 2-, 3-, 4- wire circuit
- **tolerance class:** AA, A, B (acc. DIN EN 60751)
- **sensor insulation:** hard glass fibre, optional with Kynar® shrinking tube (PVDF), Kapton® foil
dielectric strength: 0.5 kV to 3 kV / AC 50 Hz / 1 min.

### Features

- very robust version
- resistant to mechanical loads
- resistant to loads such as shock, pressure and vibration
- particularly suitable for subsequent mounting

### Certificate

- very robust version
- resistant to mechanical loads
- resistant to loads such as shock, pressure and vibration
- particularly suitable for subsequent mounting
**M O K I S**

Slotted resistance thermometer in PESU carrier housing. For this temperature sensor type M-OK/KS, a platinum thin-film resistor is directly connected to the supply line and is stress-compensated in a PESU carrier housing. Covered with a small plate and sealed with thermosetting two-component adhesive the sensor has a dielectric strength of 3 kV without an additional insulation.

## General technical data

- **measuring range**: -60°C ... +180°C // Ex: +180°C
- **mode of connection**: 4-wire circuit
- **tolerance class**: AA, A, B (acc. DIN EN 60751)
- **sensor insulation**: silicone hard glass fibre
- **dielectric strength**: 0.5 kV to 3 kV / AC 50 Hz / 1 min.
- **supply line**: E1 - single litzes
- **cross section**: AWG30 to AWG24
- **dimensions**:
  - **version A**
    - thickness: 2 mm ± 0.2 mm
    - width: 8 mm ± 0.2 mm
    - length: 65 mm ± 1 mm
  - **version B**
    - thickness: 2 mm ± 0.2 mm
    - width: 6 mm ± 0.2 mm
    - length: 100 mm ± 1 mm

**Material**: PTFE / FEP or peek connection line

**Cross section**: AWG23 to AWG24

**Certifications**

- **Features**
  - cost-effective versions
  - for mounting directly in the slots of electrical motors and generators
  - high insulation properties
  - fast thermal response time

### Features

- **4x Pt-chip sensors installed**
- **active measuring length is nearly equal to installation length**
- **housing from 2 mm thickness and 7 mm width**
- **two standard versions available, with sensor lengths of 100 mm and 1000 mm**
- **optional with shielding**

**M U L T I S P O T**

The Multispot sensor is a combination of bifilar sensor technology and thin-film construction. In the Multispot-NWPT several thin-films chip resistors are applied at equal distances on a carrier body. The measured resistances are interconnected in a manner that one single Pt100 signal is created. The carrier housing has a very good thermal conductivity. Temperatures in sectors between the resistors are well registered and thus an almost integral measuring behaviour is achieved.

## General technical data

- **measuring range**: -50°C ... +200°C
- **mode of connection**: 2-, 4-wire circuit
- **tolerance class**: AA, A, B (acc. DIN EN 60751)
- **sensor insulation**: silicone hard glass fibre
- **dielectric strength**: 0.5 kV to 3 kV / AC 50 Hz / 1 min.
- **supply line**: E1 - single litzes
- **cross section**: AWG30 to AWG24
- **dimensions**:
  - **version A**
    - thickness: 2 mm ± 0.6 mm
    - width: 7 mm ± 0.3 mm
    - length: 100 mm ± 2 mm
  - **version B**
    - thickness: 2 mm ± 0.6 mm
    - width: 10 mm ± 0.3 mm
    - length: 500 mm ± 2 mm

**Material**: PTFE / FEP connection line

**Cross section**: AWG23 to AWG24

**Dimensions**:

- **version A**
  - thickness: 2 mm ± 0.6 mm
  - width: 7 mm ± 0.3 mm
  - length: 100 mm ± 2 mm
- **version B**
  - thickness: 2 mm ± 0.6 mm
  - width: 10 mm ± 0.3 mm
  - length: 500 mm ± 2 mm

**Features**

- **Features**
  - cost-effective versions
  - for mounting directly in the slots of electrical motors and generators
  - high insulation properties
  - fast thermal response time

### Features

- **Features**
  - cost-effective versions
  - for mounting directly in the slots of electrical motors and generators
  - high insulation properties
  - fast thermal response time

**Certificates**

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**Revi. 20170706**

**EPHY-MESS GmbH** Resistance thermometers
In general

As standard Pt100 measuring resistors according to DIN EN 60751 are used. Versions with Pt500 or Pt1000 resistors are also commonly applied. Transmitters can also be integrated in the connection head. Thermocouples, PTC or NTC thermistors as well as KTY silicon sensors can also be used as measuring elements.

Application areas include temperature monitoring of bearings, temperature measurement in containers and pipelines, particularly in plant construction, in laboratory applications, in the chemical industry as well as in hazardous areas. The resistance thermometers can also be realized as a waterproof sheath resistance thermometer (WT-MI) with bendable, flexible mineral insulated line (MI) and with an operating temperature range from -200°C to +600°C.

Relevant dimensions of screw-in thermometers with connection head are:

Total length (GL): length from the bottom edge of the protection tube to the bottom edge of the 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.

