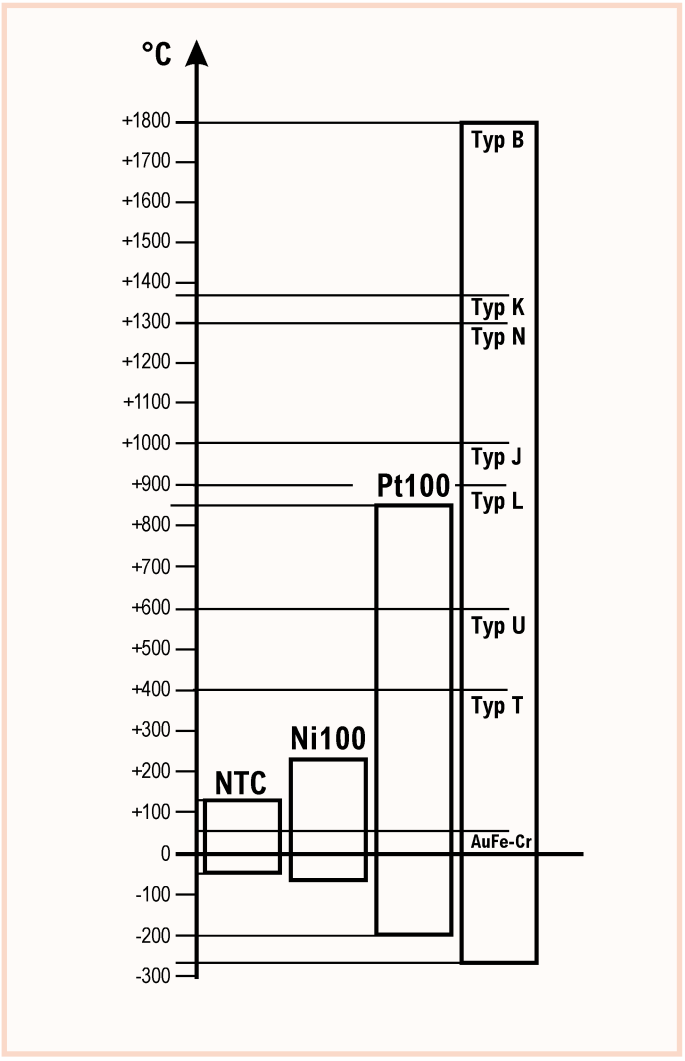
## Content

## The Right Temperature Sensor For Any Measuring Task




Selecting the right type of temperature sensor depends on your measuring task. For example, thermocouples, resistor-based sensors (Pt100 and Ntc) and pyrometers (infrared sensors) are available.

**Rule of Thumb:**

- Thermocouples are very fast and provide a large measuring range.
- Resistor-based sensors are more accurate but slower.
- Ntc sensors are very fast, accurate, but they have a limited measuring range.
- Infrared sensors do not contact the device under test and they have very small time constants, but they depend on the emission grade.
- The larger the measuring range, the more universal the possible range of applications.

**Selection Criteria:**

Select the temperature sensor that suits your measuring task according to the criteria below:

- Meas. range
- Accuracy
- Response time
- Stability
- Type of construction

## Thermocouples

Thermocouples consist of two spot-welded wires of different metals or alloys. The thermoelectric effect at the contact surface is used to measure temperatures. A relatively small thermoelectric voltage is caused, which depends on the temperature difference between the measuring point and the connecting terminals.

**Accuracy, Operating Temperatures:**

The basic values for the thermoelectric voltages and for the permissible tolerances of thermocouples are specified in standard DIN/IEC 584. Our thermocouple sensors are available in two tolerance classes as per DIN/IEC 584-2. Following limit values apply (highest value in each case) : type K / N

| | | | |
|---|---|---|---|
| Class 1: | ±1.5 °C | or ±0.004 x l t l | (-40...1000°C) |
| Class 2: | ±2.5 °C | or ±0.0075 x l t l | (-40...1200°C) |

Our thermocouple sensors generally comply with Class 2 as per DIN/IEC 584-2. The specified Tmax values refer to the tip of the sensor. The specified $T_{90}$ times refer to measuring operations in a moving liquid. The sensor handles and cables are usually resistant to temperatures up to +80 °C. Heat-resistant cables are also available on request.
Various types of thermocouples are available; these can be distinguished in terms of their temperature range, sensitivity, and in particular their compatibility with the test substance. The most popular thermocouple is the NiCr-Ni (type K).

## *new* Connecting cable with thermal line (stranded wire)
## There is no adverse temperature effect at the juncture from measuring element to cable.

With immediate effect, the sensor connecting cables for many sensor types will use a new thermal line (stranded wire, thermal line class 2) instead of the conventional compensation line. The transition from measuring element (sensor tip) to connecting cable (in the cable sleeve or in the handle) thus remains, even over a wide temperature span (up to 200 °C), unaffected by temperature error; the usual measuring errors caused by temperature differences at the juncture when using a conventional compensation line can thus with the new thermal line be avoided.

For just a few sensor types and extension cables a compensation line will continue to be used as previously. The compensation lines generally comply with Class 2 as per DIN 43722. For type K the operating temperature range of the compensation line is 0 to 150 °C.

## Resistor-Based Sensors (Pt100 Sensors)

When measuring the temperature the increase in resistance at increasing temperatures is utilised at the Pt100 sensors. The measuring resistor is fed with a constant current and the voltage drop at the resistor is measured as a function of the temperature. Due to the small resistance variation (0.3 to 0.4W/°C) the 4-conductor circuit should always be used to exclude any influences from the lead wires.

**Accuracy, Operating Temperatures:**

Pt100 sensors are, as standard, used with Class B (DIN/IEC 751) measuring resistors (surcharge for DIN Class A or 1/5 DIN Class B accuracy). The specified Tmax values relate to the tip of the sensor. The specified $T_{90}$ times are related to measurements in a moving liquid. The sensor handles and cables are usually resistant to temperatures up to +80 °C. Heat-resistant cables are available on request.

**Measuring ranges, resolution**

PT100 probes FP Axxx are by default assigned measuring range PT100-1 (resolution 0.1 K). Measuring range PT100-2 (resolution 0.01K) can be programmed as alternative on the 1st channel or in addition on the 2nd channel.

*New* Measuring range PT100-3 (resolution 0.001K) in range 0 to 65 °C (for V6 devices, with effect from 2690-8, 2890-9, 85/8690-9, 5690-1/2)

## Measurement Accuracies of Resistor-Based Temperature Sensors

| Designation | Range | Maximum Deviation | | |
|---|---|---|---|---|
| Test resistances | | DIN Class B | DIN Class A | 1/5 DIN Class B |
| Pt 100 Ω | at –200°C | ±1.3 K | | |
| | at –100°C | ±0.8 K | | |
| | at –50°C | | ±0.25 K* | |
| | at 0°C | ±0.3 K | ±0.15 K | ±0.06 K |
| | at +100°C | ±0.8 K | ±0.35 K | ±0.16 K |
| | at +200°C | ±1.3 K | ±0.55 K | ±0.26 K |
| | at + 300°C | ±1.8 K | ±0.75 K | ±0.36 K |
| | at + 400°C | ±2.3 K | | |
| higher accuracies for an additional charges | | | Order no. OPG2 | Order no. OPG5** |

* Range -50 °C only for sheathed sensors with 2mm diameter and bigger

** On request, depending on the sensor design

## Thermistors (NTC Sensors)

NTC sensors (thermistors) have a significantly higher resistance than Pt100 sensors. When measuring temperatures their negative temperature coefficient is utilised, i.e. the resistance is decreasing with increasing temperatures.

**Accuracy, Operating Temperatures:**
The accuracy data of the normalised NTC sensors are based on manufacturer specifications. The specified $T_{max}$ values relate to the tip of the sensor. The specified $T_{90}$ times are related to measurements in a moving liquid. The sensor handles and cables are resistant to temperatures up to 90°C.

**Accuracies**

| Designation | Range | Maximum Deviation |
|---|---|---|
| NTC element | –20 to 0°C | ±0.4 K |
| (10K at 25°C) | 0 to 70°C | ±0.1 K |
| | 70 to 125°C | ±0.6 K |

## Types and Fields of Application

The construction variants of temperature sensors are as many and diverse as the measuring tasks.

$T_{max}$ is the maximum operating temperature of the sensor tip.

$T_{90}$ is the time required by the sensor to reach 90% of the step response after a jump in temperature . The specified $T_{90}$ times refer to measuring operations in a moving liquid.

The temperature sensors listed are also available, on request, with other lengths and diameters

**Surface sensors with flat measuring tip**
For measurements on good heat conductors, on even and plain surfaces.

**Surface sensor with spring-type thermocouple band**
For quick measurements, also on non-plain surfaces.

**Immersion probes**
For measurements in liquids, as well as powdery substances, air and gases.

**Sensors with heat-resistant measuring tip**
For measurements at extremely high temperatures.

**Sensor with penetrating tip**
For measurements in plastic and pasty substances.

**Sword probe**
For measurements in paper, cardboard and textile stacks.

**Transducer with free sensor**
For measurements in air and gases

! If you do not find a suitable sensor in this catalogue, we can manufacture it according to your specifications (technical drawing or detailed specification) and supply you with a customised sensor!

## Temperature Measurement à la ALMEMO®

All ALMEMO® sensors can be adjusted, i.e. the correction values of the sensor can be stored in the connector. This considerably increases the accuracy of measurement.

As a result of the DAkkS and factory-set calibrations performed by us, the corrective factors are automatically determined, stored in the connector plug and locked. Maximum accuracy can then be achieved.

## Ordering Information

ALMEMO® sensors are available in different designs. The type designation can be identified by:

„P“ = temperature sensor with Pt100W test resistance
„N“ = temperature sensor with NTC element
„T“ = temperature sensor with NiCr-Ni element

All temperature sensors with an ALMEMO® flat connector can be identified by the „A“ in the order no.

Naturally, they are also available for the measuring instruments of our THERM series. In this case they will have a circular connector.

When ordering please replace the letter „**A**“ by the number „**9**“.

Example: FT**A**1201 (with ALMEMO® connector) >> FT**9**1201 (with circular connector for THERM devices)

**Describe your measuring task to us!**

**We can provide you with comprehensive advice and find the most cost-effective solution for you.**

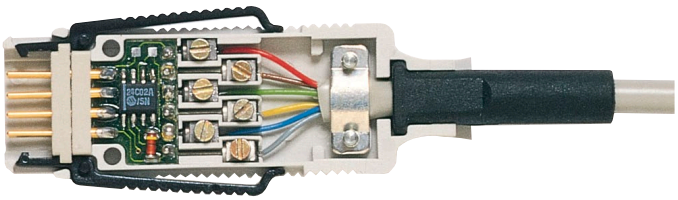
**Please do not hesitate to ask !**

## Use Your Existing Sensor Technology!

The patented idea of the intelligent connector makes the ALMEMO® system an extraordinarily flexible measuring system.

Instead of our pre-configured ALMEMO® sensors you can also use your own, existing sensors.

- We can supply you with pre-programmed ALMEMO® connectors that contain the corresponding sensor parameters and matching measuring ranges. They have six screw terminals and can be easily connected.
- You can correct the errors of the sensors, which means that even simple sensors become precision transducers
- Listing all the combinations and application options would be beyond the scope of this catalogue. Special programming, range extensions and linearisations for other sensor technology are always available for ALMEMO® devices.
- The pricing for this results from the efforts and the number of devices required.



**ALMEMO®sensor connector with 6 terminal screws and EEPROM.**

## Sheathed sensors

- These reasonably priced sensors are for universal use (-200 to +1100 °C) and suitable for immersion measurements in liquids, air, and gases. The sheathed line, depending on diameter, can be bent - within certain limits.
- Different connection variants :
  With cable and ALMEMO® connector Order no. FxAxx,
  with cable and free ends, Order no. Fx0xx.
  Connector options :
  With THERM circular connector : Option T9020RS,
  with miniature Thermo flat connector : Option OT9020FS.

### Thermocouple sheathed sensors FTAxx and FTANxx

| | |
|---|---|
| Measuring element: | FTAxx; NiCr-Ni thermocouple, type K, DIN class 1 (see 07.03)<br>FTANxx; NiCrSi-NiSi thermocouple, type N, DIN class 1 (see 07.03) |
| Sensor tip, sheathed line : | diameter, length, operating temperature; see table; material Inconel 2.4816<br>Here the sensor tip and sheathed line are of the same diameter.<br>These types are therefore also suitable for mounting with clamped screw connections. |
| Cable sleeve : | Brass, hexagonal, L = 65 mm, circumdiameter = 9 mm, operating temp. –40 to +160 °C |
| Standard cable : | New 1.5 meter FEP / silicone thermal line (stranded wire)* Operating temp. -50 to +200°C<br>There is no adverse temperature effect at the juncture from measuring element to cable. |
| Cable options : | Compensation line, PVC / PVC, insulated, operating temperature –20 to +105 °C<br>The compensation line is also available, on request, with FEP / FEP, insulated. |
| ALMEMO® connector | FTAxx NiCr-Ni ZA9020FS with resolution 0.1 K<br>FTANxx NiCrSi-NiSi ZA9021FSN with resolution 0.1 K |

### Pt100 sheathed sensors FPAxx

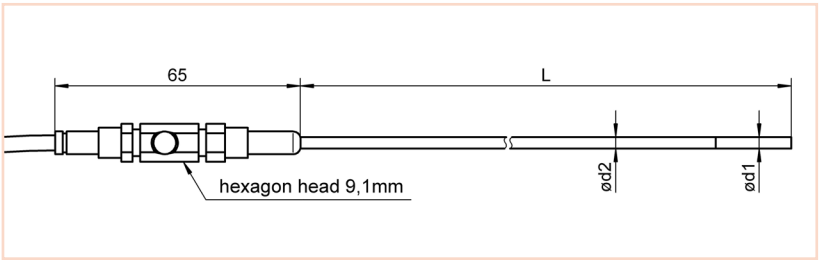
| | |
|---|---|
| Measuring element : | Pt100 4L, DIN class B (see 07.03) |
| Options : | DIN class A, 1/5 DIN class B (see 07.03) |
| Sensor tip : | diameter, length, operating temperature; see table; material stainless steel |
| Sheathed line : | diameter, length; see table; material stainless steel<br>On certain types the sensor tip and sheathed line are of different diameter; (i.e. the sensor tip is thicker). These types are therefore not suitable for mounting with clamped screw connections. Types suitable for clamped screw connections are available on request. |
| Cable sleeve : | Brass, hexagonal, L = 65 mm, circumdiameter = 9 mm, operating temp. –40 to +160 °C |
| Standard cable : | 1.5 meters line, FEP / silicone, insulated, operating temperature –50 to +200 °C |
| Cable options : | Line, PVC / PVC, insulated, operating temperature –20 to +105 °C<br>The line is also available, on request, with FEP / FEP, insulated. |
| ALMEMO® connector | Pt100, ZA9030FS1, with resolution 0.1 K<br>Option : Pt100 ZA9030FS2 with resolution 0.01 K (standard with 1/5 DIN class B) |

### NTC sheathed sensors FNAxx

| | |
|---|---|
| Measuring element : | NTC type N (see 07.04) |
| Sensor tip : | diameter, length, operating temperature; see table; material stainless steel |
| Sheathed line : | diameter, length; see table; material stainless steel<br>On certain types the sensor tip and sheathed line are of different diameter; (i.e. the sensor tip is thicker). These types are therefore not suitable for mounting with clamped screw connections. Types suitable for clamped screw connections are available on request. |
| Cable sleeve : | Brass, hexagonal, L = 65 mm, circumdiameter = 9 mm, operating temp. –40 to +160 °C |
| Standard cable : | 1.5 meters line, PVC / PVC, insulated, operating temperature –20 to +105 °C |
| Cable options : | Line, FEP / silicone, insulated, operating temperature –50 to +200 °C<br>The line is also available, on request, with FEP / FEP, insulated. |
| ALMEMO® connector | NTC, ZA9040FS, with resolution 0.01 K. |

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Sheathed sensors




Sensor with :
Sensor tip, dimensions d1,
sheathed line, dimensions d2,
overall length (including sensor tip) L,
Cable sleeve, dimensions length = 65 mm,
circumdiameter = 9 mm, Cable

## Thermocouple sheathed sensors NiCr-Ni, type K

**Typical Application: universal, in range -40 ° C to 900 ° C**

| Diameter d1=d2 | Operating temperature Sensor tip | Length L | Order no |
|---|---|---|---|
| 0.5 mm | -200...900°C | 50 mm | FTA05L0050 |
| 0.5 mm | -200...900°C | 100 mm | FTA05L0100 |
| 0.5 mm | -200...900°C | 250 mm | FTA05L0250 |
| 0.5 mm | -200...900°C | 500 mm | FTA05L0500 |
| 0.5 mm | -200...900°C | 1000 mm | FTA05L1000 |
| 1.5 mm | -200...1100°C | 100 mm | FTA15L0100 |
| 1.5 mm | -200...1100°C | 250 mm | FTA15L0250 |
| 1.5 mm | -200...1100°C | 500 mm | FTA15L0500 |
| 1.5 mm | -200...1100°C | 1000 mm | FTA15L1000 |
| 3.0 mm | -200...1100°C | 100 mm | FTA30L0100 |
| 3.0 mm | -200...1100°C | 250 mm | FTA30L0250 |
| 3.0 mm | -200...1100°C | 500 mm | FTA30L0500 |
| 3.0 mm | -200...1100°C | 1000 mm | FTA30L1000 |

| Connection cable | Operative range | Length | Order no |
|---|---|---|---|
| FEP/silicone Thermal line (stranded wire) | -50...200°C | 1.5 m | default |
| | | 5 m | OTK01L0050 |
| PVC/PVC Compensation line | -20...105°C | 1.5 m | OTK02L0015 |
| | | 5 m | OTK02L0050 |

## Thermocouple sheathed sensors NiCrSi-NiSi, type N

**Typical application: in the range -200 ° C to 1150 ° C, long-term stability at high temperatures**

| Diameter d1=d2 | Operating temperature Sensor tip | Length L | Order no |
|---|---|---|---|
| 1.5 mm | -200...1150°C | 500 mm | FTAN15L0500 |
| 1.5 mm | -200...1150°C | 750 mm | FTAN15L0750 |
| 1.5 mm | -200...1150°C | 1000 mm | FTAN15L1000 |
| 3.0 mm | -200...1150°C | 500 mm | FTAN30L0500 |
| 3.0 mm | -200...1150°C | 750 mm | FTAN30L0750 |
| 3.0 mm | -200...1150°C | 1000 mm | FTAN30L1000 |
| 6.0 mm | -200...1150°C | 500 mm | FTAN60L0500 |
| 6.0 mm | -200...1150°C | 750 mm | FTAN60L0750 |
| 6.0 mm | -200...1150°C | 1000 mm | FTAN60L1000 |

| Connection cable | Operative range | Length | Order no |
|---|---|---|---|
| FEP/silicone Thermal line (stranded wire) | -50...200°C | 1.5 m | default |
| | | 5 m | OTNK01L0050 |