The following materials are available:

- Head: brass, stainless steel, aluminium, plastic
- Protection tube: stainless steel, plastic
- Screw connection (VSB): stainless steel, plastic

Deliverable standard designs

Screw-in resistance thermometers with connection heads acc. to DIN EN 50446

- connection heads EM12 / 18 / 24 / 38
- screw-in housing
- bayonet lock
- industry plug
- redundant sensors

14. SCREW-IN RESISTANCE THERMOMETERS LTH

The group of screw-in resistance thermometers includes various thermometers in different housing types. The spectrum ranges from simple screw-in housings with connection wire, over fixed or moveable screw connections up to various connection heads with protection sheath and different process fittings. Using fixed or shiftable screw connections the thermometers are individually adjustable to their installation position and can be assembled simply and quickly. The screw connections can be designed with PTFE clamp ring or with stainless steel cutting ring.

Resistance thermometers EPHY-MESS GmbH

EPHY-MESS GmbH Resistance thermometers | 41
These sensors are plug-in or screw-in resistance thermometers with a stainless steel protection tube and connection heads in accordance with DIN EN 50446. The sensors are manufactured with permanently installed measuring resistors or replaceable mineral-insulated measuring inserts. In general connection heads types A, B and MA are used as standard types. Connection heads of the shape BUS and BUZ are also available for special applications.

In general

Plug-in or screw-in resistance thermometers with connection heads according to DIN EN 50446 are universally applicable for industrial applications and temperature measurement in solid or liquid media.

The large screw-in thermometers with DIN connection head type A or B are mainly used in chemical industry and plant engineering. These are deliverable in various configurations, e.g. with an exchangeable measuring insert or with mineral-insulated protection tubes. Spring-loaded thermometers with connection head B are installed and tested in gears of wind power plants.

They are equipped with a stainless steel protection sheath (ø 8 mm) and cable outlet with PG16 flange. Thread sizes range from M10 to G1. The thermometer can be equipped with 1 or 2 permanent connected measurement circuits or with changeable measuring insert in 2-, 3- or 4-wire circuit. Temperature range extends up to +600°C.

Depending on the application other connection heads are available e.g. made of stainless steel or plastics or with two process connections. Single or double thermometers can be manufactured.

Suitable screw connections with metric or conical threads are available for all protective sheath diameters. On request, supply lines can also be installed in the connection head. Corrugated tubings made of plastic or metal function as a mechanical protection of the connecting cable and are optional available.

The respective technical versions and special features are described in detail in the following sections.
**CONNECTION HEADS TYPE A / B / BUS / BUZ**

Screw-in thermometer with connection head type A/B are realized with one or two platinum measuring circuits and can optionally be implemented in 2-, 3- or 4-wire circuit according to DIN EN 60751. Instead of permanently installed measuring resistors a replaceable measuring insert can also be provided. The spring-loaded stainless steel protection tube offers a spring length of more than 15 mm, ensuring a constant contact pressure and a stable thermal coupling. The heads BUS and BUZ have a hinged cover.

**Features**

- Robust construction for the use in rough industrial environment
- Resistant to oils, resistant hydraulic fluids, aliphatic hydrocarbons
- O-ring provides reliable sealing
- Optional with head transmitter
- With or without spare connection
- Optional with hinged cover and replaceable measuring insert
- Also available with thermocouple type J or K

**General technical data**

- **measuring range**: -60°C ... +400°C // Ex: +180°C
- **mode of connection**: 2-, 3-, 4- wire circuit
- **tolerance class**: AA, A, B (acc. DIN EN 60751)
- **Connection heads**: A, B, BUS (others upon request)
- **interior construction**: ceramic clamp socket 2 - 8 pole
- **protection tube**:
  1) with measuring resistor insulated by shrinking tube
  2) with mineral-insulated measuring resistor
  3) with exchangeable measuring insert and fixed connected clamp socket

**Certificates**

- Robust construction for the use in rough industrial environment
- Resistant to oils, resistant hydraulic fluids, aliphatic hydrocarbons
- O-ring provides reliable sealing
- Optional with head transmitter (4-20 mA)
- With or without spare connection
- Optional with hinged cover and replaceable measuring insert
- Also available with thermocouple or KTY measuring elements

**CONNECTIOIN HEADS TYPE MA**

Smaller screw-in thermometers with connection head type MA. The sensors consist of one or two fixed connected platinum measuring resistors in 2-, 3- or 4-wire circuit or a replaceable measuring insert KTY, silicon sensors, thermocouples as well as PTC or NTC thermistors can also be installed in the protection tube.

**General technical data**

- **measuring range**: -60°C ... +180°C
- **mode of connection**: 2-, 3-, 4- wire circuit
- **Tolerance class**: AA, A, B (acc. DIN EN 60751)
- **Connection heads**: type MA with screw cover
- **interior construction**: ceramic clamp socket 2 - 4 pole
- **protection tube**: with shrinking tube insulated measuring resistor
- **dimensions**: protection tube diameter ø 5 mm ... 8 mm
- **protection tube length**: 20 mm ... 1000 mm

**dielectric strength**: 0.5 kV to 2.5 kV / AC 50 Hz / 1 min.

**supply line**:
- **Sx** hose line with x single litzes
- **Gx** screened hose line with x single litzes

**material**: PTFE / FEP, peek, or silicone connection line

**assembly**

1. stainless steel screw connection, fixed or shiftable, with PTFE clamp ring, steel or brass cutting ring
2. stainless steel screw-in adapter, fixed