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Resistor-based sensors Pt100 4L

**Typical Application: universal, in range -40°C to 500°C**

| Diameter d1 Sensor tip | Diameter d2, Sheathed line | Operating temp. Sensor tip | Length L | Order no. |
|---|---|---|---|---|
| 1.5 mm | 1.5 mm** | -40...500°C | 100 mm | FPA15L0100 |
| 1.5 mm | 1.5 mm** | -40...500°C | 250 mm | FPA15L0250 |
| 1.5 mm | 1.5 mm** | -40...500°C | 500 mm | FPA15L0500 |
| 2.2 mm* | 2.0 mm | -40...500°C | 100 mm | FPA22L0100 |
| 2.2 mm* | 2.0 mm | -40...500°C | 250 mm | FPA22L0250 |
| 2.2 mm* | 2.0 mm | -40...500°C | 500 mm | FPA22L0500 |
| 3.2 mm* | 2.8 mm | -40...500°C | 100 mm | FPA32L0100 |
| 3.2 mm* | 2.8 mm | -40...500°C | 250 mm | FPA32L0250 |
| 3.2 mm* | 2.8 mm | -40...500°C | 500 mm | FPA32L0500 |

* This sensor type (reinforced tip) is not suitable for clamped screw connections.
Suitable types FPA20Lx or FPA30Lx with same end-to-end diameter are available on request.
** Too strong bending of / kinking of the sheathed line should be avoided.

| Options | Order no. |
|---|---|
| **PT100 measuring resistor** | |
| Accuracy | |
| Class B | default |
| Class A | OPG2 |
| Class 1/5 DIN Class B | OPG5 |
| **Ceramic measuring resistor** | |
| operating range -200 ... 600 ° C | OPM1 |

| Connection cable | Operative range | Length | Order no. |
|---|---|---|---|
| FEP/silicone | -50...200°C | 1.5 m<br>5 m | default<br>OPK01L0050 |
| PVC/PVC | -20...105°C | 1.5 m<br>5 m | OPK02L0015<br>OPK02L0050 |

## Resistor-based sensors NTC

**Typical Application: universal, in range 0°C to typ. 70°C**

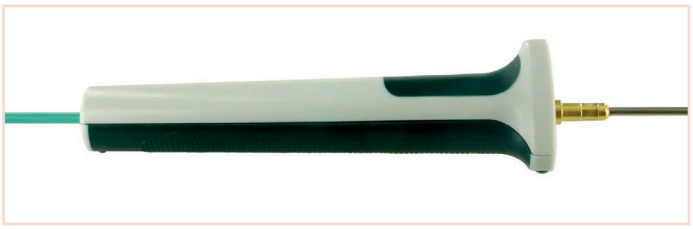
| Diameter d1 Sensor tip | Diameter d2, Sheathed line | Operating temp. Sensor tip | Length L | Order no. |
|---|---|---|---|---|
| 2.0 mm | 2.0 mm | -20...100°C | 100 mm | FNA20L0100 |
| 2.0 mm | 2.0 mm | -20...100°C | 250 mm | FNA20L0250 |
| 2.0 mm | 2.0 mm | -20...100°C | 500 mm | FNA20L0500 |
| 3.2 mm* | 2.8 mm | -20...100°C | 100 mm | FNA32L0100 |
| 3.2 mm* | 2.8 mm | -20...100°C | 250 mm | FNA32L0250 |
| 3.2 mm* | 2.8 mm | -20...100°C | 500 mm | FNA32L0500 |

* This sensor type (reinforced tip) is not suitable for clamped screw connections.
Suitable types with same end-to-end diameter are available on request.

| Connection cable | Operative range | Length | Order no. |
|---|---|---|---|
| PVC/PVC | -20...105°C | 1.5 m<br>5 m | default<br>OPK02L0050 |

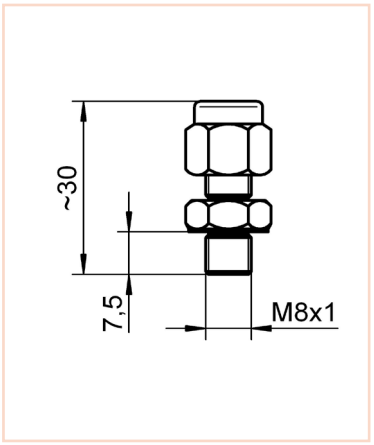
DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Handle for sensors with hexagonal cable sleeve



Option Handle including fitting **Order no. OFH1**

## Clamp srew connection ZT943xKV




**Operative range**
For sheath elements

**Option:**
Notched steel ring
(once fitted, cannot be removed),
$T_{max}$ = 800 °C
For ZT9431KV
Order no. OT9431ST
For ZT9432KV
Order no. OT9432ST

| **Variants** (with PTFE clamping ring) | **Order no.** |
|---|---|
| for types FTA15Lxxxx, FPA16Lxxxx | **ZT9431KV** |
| for types FTA30Lxxxx, FPA30Lxxxx and FNA30Lxxxx | **ZT9432KV** |

### Technical data

| | |
|---|---|
| Operating temperature | up to maximum 250 °C<br>with option up to 800 °C |
| Thread | M8x1, 14 AF |

## Heat-conducting paste ZB9000WP

For surface measurement, operative range -30 to +200 °C, heat-conducting paste, tube, 12 ml **Order no. ZB9000WP**



DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni-sensor FTA 15 P

For immersion measurement

Meas. element: NiCr-Ni Class 1 *
Measuring tip: Operative range -200...+1100 °C
200x1.5 mm, sheathed line, Inconel
$T_{90}$: * 1.5 s
Cable: approx. 1.4 m FEP/silicone
with spray-coated ALMEMO® connector

L = 200 mm **Order no. FTA15P**
Sensor with handle **Order no. FTA15PH**
(No variants available)

## Pt100-sensor FPA 32 P

For immersion measurement

Meas. element: Pt100, Class B *
Measuring tip: Operative range -40...+500 °C
200 x 2.8/3.2 mm, sheathed line
$T_{90}$: * 10 s
Cable: approx. 1.4 m PVC
with spray-coated ALMEMO® connector

L = 200 mm **Order no. FPA32P**
Sensor with handle **Order no. FPA32PH**
(No variants available)

## NTC-sensor FNA 305


For Indoor air measurements

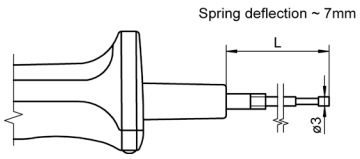
Meas. element NTC*
Measuring tip Operative range -10 to +60 °C
(non-condensing)
Protective tube in stainless steel
Diameter = 3.0mm, length = 50 mm
mounted directly on ALMEMO® connector
$T_{90}$ 8 s

L = 50 mm **Order no. FNA305**
(No variants available)

* For general technical data, see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni sensor with handle FTA 120x

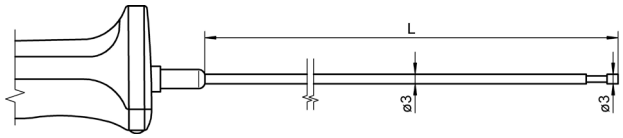



For surface measurement and immersion measurement

Meas. element: NiCr-Ni class 1 *
Measuring tip: Operative range -200...+400 °C
Silver rivet, level, spring-loaded,
not electrically isolated
$T_{90}$: * 3 s
Handle: * 138 mm
Cable: 1.5 m PVC

L = 30 mm **Order no. FTA1201**
L = 150 mm **Order no. FTA1202**

## NiCr-Ni sensor with handle FTA 122 LxxxxH

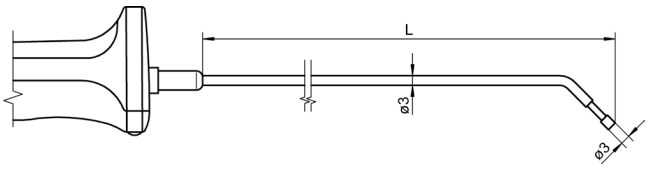



For surface measurement and immersion measurement

Meas. element: NiCr-Ni class 1 *
Measuring tip: Operative range -200...+400 °C
Silver rivet, level, not electr. isolated
$T_{90}$: * 3 s
Handle: * 127 mm
Cable: *new* 1.5 m FEP/silicone thermal line**

L = 50 mm **Order no. FTA122L0050H**
L = 100 mm **Order no. FTA122L0100H**
L = 200 mm **Order no. FTA122L0200H**

## NiCr-Ni sensor with handle FTA 121 LxxxxH

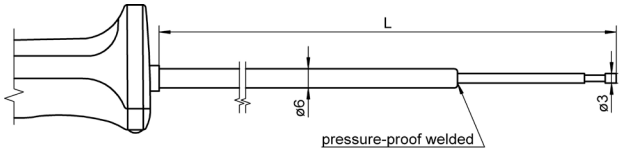



For surface measurement and immersion measurement

Meas. element: NiCr-Ni class 1 *
Measuring tip: Operative range -200...+400 °C
Silver rivet, level, angled,
not electrically isolated
$T_{90}$: * 3 s
Handle: * 127 mm
Cable: *new* 1.5 m FEP/silicone thermal line**

L = approx. 50 mm **Order no. FTA121L0050H**
L = approx. 200 mm **Order no. FTA121L0200H**

## NiCr-Ni sensor with handle FTA 150 LxxxxH




For surface measurement and immersion measurement

Meas. element: NiCr-Ni class 1 *
Measuring tip: Operative range -200...+800 °C
(for brief periods1000°C)
Stainless-steel rivet, level,
electrically isolated
$T_{90}$: * 3 s
Handle: * 127 mm
Cable: *neu:* 1.5 m FEP/silicone thermal line**

L = 350 mm **Order no. FTA150L0350H**
L = 700 mm **Order no. FTA150L0700H**
L = 1250 mm **Order no. FTA150L1250H**

* For general technical data, see page 07.03.
** There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Temperature



## NiCr-Ni sensor FTA 109 P

For surface measurement

Meas. element: NiCr-Ni class 2 *
Measuring tip: Operative range -50...+500 °C
Thermal ribbon, not electr. isolated
Measuring head approx. 15 mm diameter
$T_{90}$: * 1 s
Cable: approx. 1.5 m PVC

L = approx. 180 mm **Order no. FTA109P**
Sensor with handle **Order no. FTA109PH**
(No variants available)

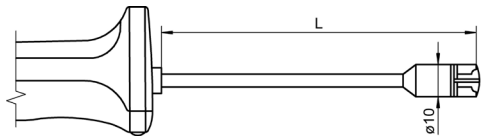
## NiCr-Ni sensor FTA 104 P

For surface measurement

Meas. element: NiCr-Ni class 2 *
Measuring tip: Operative range -50...+500 °C
Thermal ribbon, not electr. isolated
Measuring head approx. 15 mm diameter
$T_{90}$: * 1 s
Cable: approx. 1.5 m PVC

L = approx. 180 mm,
with 90° angle, approx. 50 mm **Order no. FTA104P**
Sensor with handle **Order no. FTA104PH**
(No variants available)

## NiCr-Ni sensor with handle FTA 153 LxxxxH

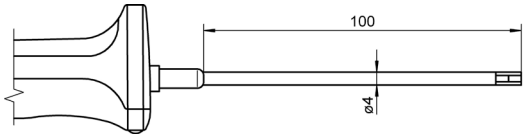



For surface measurement

Meas. element: NiCr-Ni class 2 *
Measuring tip: Operative range -200...+250 °C
Thermal ribbon, crossed,
not electrically isolated
$T_{90}$: * 1.5 s
Handle: * 127 mm
Cable: 1.5 m PVC

L = 100 mm **Order no. FTA153L0100H**
L = appr. 180 mm angled 45°, 160/50mm
**Order no. FTA1533L0180H**

## NiCr-Ni sensor with handle FTA 1535 LxxxxH



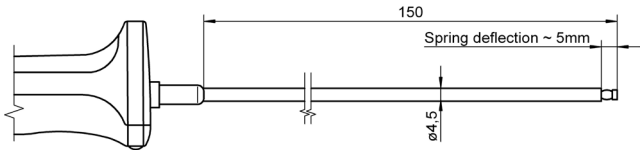

For surface measurement

Meas. element: NiCr-Ni class 2 *
Measuring tip: Operative range -200...+250 °C
Thermal ribbon, not electr. isolated
$T_{90}$: * 2 s
Handle: * 127 mm
Cable: 1.5 m PVC

L = 100 mm **Order no. FTA1535L0100H**

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni sensor with handle FTA 420 LxxxxH

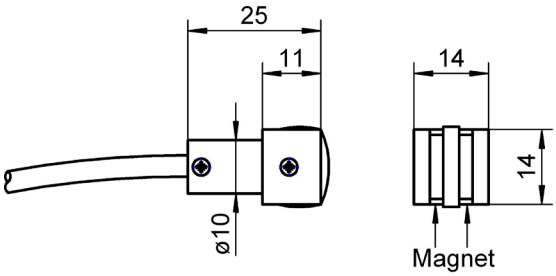



For surface measurement on level surfaces

Meas. element: NiCr-Ni Class 1 *
Measuring tip: Operative range -50...+500 °C
Silver disc, spring-loaded,
not electrically isolated
$T_{90}$: * 2 s
Handle: * 127 mm
Cable: 1.5 m PVC

L = 150 mm **Order no. FTA420L0150H**

## NiCr-Ni sensor FTA 025 P




Magnet sensor for surface measurement

Meas. element: NiCr-Ni Class 2 *
Measuring tip: Operative range -50...+300 °C
Thermal ribbon, not electr. isolated
Fastened by magnet
$T_{90}$: * 1.5 s
Cable: approx. 2 m PVC

Magnet sensor
(No variants available) **Order no. FTA025P**

Magnet sensor with Velcro fastener e.g. for pipework

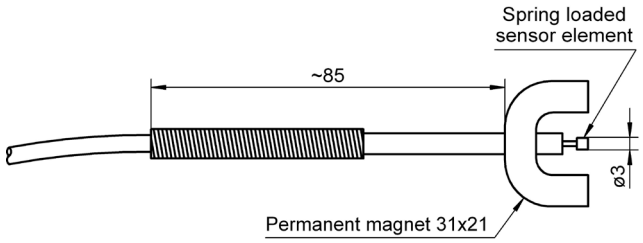
Klettband: approx. 400 mm,
for pipe diameter appr. 10 to 75 mm
Operating range: -10 ... +110 °C
mounted on sensor tip

Magnet sensor, including Velcro fastener
**Order no. FTA025PKB**



DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni sensor FTA 131

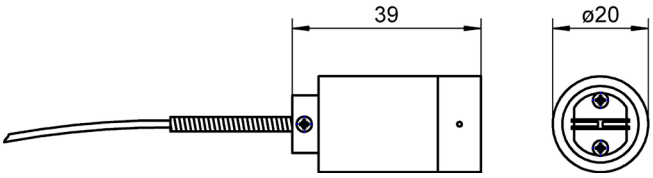



Magnet sensor For surface measurement

Meas. element: NiCr-Ni Class 2 *
Measuring tip: Operative range -50...+100 °C
Silver rivet, level, spring-loaded,
not electrically isolated
Fastened by magnet
$T_{90}$: * 3 s
Cable: 3 m FEP/silicone

Magnet sensor **Order no. FTA131**

## NiCr-Ni sensor FTA 026 P

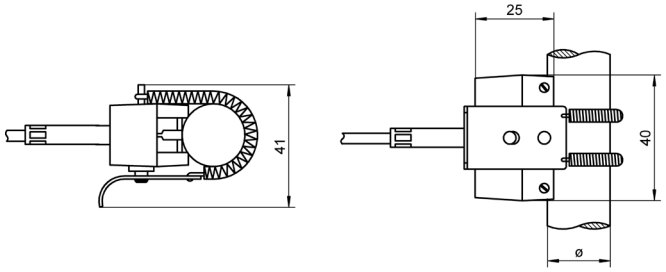



For surface measurement

Meas. element: NiCr-Ni Class 1 *
Measuring tip: Operative range -50...+300 °C
Thermal ribbon,
not electrically isolated
$T_{90}$: * 1.5 s
Cable: approx. 0.9 m line, fabric insulation

Ribbon sensor **Order no. FTA026P**
(No variants available)

## NiCr-Ni sensor FTA 8068

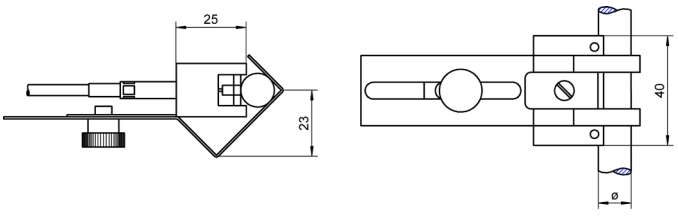



For surface measurement on pipes

Meas. element: NiCr-Ni Class 2 *
Measuring tip: Operative range -50...+120 °C
Thermal ribbon, not electr. isolated
Fastened by pipe clamp
(spring-loaded)
$T_{90}$: * 3 s
Pipe diameter: 12...25 mm
Cable: 1.2 m PVC

Pipe clamp sensor **Order no. FTA8068**

## NiCr-Ni sensor FTA 8069




For surface measurement on pipes

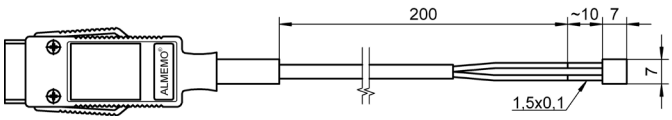
Meas. element: NiCr-Ni Class 2 *
Measuring tip: Operative range -50...+120 °C
Thermal ribbon, not electr. isolated
Fastened by pipe clamp
$T_{90}$: * 3 s
Pipe diameter: 12...30 mm
Cable: 1.2 m PVC

Pipe clamp sensor **Order no. FTA8069**

* For general technical data, see page 07.03.