**Threads**:

M10x1 / G1/4" / G3/8" / G1/2" / G3/4" / G1" / NPT

**Certificates**

- Screw-in thermometer with connection head MA
- With or without spare connection
- Optional with head transmitter (4-20 mA)
- Also available with thermocouple or KTY measuring elements

**Features**

- Small connection head type MA
- With or without spare connection
- Optional with head transmitter (4-20 mA)
- Also available with thermocouple or KTY measuring elements

**Technical data**

- Measuring range: -60°C ... +180°C
- Mode of connection: 2-, 3-, 4-wire circuit
- Tolerance class: AA, A, B (acc. DIN EN 60751)
- Connection heads: type MA with screw cover
- Interior construction: ceramic clamp socket 2 - 4 pole
- Protection tube: with shrinking tube insulated measuring resistor
- Dimensions: protection tube diameter ø 5 mm ... 8 mm, protection tube length 20 mm ... 1000 mm
- Dielectric strength: 0.5 kV to 2.5 kV / AC 50 Hz / 1 min.
- Supply line: Sx hose line with x single litzes
- Material: PTFE / FEP, peek, or silicone connection line assembly
- Assembly: 1) stainless steel screw connection, fixed or shiftable, with PTFE clamp ring, steel or brass cutting ring
  2) stainless steel screw-in adapter, fixed
- Threads: M10x1 / G1/4" / G3/8" / G1/2" / G3/4" / G1" / NPT
16. CONNECTION HEADS
TYPE EM12/18/24/38

These thermometers are equipped with one or two measuring resistors in a stainless steel protection tube with fixed connection head type EM12 / 18 / 24 / 38 and with an optional connection line. The heads are made of brass, nickel-plated brass or stainless steel. Fixed or shiftable screw connections are available as accessories.

In general

The group of compact screw-in thermometers with connection head consists of thermometers of the type EM12 / EM18 / EM24 / EM38 (LT12 / LT18 / LT24 / LT38). They are often used for control of the bearing temperature in electric motors and generators or in large pumps. They can also be delivered in a certified Ex-version (explosion protection system type Ex ia, Ex eb or Ex ta) according to IECEx, ATEX, TR or UL/CSA regulations. The code number of the thermometer (12/18/24/38) indicates the outer diameter in mm of the respective connection head with the nominal cable connection port.

For screw-in thermometers with connection head type EM, one or two Pt100 measuring resistors are installed in a stainless steel protection tube and optionally equipped with an connecting line. The measuring resistor is electrically isolated against the protection tube and embedded in thermal compound for better thermal coupling. The protection tube is filled with a ceramic filler to increase the shock resistance.

The temperature measurement takes place towards the front area of the protection tube. The cable transition from the sensor to the supply line is located within the sensor head. A version with permanent sealed supply line in the sensor head is available on request (Ex-version). The cable connection outlet can be ordered either with or without cover plate. Fixed or shiftable screw connections are available as accessories.

Versions of screw-in thermometers with connection heads type EM-xx

EM12 / EM18, LT12, LT18
screw-in resistance thermometer with compact connection heads type EM12 / EM18

EM24 / EM38, LT24, LT38
screw-in resistance thermometer with larger connection heads type EM24 / EM38

The respective technical versions and special features are described in detail in the following sections.
Resistance thermometers

**Features**
- Small and compact connection head
- Reverse polarity protected, 4-pole M8 connector or M12 connector (EM38 / LT38)
- With a permanent sealed, straight or angled cable coupling
- Connection heads available in stainless steel or brass

**General technical data**

- **measuring range**
  - -30°C ... +160°C
- **mode of connection**
  - 2-, 3-, 4-wire circuit
- **tolerance class**
  - AA, A, B (acc. DIN EN 60751)
- **connection heads**
  - type EM12 / EM18
- **interior construction**
  - Plastics sealing
- **dimensions**
  - EM12 (LT12): ø 12 mm, height approx. 25 mm
  - EM18 (LT18): ø 18 mm, height approx. 25 mm
- **protection tube**
  - Stainless steel, bare or shrinking tube insulation
  - Protection tube diameter: ø 5 mm ... 12 mm
  - Protection tube length: 20 mm ... 1000 mm
- **dielectric strength**
  - 0.5 to 1.5 kV / AC 50 Hz / 1 min
- **supply line**
  - Sx - hose line with x single litzes
  - Gx - screened hose line with x single litzes
- **material**
  - Silicone or PTFE connection line
  - Cross section
    - AWG30 to AWG22
- **plug connector**
  - 4-pole M8 connector (EM12 / LT12)
  - 4-pole M12 connector (EM18 / LT18)

**Connection heads EM12 / 18**

The screw-in resistance thermometers with connection heads EM12 (LT12) or EM18 (LT138) are generally available with a P100 measuring resistor in 2-, 3- or 4-wire circuit. If two P100 measuring resistors are installed, a 2-wire circuit is only available because of space reasons. The connection cable can be equipped with a permanent sealed, straight or angled socket connector. The 4-pole M8 connector (EM12 / LT12) or the M12 connector (EM18 / LT18) are in the centreline and are protected against reverse polarity according to DIN IEC 60947-5-2.