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni film thermocouple FTA 683



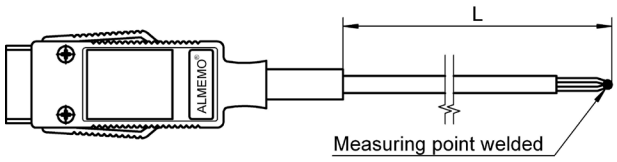

For surface measurement

Meas. element: NiCr-Ni Class 2*
Measuring tip: Operative range -100 to +200°C
Folie, Insulation Kresol
$T_{90}$: * 2 s

*new* With permanently connected FEP / silicone thermal line (stranded wire)**
-50 to +200°C, 2 meters, with ALMEMO® connector
**Order no. FTA683**

Measuring element without cable, free ends
(for your own sensors) **Order no. FT0683**

## NiCr-Ni sensor FTA 390 x



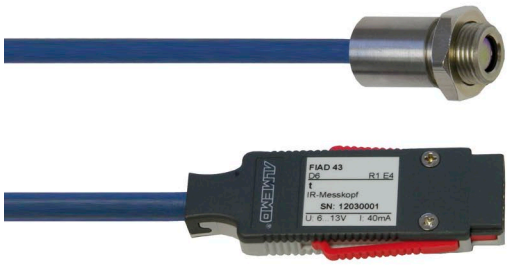

For surface measurement

Meas. element: NiCr-Ni Class 2 *
Measuring tip: Thermowire, welded,
not electrically isolated
$T_{90}$: * 3 s
Wire: 1.5 m

Insulation, glass fiber,
Operative range -25...+400 °C **Order no. FTA3900**
Insulation FEP,
Operative range -200...+205 °C **Order no. FTA39010**

* For general technical data, see page 07.03.
** There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

## Digital infra-red sensor for measuring surface temperature FIAD43



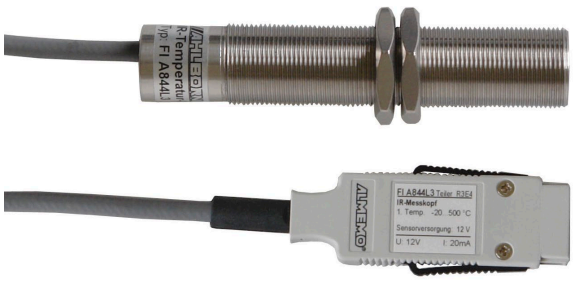

Operative range: -40...600 °C,
Miniature probe head, with cable and ALMEMO® D6 plug
and 1 mounting nut

Cable length = 1 m **Order no. FIAD4332**
Cable length = 3 m **Order no. FIAD4332L3**

For technical data, see page 07.34

DAkkS or factory calibration KI9xxx temperature for digital sensor (see chapter Calibration certificates)

## Compact infra-red probe head FIA844




Operative range: -20...500 °C,
Probe head, with cable and ALMEMO® plug
and 2 mounting nuts

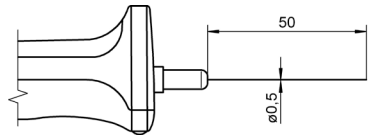
Cable length = 1 m **Order no. FIA844**
Cable length = 3 m **Order no. FIA844L3**

For technical data, see page 07.36

Factory calibration KI9xxx temperature for sensor (see chapter Calibration certificates)

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni sensor with handle FTA 05 L0050H

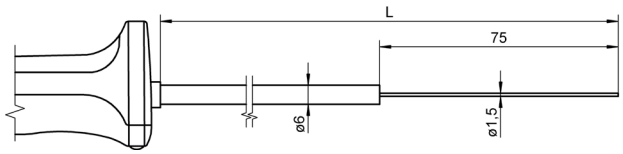



For immersion measurement

Meas. element: NiCr-Ni Class 1 *
Measuring tip: Operative range -200...+500 °C
Sheathed line, Inconel
$T_{90}$: * 0.8 s
Handle: * 127 mm
Cable: *new* 1.5 m FEP/silicone thermal line**

L = 50 mm **Order no. FTA05L0050H**

## NiCr-Ni sensor with handle FTA 125 LxxxxH

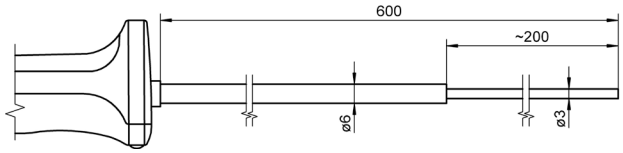



For immersion measurement

Meas. element: NiCr-Ni Class 1 *
Measuring tip: Operative range -200...+800 °C
Sheathed line, Inconel
$T_{90}$: * 1.5 s
Handle: * 127 mm
Cable: *new* 1.5 m FEP/silicone thermal line**

L = 300 mm **Order no. FTA125L0300H**

## NiCr-Ni sensor with handle FTA 126 LxxxxH

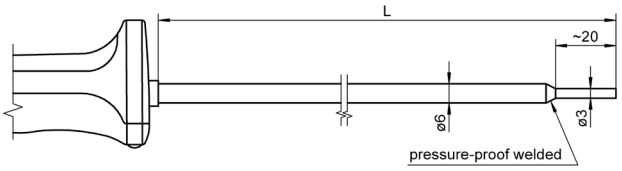



For immersion measurement

Meas. element: NiCr-Ni Class 1 *
Measuring tip: Operative range -200...+900 °C
Sheathed line, Inconel
$T_{90}$: * 2.5 s
Handle: * 127 mm
Cable: *new* 1.5 m FEP/silicone thermal line**

L = 600 mm **Order no. FTA126L0600H**

## NiCr-Ni sensor with handle FTA 1261 LxxxxH




For immersion measurement in plastic and pasty substances, e.g. bitumen

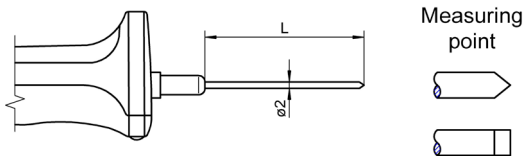
Meas. element: NiCr-Ni Class 1 *
Measuring tip: Operative range -200...+500 °C
Sheathed line, Inconel
$T_{90}$: * 3 s
Handle: * 127 mm
Cable: *neu:* 1.5 m FEP/silicone thermal line**

L = 150 mm **Order no. FTA1261L0150H**
L = 300 mm **Order no. FTA1261L0300H**

* For general technical data, see page 07.03.
** There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni sensor with handle FTA 123 LxxxxH

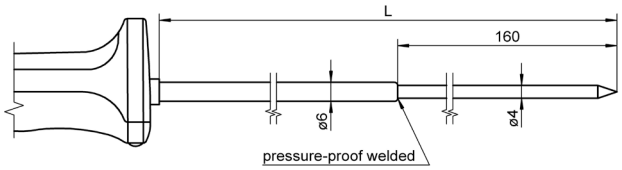



For immersion measurement in plastic and pasty substances

| | |
|---|---|
| Meas. element: | NiCr-Ni Class 1 * |
| Measuring tip: | Operative range -200...+300 °C<br>Penetrating tip |
| $T_{90}$: * | 3 s |
| Handle: * | 127 mm |
| Cable: *new* | 1.5 m FEP/silicone thermal line** |

| | |
|---|---|
| L = 50 mm | **Order no. FTA123L0050H** |
| L = 100 mm | **Order no. FTA123L0100H** |

## NiCr-Ni sensor with handle FTA 1231 LxxxxH




For immersion measurement in plastic and pasty substances

| | |
|---|---|
| Meas. element: | NiCr-Ni Class 1 * |
| Measuring tip: | Operative range -200...+400 °C<br>Penetrating tip, cone<br>stainless steel 1.4541 |
| $T_{90}$: * | 6 s |
| Handle: * | 127 mm |
| Cable: *new* | 1.5 m FEP/silicone thermal line** |

| | |
|---|---|
| L = 250 mm | **Order no. FTA1231L0250H** |

* For general technical data, see page 07.03.
** There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03



DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni thermowire T 190-0

Thermowire: NiCr-Ni, class 2*
Insulation : Glass fiber (wires and sheath)
Operating temp.: -25°C to +400°C
Wire diameter: 0.5 mm
External diameter: approx. 1.3 x 2.1 mm

NiCr-Ni thermowire per meter
with glass fiber covering **Order no. LT01900**

NiCr-Ni thermowire sensor, welded tip, with
ALMEMO® connector 1.5m long **Order no. FTA3900**
ALMEMO® connector 5m long **Order no. FTA3900L05**

## NiCr-Ni thermowire T 190-1

Thermowire: NiCr-Ni, Class 2*
Insulation : Glass fiber (wires and sheath)
Operating temp.: -25°C to +400°C
Wire diameter: 0.2 mm
External diameter: approx. 0.6 x 1.0 mm

NiCr-Ni thermowire per meter
with glass fiber covering **Order no. LT01901**

NiCr-Ni thermowire sensor, welded tip, with
ALMEMO® connector 1.5 m long **Order no. FTA3901**
ALMEMO® connector 5m long **Order no. FTA3901L05**

## NiCr-Ni thermowire T 190-2

Thermowire: NiCr-Ni, Class 2*
Insulation : PVC (wires and sheath)
Operating temp.: -10°C to +105°C
Wire diameter: 0.5 mm
External diameter: approx. 2.2 x 3.4 mm

NiCr-Ni thermowire per meter
with PVC insulation **Order no. LT01902**

NiCr-Ni thermowire sensor, welded tip, with
ALMEMO® connector 1.5 m long **Order no. FTA3902**
ALMEMO® connector 5 m long **Order no. FTA3902L05**

## NiCr-Ni thermowire T 190-3

Thermowire: NiCr-Ni, Class 2*
Insulation : Silicone (wires and sheath)
Operating temp.: -45°C to +200°C
Wire diameter: 0.5 mm
External diameter: approx. 4 mm

NiCr-Ni thermowire per meter
with silicone insulation **Order no. LT01903**

NiCr-Ni thermowire sensor, welded tip, with
ALMEMO® connector 1.5 m long **Order no. FTA3903**
ALMEMO® connector 5 m long **Order no. FTA3903L05**

* For general technical data, see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NiCr-Ni thermowire T 190-10

Thermowire: NiCr-Ni, class 2*
Insulation : FEP (Wires and sheath)
Operating temp.: -200°C to +205°C
Wire diameter: 0.5 mm
External diameter: approx. 1.5 x 2.5 mm

NiCr-Ni thermowire per meter with FEP insulation **Order no. LT019010**

NiCr-Ni thermowire sensor, welded tip, with
ALMEMO® connector 1.5m long **Order no. FTA39010**
ALMEMO® connector 5m long **Order no. FTA39010L05**

## NiCr-Ni thermowire T 190-11

Thermowire: NiCr-Ni, class 2*
Insulation : FEP (Wires and sheath)
Wire diameter: 0.2 mm
External diameter: approx. 1.3 x 2.0 mm

NiCr-Ni thermowire per meter with FEP insulation **Order no. LT019011**

NiCr-Ni thermowire sensor, welded tip, with
ALMEMO® connector 1.5m long **Order no. FTA39011**
ALMEMO® connector 5m long **Order no. FTA39011L05**

## NiCr-Ni thermowire T 190-7

Nur für trockene, nicht agressive Umgebung!

Thermowire: NiCr-Ni, Class 2*
Insulation : Ceramic fiber (Wires and sheath)
Operating temp.: -40°C to +1200°C
Wire diameter: 0.8 mm
External diameter: approx. 3 x 4 mm

NiCr-Ni thermowire per meter with ceramic fiber insulation **Order no. LT01907**

NiCr-Ni thermowire sensor, welded tip, with
ALMEMO® connector 1.5m long **Order no. FTA3907**
ALMEMO® connector 5m long **Order no. FTA3907L05**

## NiCr-Ni compensation line T 191-1

**Other types are available on request.**
LT01912 Insulation Silicone/silicone/glass filament, up to 200°C
LT01913 Insulation PVC / screening film / PVC, up to 105°C

compensation line: NiCr-Ni
Insulation : PVC (Wires and sheath)
Operating temp.: -10°C to +105°C
Wire diameter: 0.5 mm
External diameter: approx. 3.6 mm

NiCr-Ni bunched conductor with PVC insulation, for each meter **Order no. LT01911**

## NiCr-Ni thermal line (Litze) T 191-6

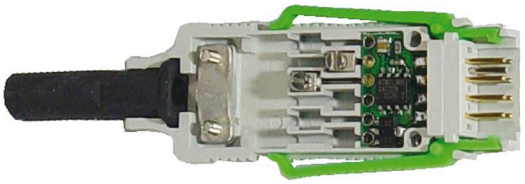
Thermal line (stranded wire)**: NiCr-Ni*
Insulation: Wires : FEP, sheath : silicone
Operating temp.: -50...+200°C
Wire diameter: 0.7 mm
External diameter: approx. 3.8 mm

NiCr-Ni thermal line (stranded wire) with FEP / silicone insulation, per meter **Order no. LT01916**

* For general technical data, see page 07.03.
** There is no adverse temperature effect at the juncture from measuring element to cable. see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## ALMEMO® connector for thermocouples (see Chapter Input connectors)



**For Types K, N, L, J, T**
(no thermo-electric transition / with thermal material)

| | |
|---|---|
| NiCr-Ni (K) | **Order no. ZA9020FS** |
| NiCroSil-NiSil (N) | **Order no. ZA9021FSN** |
| Fe-CuNi (L) | **Order no. ZA9021FSL** |
| Fe-CuNi (J) | **Order no. ZA9021FSJ** |
| Cu-CuNi (T) | **Order no. ZA9021FST** |

**For Types U, S, R, B, AuFe-Cr**

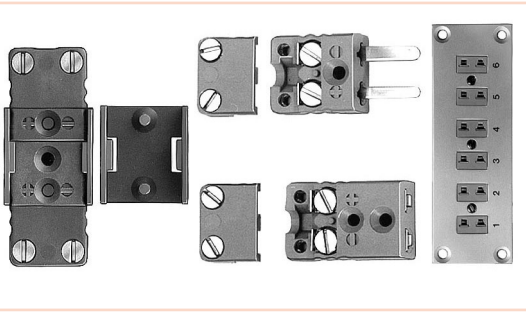
| | |
|---|---|
| Cu-CuNi (U) | **Order no. ZA9000FSU** |
| PtRh10-Pt (S) | **Order no. ZA9000FSS** |
| PtRh13-Pt (R) | **Order no. ZA9000FSR** |
| PtRh30-PtRh6 (B) | **Order no. ZA9000FSB** |
| AuFe-Cr (A) | **Order no. ZA9000FSA** |

## ALMEMO® adapter plug with miniature flat socket


**For Types K, J, T, S**

| | |
|---|---|
| NiCr-Ni (K) | **Order no. ZKA029RA** |
| Fe-CuNi (J) | **Order no. ZJA029RA** |
| Cu-CuNi (T) | **Order no. ZTA029RA** |
| PtRh-Pt (S) | **Order no. ZSA029RA** |

## Miniature flat connectors for thermocouples types K, J, T, S, E



**Examples for NiCr-Ni (K):**

| | |
|---|---|
| NiCr-Ni flat socket | **Order no. ZK9029FB** |
| NiCr-Ni flat connector | **Order no. ZK9029FS** |
| Locking plate (10 pieces) | **Order no. ZB9026VP** |
| NiCr-Ni single built-in socket | **Order no. ZK9029FE** |
| 1-row panel with NiCr-Ni socket | **Order no. ZK9029FB1** |
| 6-row panel with NiCr-Ni socket | **Order no. ZK9029FB6** |

- Connectors with thermo contacts for avoiding voltage corruption at thermocouple junctions.
- For ambient temperatures –183 to +200 °C.
- Locking plate for complete coupling.

Order numbers for the above examples are compiled from the following coding elements : Z①9029F②③.

The coding elements can be taken from the table below.

**Ordering:**

| Type ① | Color (IEC 584) | Variant ② | Panel ③ | Panel dimensions |
|---|---|---|---|---|
| NiCr-Ni (K) | green | Male connector = S | 1-er (1-rhg) | 38 x 38 x 2.5 mm |
| Fe-CuNi (J) | black | Female connector = B | 6-er (1-rhg) | 113 x 38 x 2.5 mm |
| Cu-CuNi (T) | brown | | 12-er (1-rhg) | 203 x 38 x 2.5 mm |
| NiCr-CuNi (E) | lilac | | 24-er (2-rhg) | 203 x 76 x 2.5 mm |
| PtRh-Pt (S) | orange | | | mounting depth: 25.4 mm |

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pt100 cable sensor

Inexpensive resistance-based temperature sensors, for universal use. For immersion measurements in air and gases. Rigid protective tube made from stainless steel
A wide variety of cable variants.
Operating temperature (depending on variant) -40 to +400°C.

## Technical features

**Measuring element :** Pt100 4L, DIN class B, For technical data see page 07.03.
**Protective tube:** Diameter, length see Variants, stainless steel 1.4301
**Junction of protective tube / connecting cable:** Direct, hard-crimped for dry uses
**Cables:** Length = 1.5 meters, Other lengths are available as options. Cable diameter is never larger than the diameter of the protective tube.
**Operating temperature:** see variants, Always for whole sensor (i.e. sensor tip and cable)
**ALMEMO® connector:** Pt100 ZA9030FS2 with resolution 0.01 K .

## Variants

### With FEP / FEP cable (black),

**Operative range -40...+250°C:**

| Diameter | Length | Order no. |
|---|---|---|
| 3.0 mm | 50 mm | **FPA30K03L0050** |
| 3.0 mm | 100 mm | **FPA30K03L0100** |
| 4.0 mm | 50 mm | **FPA40K03L0050** |
| 4.0 mm | 100 mm | **FPA40K03L0100** |

**A longer cable is available as an option**

| | |
|---|---|
| Total length 5 m | OPK03L0050 |
| Total length 10 m | OPK03L0100 |

### With FEP / silicone cable (red),

**Operative range -40...+200°C:**

| Diameter | Length | Order no. |
|---|---|---|
| 5.0 mm | 50 mm | **FPA50K01L0050** |
| 5.0 mm | 100 mm | **FPA50K01L0100** |
| 6.0 mm | 50 mm | **FPA60K01L0050** |
| 6.0 mm | 100 mm | **FPA60K01L0100** |

**A longer cable is available as an option**

| | |
|---|---|
| Total length 5 m | OPK01L0050 |
| Total length 10 m | OPK01L0100 |

### Cable with glass-fiber / glass-fiber / VA wire shielding,

**Operative range -40...+400°C:**

| Diameter | Length | Order no. |
|---|---|---|
| 5.0 mm | 50 mm | **FPA50K06L0050** |
| 5.0 mm | 100 mm | **FPA50K06L0100** |
| 6.0 mm | 50 mm | **FPA60K06L0050** |
| 6.0 mm | 100 mm | **FPA60K06L0100** |

**A longer cable is available as an option**

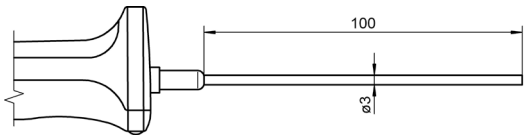
| | |
|---|---|
| Total length 5 m | OPK06L0050 |
| Total length 10 m | OPK06L0100 |

**Other designs are available on request:**

Pt100 cable sensors FPA30K20L0020 vapor-tight (protective class IP69K), inter alia for temperature measuring in autoclaves, sterilizing units, high-temperature steam applications, vacuum applications, freeze drying units, -30. to +150 °C, protective tube in stainless steel with PFA cable.