**Features**
- 6- or 8-wire circuit for 2x Pt100 versions (only EM18 / LT38)
- Clamp socket or fixed connected supply lines
- M12 round connector with screw connection (EM34 / LT24)
- Connection heads available in stainless steel, brass or nickel-plated brass
- Special version EM14 (height of the head only 22 mm)

**General technical data**

- **measuring range**
  - -60°C...260°C // Ex: +180°C
- **mode of connection**
  - 2-, 3-, 4- or 6-wire circuit)
  - 6- or 8-wire circuit (EM38)
  - 2x Pt100 combined with EM24 head
- **tolerance class**
  - AA, A, B (acc. DIN EN 60751)
- **connection heads**
  - type EM24 / EM38
- **interior construction**
  - Plastic clamp socket, sealed
- **dimensions**
  - EM24 (LT24): ø 24 mm, height approx. 36 mm
  - EM38 (LT38): ø 38 mm, height approx. 38 mm
- **protection tube**
  - Stainless steel, bare or insulated by shrinking tube
  - Dimensions tube
    - Protection tube diameter: ø 5 mm ... 12 mm
    - Protection tube length: 20 mm ... 1000 mm
    - Dielectric strength: 0.5 kV to 2.5 kV / AC 50 Hz / 1 min
    - Supply line
      - Sx - hose line with x single litzes
      - Gx - screened hose line with x single litzes
      - Material
        - Silicone or PTFE connection line
        - Cross section
          - AWG30 to AWG22
          - Assembly
            - thread
              - M10x1 // G1/4" // G3/8" // G1/2" // G3/4" // G1"

**Connection heads EM24 / 38**

Screw-in resistance thermometers with compact connection heads EM38 / LT38 (LT24 / LT38) can be easily attached at the measuring point by screw socket or by flange. One can choose between brass, nickel-plated brass or stainless steel connection heads.

**Features**
- 6- or 8-wire circuit for 2x Pt100 versions (only EM18 / LT38)
- Clamp socket or fixed connected supply lines
- M12 round connector with screw connection (EM34 / LT24)
- Connection heads available in stainless steel, brass or nickel-plated brass
- Special version EM14 (height of the head only 22 mm)
Resistance thermometers with industrial plug connectors allow for an easy installation and have proven to be excellent, e.g., in wind turbines or agricultural machinery.

**17. INDUSTRIAL PLUG RESISTANCE THERMOMETERS**

Screw-in thermometers with plastic industrial plug connectors are an alternative to sensors with metal-based connection heads. They are also used as standard thermometers for measuring temperature measurement and for temperature measurement in liquid media.

The connection head can be released easily from the mounted sensor by loosening the central screw without disconnecting the attached cables. Industrial plug connectors are protected against reverse polarity.

In wind power plants, they monitor hydraulic drives, e.g., the pitch or azimuth adjustment of rotor blades and nacelles. These thermometers are also used in tractors.

**Features**
- Temperature range from -60°C ... +260°C
- Compact connection head (28 x 28 x 50 mm)
- Quick release without disconnecting the cable
- Reverse polarity protection
- Optional with spring-loaded protection tube

**General technical data**

- **measuring range**
  - -60°C ... +260°C // sensor head -30°C ... +90°C
- **mode of connection**
  - 2-, 3-wire circuit
- **tolerance class**
  - AA, A, B (acc. DIN EN 60751)
- **sensor insulation**
  - stainless steel sleeve
- **dimensions sleeve**
  - protection tube diameter: ø 5 mm ... 12 mm
  - protection tube length: 20 mm ... 1000 mm
- **connection head**
  - Hirschmann plug, PG screw connection
- **connection line**
  - Sx hose line with x single litzes
- **cross section**
  - A: WG30 to AWG20
- **spring-loaded version**
  - thread G1/2"
  - width across flats 27 mm
  - nominal length 118 mm
  - total length 150 mm
  - spring load 15 mm
- **version special immersion sheath**
  - thread G1/4"
  - width across flats 27 mm
  - nominal length 113 mm
  - total length 235 mm
  - pressure resistance 100 bar

**Version with spring-loaded protection tube**

**Version with special immersion sheath**
Cable resistance thermometers are frequently used solutions for the handling of various temperature measurement tasks. Assembled with shrinking tube, metal sleeve or ceramic sleeve they are mainly used in lower temperature ranges from -40°C to 260°C. In addition, special versions with an operating temperature of up to +400°C are also part of the EPHY-MESS portfolio. The thin or mini-wire WKF cable resistance thermometers according to DIN EN 60751 are used as basic measuring elements. Other nominal values (e.g. 500 Ω, 1000 Ω) or other resistive materials (e.g. Mg, Cr) are available upon request. Also thermocouples, PTC or NTC thermistors as well as KTY silicon sensors can be used as measuring elements.

In general

EPHY-MESS offers you a wide range of cable resistance thermometers.

Applications are e.g.