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pt100 sensor with handle FPA 106 LxxxxH

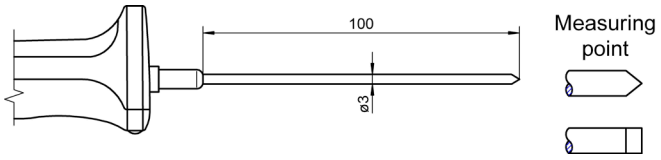



Meas. element: Pt100, class B *
Measuring tip: Operative range -40...+500 °C
Sheath element, stainless steel
$T_{90}$: * 8 s
Handle: * 127 mm
Cable: 1.5 m FEP/silicone

L = 100 mm **Order no. FPA106L0100H**

For immersion measurement

## Pt100 sensor with handle FPA 123 LxxxxH

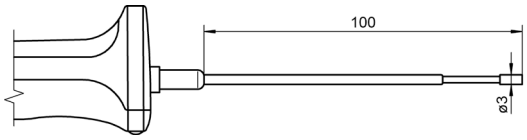



Meas. element: Pt100, Class B *
Measuring tip: Operative range -40...+500 °C
Penetrating tip
$T_{90}$: * 8 s
Handle: * 127 mm
Cable: 1.5 m FEP/silicone

L = 100 mm **Order no. FPA123L0100H**

For immersion measurement in plastic and pasty substances

## Pt100 sensor with handle FPA 124 LxxxxH




Meas. element: Pt100, Class B *
Measuring tip: Operative range -40...+300 °C
Silver rivet, level
$T_{90}$: * 10 s
Handle: * 127 mm
Cable: 1.5 m FEP/silicone

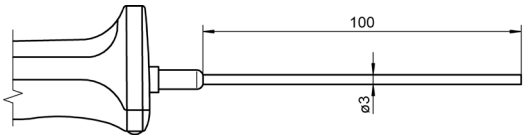
L = 100 mm **Order no. FPA124L0100H**

For surface measurement and immersion measurement

* For general technical data, see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## NTC sensor with handle FNA 106 LxxxxH

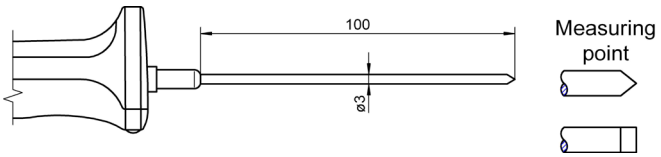



For immersion measurement

Meas. element: NTC *
Measuring tip: Operative range -20...+100 °C
Sheath element, stainless steel
$T_{90}$: * 8 s
Handle: * 127 mm
Cable: 1.5 m PVC

L = 100 mm **Order no. FNA106L0100H**

## NTC sensor with handle FNA 123 LxxxxH

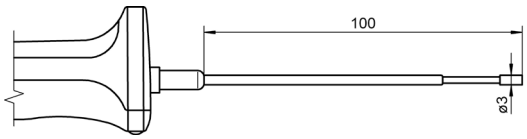



For immersion measurement in plastic and pasty substances

Meas. element: NTC *
Measuring tip: Operative range -20...+100 °C
Penetrating tip
$T_{90}$: * 8 s
Handle: * 127 mm
Cable: 1.5 m PVC

L = 100 mm **Order no. FNA123L0100H**

## NTC sensor with handle FNA 124 LxxxxH




For surface measurement and immersion measurement

Meas. element: NTC *
Measuring tip: Operative range -20...+100 °C
Silver rivet, level
$T_{90}$: * 10 s
Handle: * 127 mm
Cable: 1.5 m PVC

L = 100 mm **Order no. FNA124L0100H**

## NTC sensor FNA 305


For room air measurement

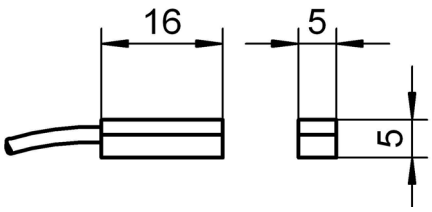
Meas. element: NTC*
Measuring tip: Operative range -10...+60°C
(non-condensing), Protective tube
in stainless steel
diameter = 3.0mm, length = 50mm
mounted directly on ALMEMO® connector
$T_{90}$: 8 s

L = 50 mm **Order no. FNA305**
(No variants available)

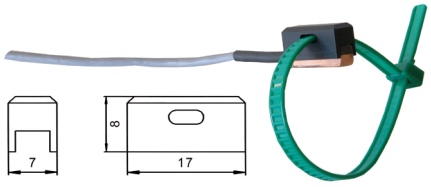
* For general technical data, see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pt100 sensor FPA 611 x




For surface measurement



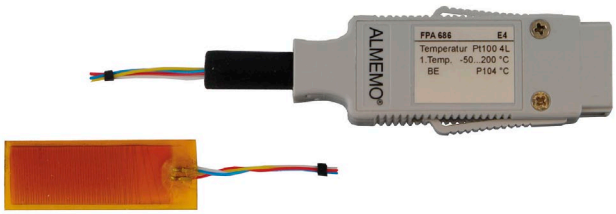

Meas. element: Pt100, class B *
Measuring tip: Operative range see below
Copper, level
*new* Improved thermal transfer thanks to innovative sensor element and new contact technology
$T_{90}$: * 20 s
Cable: see below

Surface sensor
-10...+90°C, Cable PVC, 2 m **Order no. FPA611**

-10...+110°C, Cable, PFA, 3m for more demanding mechanical stress ALMEMO® connector, resolution 0.01 K
**Order no. FPA611S01**

Accessories
Fixture for fastening
with cable ties **Best-Nr. ZB9611RM**

## Pt100 film sensor FPA 686

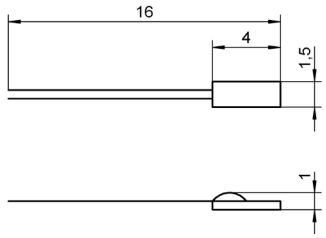



For surface measurement

Meas. element: Pt100, class B*, gewickelt
Messfläche: Operative range -50...+200 °C,
temperature-resistant foil,
15 x 40 mm, approx. 0.5 mm thick
$T_{90}$*: 2 s
Cable: Stranded wire PFA, 4-wire twisted

Length 2 m **Order no. FPA686**
Length 10 m **Order no. FPA686L10**

## Pt100 ceramic chip sensor element FP 0802




Unprotected sensor element for constructing your own sensors

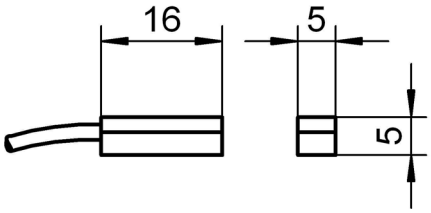
Meas. element: Pt100, Class B *
Measuring tip: Operative range -40...+400 °C
Ceramic chip sensor
Connection wires: 10 mm, bare

Ceramic chip sensor **Order no. FP0802**

* For general technical data, see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

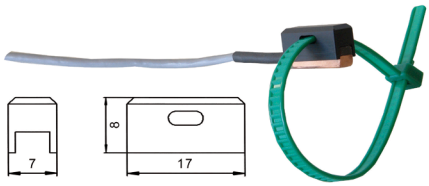
## NTC sensor FNA 611




For surface measurement

Meas. element: NTC *
Measuring tip: Operative range -10...+90 °C
Copper, level
$T_{90}$: * 20 s
Cable: 2 m PVC

Surface sensor **Order no. FNA611**




Accessories
Fixture for fastening with cable ties **Best-Nr. ZB9611RM**

## NTC sensor FN 0001 K

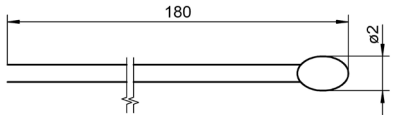
Unprotected sensor element with cable

Meas. element: NTC*
Measuring tip: Sensor element, unprotected
Operative range: -20...+100°C
Connection wires: appr. 180 mm, fluoropolymer insulation
Connecting cable: 2 meters, PVC, thin stranded pick-up wire, Operative range -10 to +90 °C
Cable juncture, in shrink-fit

NTC sensor with cable, free ends **Order no. FN0001K**

Option:
ALMEMO® connector including assembly
Single connectors for 1 sensor Order no. OT9040AS
Double connector for 2 sensors Order no. OT9040AS2