- temperature control in coil or slot of electric machines
- temperature measurements in laboratories and testing facilities
- temperature measurements of air, water and solids
- temperature measurements in hazardous areas

Operating conditions for these sensors are really diverse. For the above mentioned areas of application we also offer water-resistant cable thermometers for use in liquids, as well as extra high-voltage resistant sensors up to 7 kV for direct use in special high-voltage machines. EPHY-MESS manufactures tailor-made sensors according to customers requirements. The following cable thermometers are available as standard version:

**Versions of cable resistance thermometers**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-OK / ESH</td>
<td>cable resistance thermometer with single shrinking tube insulation</td>
</tr>
<tr>
<td>M-OK / ESH-SIT</td>
<td>cable resistance thermometer with electrically protective separation acc. to DIN EN 60335-6-1 and DIN EN 50178</td>
</tr>
<tr>
<td>M-OK / DSH</td>
<td>cable resistance thermometer with double shrinking tube insulation</td>
</tr>
<tr>
<td>M-OK / DSH-SIT</td>
<td>cable resistance thermometer with electrically protective separation acc. to DIN EN 60335-6-1 and DIN EN 50178</td>
</tr>
<tr>
<td>M-OK / KH</td>
<td>cable resistance thermometer with ceramic sleeve</td>
</tr>
<tr>
<td>M-OK / KH-SIT</td>
<td>cable resistance thermometer with electrically protective separation acc. to DIN EN 60335-6-1 and DIN EN 50178</td>
</tr>
<tr>
<td>M-OK / MH</td>
<td>cable resistance thermometer with metal sleeve</td>
</tr>
<tr>
<td>M-OK / MH-SIT</td>
<td>cable resistance thermometer with electrically protective separation acc. to DIN EN 60335-6-1 and DIN EN 50178</td>
</tr>
</tbody>
</table>
M-OK/ESH
Cable resistance thermometer with shrinking tube insulation. For this thermometer, one or two platinum measuring resistors are crimped, hard or soft soldered on the connection cable and insulated with a shrinking tube. Depending on the application, the thermometers are single (ESH) or double (DSH) insulated with shrinking tubes made of Kynar®, Kynarflex® or PTFE.

Features
• measuring resistors crimped, hard or soft soldered to connection line
• universal applications
• high-voltage-resistant insulation
• waterproof version available (PHE)

General technical data
measuring range
-60°C … +260°C // Ex: +180°C
mode of connection
2-, 3-, 4-wire circuit
tolerance class
AA, A, B (acc. DIN EN 60751)
sensor insulation
Teflon® shrinking tube (PTFE / FEP), Kynar® / Kynarflex® shrinking tube (PVDF), glass fibre filament tube (LGLS)
dielectric strength
0.5 kV to 1.5 kV / AC 50 Hz / 1 min. (ESH)
0.5 kV to 5 kV / AC 50 Hz / 1 min. (DSH)
supply line
E1 single litzes
S1 hose line with single litzes
Gx screened hose line with single litzes
PFA FEP cross line with single litzes
VL stranded line
material
PTFE / FEP, peak or silicone connection line
cross section
AWG30 to AWG18
dimensions
diameter from approx. ø 2 mm
length from approx. 20 mm
special versions up to 7 kV available

Cable resistance thermometer with metal sleeve. In this design, one or two platinum measuring resistors are connected to the supply line by soldering (hard or soft soldering). In this case, the two soldering points are insulated against each other and the measuring resistor is insulated against the sleeve. The sensor is then assembled with heat conductive paste in a metallic protection sleeve made of brass or stainless steel. The sensor is fixed connected to the supply line by press squeeze, roll squeeze or casting.

Features
• measuring resistors protected by metal sleeve
• in IP00 or in IP65/67 measuring resistors integrated
• waterproof design available (PHE)
• versatile usability, thanks to the variable dimensions
• all and water resistant versions available

General technical data
measuring range
-60°C … +260°C // Ex: +180°C
mode of connection
2-, 3-, 4-wire circuit
tolerance class
AA, A, B (acc. DIN EN 60751)
sensor insulation
stainless steel or brass*) protection sleeve
*) not available for all dimensions
dielectric strength
0.5 kV to 2.5 kV / AC 50 Hz / 1 min.
supply line
E1 single litzes
S1 hose line with single litzes
Gx screened hose line with single litzes
VL stranded line
material
PTFE / FEP, peak or silicone connection line
cross section
AWG30 to AWG18
cable connection
press squeeze, roll squeeze, casting
dimensions
diameter from approx. ø 2 mm
length from approx. 20 mm

Cable resistance thermometers
EPHY-MESS GmbH

54 | Resistance thermometers EPHY-MESS GmbH

55 | Resistance thermometers EPHY-MESS GmbH


**Features**

- High-voltage resistant insulated
- Increased mechanical protection
- Gas-tight ceramic sleeve
- Fast thermal response time

**General technical data**

- Measuring range:
  - -60°C … +180°C // Ex: +180°C
- Mode of connection:
  - 2-, 3-, 4-wire circuit*
- Depending on housing and connection line
- Tolerance class:
  - AA, A, B (acc. DIN EN 60751)
- Sensor insulation:
  - Ceramic sleeve, Al2O3-ceramic
- Dielectric strength:
  - 0.5 kV to 4 kV / AC 50 Hz / 1 min.
- Supply line:
  - E1 single litzes
  - Sx hose line with x single litzes
  - S4 hose line with 4 litzes
  - FSx flat hose line with x single litzes
  - HL stranded line

**Material**

- PTFE / FEP, Peek

**Cross section**

- AWG30 to AWG20

**Dimensions**

- Max. ø 3 mm x 15 mm (single side flat closed)
- ø 4 mm x 20 mm (single side flat closed)
- ø 4.9 mm x 25 mm (single side round closed)
- ø 4.9 mm x 30 mm (single side round closed)

**Special versions**

- Up to +400°C (only with glass fibre hose line)
- Up to 5 kV (only with Teflon® connection line)
- Combined with glass fibre filament tube (LGLS) insulation

**Certificates**

- Versions with Pt100 or Pt1000 resistors
- Two versions available with +190°C or +250°C
- According DIN EN 61800-5-1 and DIN EN 50178

---

**M-OK/KH**

Cable resistance thermometer with ceramic sleeve (KH). In this thermometer one or two platinum measuring resistors are connected to the supply line by soldering (hard / soft soldering). The solder joints are isolated from each other by shrinking tube. The measuring resistor is seated in the corresponding connection line (strain-relieved) in a ceramic sleeve. By encapsulating the sensor in a ceramic sleeve, internal components are fixed and increased mechanical protection as well as fast response time is achieved.

**Features**

- High voltage resistant insulated
- Increased mechanical protection
- Gas tight ceramic sleeve
- Fast thermal response time

**General technical data**

- Measuring range:
  - -60°C … +380°C // Ex: +180°C
- Mode of connection:
  - 2-, 3-, 4-wire circuit*
- Depending on housing and connection line
- Tolerance class:
  - AA, A, B (acc. DIN EN 60751)
- Sensor insulation:
  - Ceramic sleeve, Al2O3-ceramic
- Dielectric strength:
  - 3.8 kV / AC 50 Hz / 1 min.
- Supply line:
  - E1 single litzes
  - Sx hose line with x single litzes
  - S4 hose line with 4 litzes
  - FSx flat hose line with x single litzes
  - HL stranded line

**Material**

- PTFE / FEP, Peek

**Cross section**

- AWG26/7 or AWG24/7

**Dimensions**

- Max. ø 4.5 mm length 50 mm ± 3 mm

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**M-OK/DSH-SIT**

Cable resistance thermometer with electrical protective separation. With this cable thermometer, one or two measuring resistors are seated in the supply line and double insulated with shrinking tube. The sensors are used in motor-powered machines with a rated voltage of up to 690 V and comply with DIN EN 50178 and DIN EN 61800-5-1. Due to the requirements resulting from these standards, constructional changes are restricted to a limited extent.

**Features**

- Two versions with Pt100 or Pt1000 resistors
- Two versions available with +190°C or +250°C
- According DIN EN 61800-5-1 and DIN EN 50178

**General technical data**

- Measuring range:
  - -55°C … +190°C // -70°C … +250°C
- Mode of connection:
  - 2-wire circuit
- Tolerance class:
  - B (acc. DIN EN 60751)
- Sensor insulation:
  - Teflon® shrinking tube (PTFE / FEP)
  - Kynar® / Kynarflex® shrinking tube (PVDF)
- Dielectric strength:
  - 3.8 kV / AC 50 Hz / 1 min.
- Supply line:
  - E1 single litzes
  - Sx hose line with x single litzes
  - S4 x 247 mm in request
- Material:
  - PTFE / FEP, Peek

**Cross section**

- AWG26/7 or AWG24/7

**Dimensions**

- Max. ø 4.5 mm length 50 mm ± 3 mm
19. RESISTANCE THERMOMETERS WITH SCREW-IN HOUSING M-OK/SGH

The compact thermometers with screw-in housing M-OK/SGH also belong to the group of cable thermometers. They are often used in areas of tight space, at the end face of machine housings or are installed in e. g. switching cabinets for monitoring surface temperatures. They are also used for thermal supervision of induction coils or for temperature control of cooling water.

The brass or stainless steel screw-in housings are available with or without protection tube, with permanent potted shrinking tube, with PTFE single litz wires or with a pressure mounted connector plug. Also versions with cable shoe are available.

**Features**

- any size of small measuring elements can be installed
- they do not require space for assembly on housings and surfaces
- housing made of brass, aluminum or stainless steel
- with fixed connected supply line or connection plug

**General technical data**

- **measuring range**
  -40°C ... +260°C
- **mode of connection**
  2-, 3-) single litz
- **tolerance class**
  AA, A, B (acc. DIN EN 60751)
- **screw-in housing**
  (A) without protection tube, brass or aluminum
  (B) with protection tube, stainless steel screw-in housing, permanent sealed hose line or connection plug

**Dimensions**

- **dimensions**
  - see right hand table

**Dielectric strength**

- 0.5 kV to 2.5 kV / AC 50 Hz / 1 min.**
  - not with glass fibre insulation

**Supply lines**

- E1 single litz
- Sx hose line with x single litzes
- Gx screened hose line with x single litzes

**Optional with connection plug**

- material: silicone or PTFE glass fibre hose line
  - depending on the size of the housing cross section

**Certificates**

- In addition to Pt100, Pt500, Pt1000 measuring resistors, thermocouples, PTC, NTC, KTY or bimetallic switches can also be installed.

**Sleeves with thread for model (B) with protective tube**

- Ø-stainless steel sleeve [mm]
  - M10x1
  - G1/4"
  - G3/8"
  - G1/2"

- from 20
  - M30x1
  - G1"
  - G3/4"
  - G1 1/2"

- 4 mm
  - 5 mm (standard)
  - 6 mm (optional)
  - 8 mm

**Overview of available screw-in housings for model (A) without protection tube**

<table>
<thead>
<tr>
<th>Material</th>
<th>Sensor in the screw base</th>
<th>Optional with connection plug</th>
<th>Automatic with glass fibre hose line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brass</td>
<td>(for better thermal conductivity)</td>
<td>Optional with connection plug</td>
<td>Glass fibre hose line</td>
</tr>
<tr>
<td>Aluminum</td>
<td>Stainless steel screw-in housing</td>
<td>Permanent sealed connection plug</td>
<td>Glass fibre hose line</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td></td>
<td></td>
<td>Glass fibre hose line</td>
</tr>
</tbody>
</table>

| M4 x 6 mm | SW 7 x 10 mm |
| M4 x 7,5 mm | SW 8 x 10 mm |
| M5 x 7,5 mm | SW 8 x 15 mm |
| M6 x 7,5 mm* | SW 10 x 10 mm |
| M6 x 7,5 mm* | SW 10 x 15 mm |
| M6 x 7,5 mm* | SW 12 x 20 mm** |
| M8 x 7,5 mm* | SW 13 x 10 mm |
| M8 x 8 mm* | SW 19 x 24 mm** |

| M6 x 6 mm | SW 8 x 10 mm |
| M6 x 7,5 mm* | SW 10 x 15 mm |
| M8 x 7,5 mm* | SW 12 x 20 mm** |
| M8 x 8 mm* | SW 19 x 24 mm** |

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| M6 x 7,5 mm* | SW 10 x 10 mm |
| M6 x 7,5 mm* | SW 10 x 15 mm |
| M6 x 7,5 mm* | SW 12 x 20 mm** |
| M8 x 7,5 mm* | SW 13 x 10 mm |
| M8 x 8 mm* | SW 19 x 24 mm** |

| M6 x 6 mm | SW 8 x 10 mm |
| M6 x 7,5 mm* | SW 10 x 15 mm |
| M8 x 7,5 mm* | SW 12 x 20 mm** |
| M8 x 8 mm* | SW 19 x 24 mm** |

**Sleeves with thread for model (B) with protective tube**

<table>
<thead>
<tr>
<th>Ø-stainless steel sleeve [mm]</th>
<th>Installation length [mm]</th>
<th>Threads</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4 x 6 mm</td>
<td>SW 8 x 10 mm</td>
<td></td>
</tr>
<tr>
<td>M4 x 7,5 mm</td>
<td>SW 10 x 15 mm</td>
<td></td>
</tr>
<tr>
<td>M5 x 7,5 mm</td>
<td>SW 10 x 15 mm</td>
<td></td>
</tr>
<tr>
<td>M6 x 7,5 mm*</td>
<td>SW 12 x 20 mm**</td>
<td></td>
</tr>
<tr>
<td>M8 x 7,5 mm*</td>
<td>SW 13 x 10 mm</td>
<td></td>
</tr>
<tr>
<td>M8 x 8 mm*</td>
<td>SW 19 x 24 mm**</td>
<td></td>
</tr>
</tbody>
</table>
BAYONET LOCK RESISTANCE THERMOMETERS

Bayonet lock resistance thermometers are ideally suited for temperature monitoring of machines and tools in manufacturing and for industrial motor protection. Resistance elements, semiconductors or thermocouples are used as basic measuring elements in the protection tube.

In general

EPHY-MESS thermometers with bayonet lock are assembled with one or two measuring resistors, optional with thermocouples, PTC or NTC thermistors or with EPHY silicon sensors, which are located in a stainless steel sleeve and protected by a spring against bending. The thermometer operates with high mechanic reliability because of the adjustable and latching locking bayonet cap.

The tension spring is mounted on the sleeve to provide a defined and adjustable pressing for a stable thermal coupling even under mechanical vibrations or elongations caused by temperature changes. Furthermore the bayonet cap can be screwed to adjust either the immersion depth within the drill hole or to adjust the spring tension according to customized setup.

Sensor with angled bayonet cap are the solution of choice in confined spaces.

General technical data

- measuring range: -55°C...220°C / Ex: +180°C
- mode of connection: 2-, 3-, 4-wire connection
- tolerance class: AA, A, B (acc. DIN EN 60751)
- sensor insulation: stainless steel sleeve, ø 6 - 9 mm x NL= 47, GL = 90 (beveled), front surface flat closed or drill angle 118°
- spring length: 175 mm / 210 mm / 250 mm
- spring travel: > 12 mm
- dielectric strength: 0.5 kV to 3.4 kV / AC 50 Hz / 1 min.
- supply line: Sx hose line with x single litzes / Gx screened hose line with x single litzes
- material: PTFE / FEP, peek, or silicone connection line
- cross section: A
- accessories: screw-in nipples ø 12 / 7 mm, nickel-plated brass, M10 x 1 SW 14, L = 60 mm or L = 30 mm assembly
- bayonet cap stainless steel ø = 14 mm / 12 A, L = 24 mm adjustable upon pressure spring. The assembly is always carried out with the bayonet nipple.

Features

- short response times by mechanical pressing
- with fixed or adjustable bayonet cap
- easy and quick assembly / disassembly

Certificates

EPHY-MESS GmbH
21. SHEATHED RESISTANCE THERMOMETERS WT-MI

Sheathed resistance thermometers are extremely sturdy, pressure resistant, mechanically stable and vibration-resistant. Due to the small diameter these thermometers have a very short response time and are suited to be placed in areas difficult to access, in windings and in narrow openings.

Sheathed resistance thermometers monitor the thermal conditions in tanks, pipes, apparatus and machinery, in laboratories or in experimental plants as well as in-tries and in braking systems. Furthermore they guarantee exact temperature measuring in gaseous or liquid media, in low and high pressure environments with low flow speeds and for applications where flexibility and easy replacement are required. The bendable sheathed cable made of stainless steel or Inconel® is filled with MgO₂ powder.

EPHY-MESS offers various sensor sets for different measurement tasks on pipelines. Sensor sets consist of a thermometer, customized strip-wings, upper and lower insulation part, shrinking tube insulation and the associated spigot connection port.

In general

Sheathed resistance thermometers monitor the thermal conditions in tanks, pipes, apparatus and machinery, in laboratories or in experimental plants as well as in tries and in braking systems. Furthermore they guarantee exact temperature measuring in gaseous or liquid media, in low and high pressure environments with low flow speeds and for applications where flexibility and easy replacement are required. The bendable sheathed cable made of stainless steel or Inconel® is filled with MgO₂ powder.

The surface temperature sensors for pipes are based on Pt100 measuring resistors in a metal sleeve. Due to its flexible capillary tube the sensor can be directly embedded in the milled spigot connector and is welded on the adaptor socket by its outgoing "wings of steel". Thus the best thermal coupling is ensured.

After embedding the sensor in the milled spigot connector the sensor is then coated with ceramic fibre leaves and insulated by a thick-walled shrinking tube, to avoid possible influences of the ambient temperatures.

Versions of sheathed resistance thermometers

Sheathed resistance thermometers

Sheathed resistance thermometers special version „Halbmondfühler“

Sheathed resistance thermometers special version „Flügelfühler“

The respective technical versions and special features are described in detail in the following sections.

Sensor sets consist of a thermometer, customized strip-wings, upper and lower insulation part, shrinking tube insulation and the associated spigot connection port.

The surface temperature sensors for pipes are based on Pt100 measuring resistors in a metal sleeve. Due to its flexible capillary tube the sensor can be directly embedded in the milled spigot connector and is welded on the adaptor socket by its outgoing "wings of steel". Thus the best thermal coupling is ensured.

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Resistance thermometers

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>-40°C ... +60°C (thermocouples)</th>
<th>-40°C ... +350°C (thermocouples)</th>
<th>-40°C ... +60°C (V-version)</th>
</tr>
</thead>
<tbody>
<tr>
<td>mode of connection</td>
<td>2-, 3-, 4-wire circuit</td>
<td>2-, 3-, 4-wire circuit</td>
<td>2-, 3-, 4-wire circuit</td>
</tr>
<tr>
<td>protection tube diameter from ø 1.5 mm</td>
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<td>protection tube diameter from ø 1.5 mm</td>
</tr>
<tr>
<td>Special versions</td>
<td>Sheathed resistance thermometers special design „Flügelfühler“</td>
<td>Sheathed resistance thermometers special design „Halbmondfühler“</td>
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Resistance thermometers EPHY-MESS GmbH

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22. GENERAL NOTES

General assembly and connection notes

• The installation of the thermometers should be free of tension, compression, bend and torsion.
• Avoid punctual or sharp-edged loads on the thermometer housing as that might cause damage or also lead to measured value deviations.
• The connection cable should be laid strain relieved, ideally protected, and should neither be twisted, pressed too hard nor kinked.
• When installing, prevent damage to the cable (insulation, shield, etc.).
• The thermometer should only be connected to the display- and evaluation unit.
• For the versions with EExd, ATEX, TR or UL/CSA approval, the special requirements of the type examination certificate have to be considered absolutely.

General guidelines for the cable confectioning

The cable lengths of the single sensors are usually free selectable. Regularly all cable ends are stripped and tin-coated. If required, cable ends are also deliverable with cable end sleeves, with flat or pin contacts, as well as with Harting- or Lemo-plugs / coupling in 2-, 3- or 4-pole version. Upon request, we also mount plugs from other manufacturers or plugs provided by our customers.
23. KNOW-HOW AND CREATIVITY

Our highly qualified technicians and engineers develop temperature sensors which can operate reliably under the harshest environmental conditions. With excellent technical know-how and modern equipment, we offer an environment in which creativity and wealth of ideas will be implemented to the benefit of our customers. Moreover we maintain close contacts with renowned universities, educational institutions and accredited research institutes.

ALWAYS AT THE CUTTING EDGE

The R&D department ensures proper product design and process development. Feasibility studies and prototype assembly are coordinated. With high-quality testing methods in research laboratories customer-specific designs and applications are developed and qualified by final article inspections (e.g. compressive strength and vibration testing, fatigue testing as well as temperature and climate tests). Optimizations are carried out in accordance with RoHS and REACH for instance by applying low-polluting materials.

The two ever important goals for EPHY-MESS are quality improvements to existing products as well as work process improvements to the benefit of our customer.