## NTC sensor element FN 0001




Unprotected sensor element for constructing your own sensors

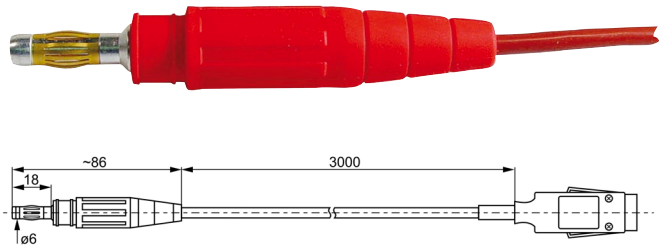
Meas. element: NTC *
Measuring tip: Operative range -20...+100 °C
Sensor
Connection wires 180 mm, fluoropolymer insulation

Sensor **Order no. FN0001**

* For general technical data, see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pt100 Plug-in laboratory sensor FPA 416

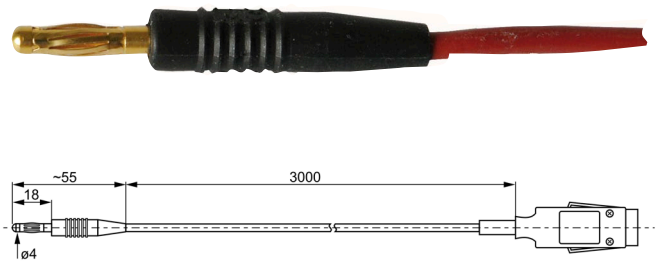



Meas. element: Pt100, class B *
Measuring tip: Operative range -40...+150 °C
$T_{90}$:* 15 s
Cable: Silicone/FEP 3m
ALMEMO® connector: resolution 0.01 °C

Plug-in laboratory sensor **Order no. FPA416**

Measuring element PT100, 4-conductor class B, integrated in the socket of a 6 mm laboratory connector made of brass (nickel-plated).

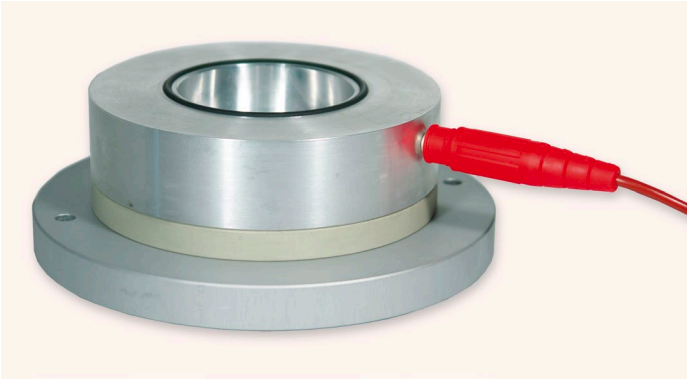
## Pt100 Plug-in laboratory sensor FPA 414




Meas. element: Pt100, Class B *
Measuring tip: Operative range -40...+150 °C
$T_{90}$:* 15 s
Cable: Silicone/FEP 3m
ALMEMO® connector: resolution 0.01 °C

Plug-in laboratory sensor **Order no. FPA414**

Measuring element PT100, 4-conductor class B, integrated in the socket of a 4 mm laboratory connector made of brass (gold-plated).



Plug-in laboratory sensor, examples of use
Measuring object with hole for inserted PT100 plug-in laboratory sensor.

* For general technical data, see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Pt100 glass thermometer with immersion depths as per ASTM

**Operative range:**

For immersion measurement in liquid media at low immersion depths.

| Variants | Order no. |
|---|---|
| Pt100 glass thermometer with immersion depths as per ASTM specifications, with ALMEMO® connector (including 2-meter FEP / silicone cable) | **FPA910** |

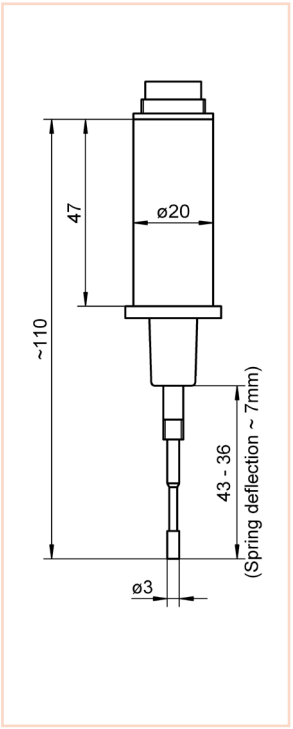
### Technical data

| | |
|---|---|
| Meas. element: | Pt100, class A |
| Measuring tip | Operative range -50 to +310 °C<br>Glass, tapered<br>Diameter = 3 mm, length = 15 mm |
| Shaft | Glass, Diameter = 6 mm |
| | NL= 250 mm (total nominal length)<br>Labeling codes for immersion depths : identification rings on the shaft as per ASTM specifications (American Society for Testing and Materials) |
| $T_{90}$ | 2.5 seconds |
| Cable junction sleeve | Stainless steel, 8 x 40 mm<br>Cable exit secured with shrink-fit sleeve |
| Cable | 2 meters, FEP / silicone |
| ALMEMO® connector | Resolution 0.01 K<br>Also available on request<br>Resolution 0.001 K, in range -8 to +65 °C<br>On devices with effect<br>from ALMEMO® 2690 |



DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Insertable sensor NiCr-Ni with round mounting plug T 820-6




**Operative range:**

Measuring tip, spring-loaded, for surface and immersion measurement.

### Technical data

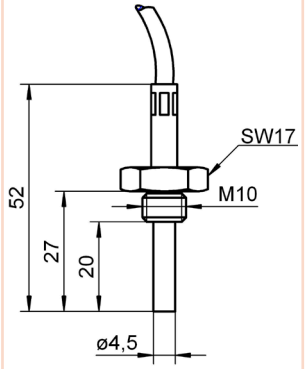
| | |
|---|---|
| Measuring element | NiCr-Ni class 2* |
| Measuring tip | Operative range -40 to +400 °C<br>Silver rivet, level, spring-loaded<br>not electrically isolated |
| $T_{90}$ * | 3 s |
| Insert length | 60 mm (see layout drawing) |
| Fixture | Plastic, Ø 20 mm,<br>resistant up to +120 °C |
| Connection | Round mounting plug |

**Accessories:**

ALMEMO® connecting cable, 2 meters Order no. ZA9020BK2

| Types | Order no. |
|---|---|
| Insertable sensor NiCr-Ni with round mounting plug | **FT98206** |

## Screw-fit sensor NiCr-Ni, Pt100, NTC, with fitted cable Fx 0710 L27M10




**Operative range:**

For immersion measurement

### Technical data

| | |
|---|---|
| Meas. element: | see under variants |
| Sensor materials | Stainless steel |
| Operative range | see under variants |
| Thread | M10 |
| Insert length | 27 mm (see layout drawing) |
| Cable | 3 meters, free ends<br>see under variants |

**Options:**

ALMEMO® connector, including assembly, for NiCr-Ni sensors
Order no. OT9020AS

For Pt100 sensors
Order no. OT9030AS

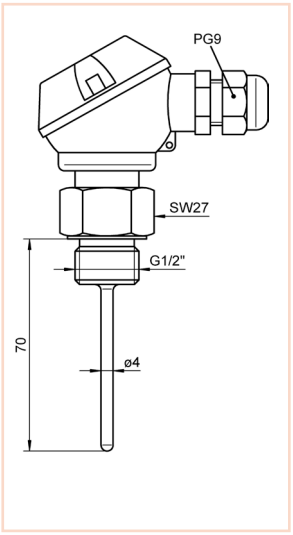
For NTC sensors
Order no. OT9040AS

| Variants | Order no. |
|---|---|
| Screw-fit sensor, with cable, free ends | |
| NiCr-Ni class 2*, -100 to +400 °C Thermal line<br>Glass filament / glass filament / VA wire shielding | **FT0710L27M10** |
| Option Cable length 5 meters | **OTK06L0050** |
| Pt100 class B* -40 to +200 °C Cable FEP / silicone<br>Cable juncture, in shrink-fit | **FP0710L27M10** |
| Option Cable length 5 meters | **OPK01L0050** |
| NTC*, -20 to +100 °C Cable, PVC,<br>Cable juncture, in shrink-fit | **FN0710L27M10** |
| Option Cable length 5 meters | **OPK02L0050** |

* For general technical data, see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Einbausensor Pt100 mit Anschlußkopf FP 0463




**Operative range:**

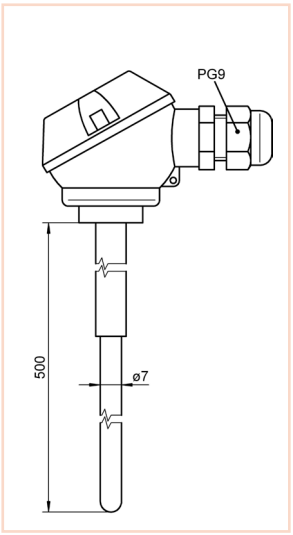
For immersion measurements, pressure-sealed up to 15 bar.

### Technical data

| | |
|---|---|
| Meas. element: | Pt100, class B* |
| Sensor tube | Stainless steel |
| Operative range: | -40...+350°C |
| Thread | 1/2”, with copper ring seal, pressure-sealed up to 15 bar |
| Insert length | 70 mm (see layout drawing) |
| Terminal head | Clamp connector |

| **Variants** | **Order no.** |
|---|---|
| (on request with cable and ALMEMO® connector) | |
| Insertable sensor with terminal head | |
| Pt100, Class B* | **FP0463** |

## Insertable sensor PtRh-Pt (S) with terminal head FT 0425




**Operative range:**

For immersion measurements, up to 1400 or 1600 °C.

**Accessories**

Ceramic protective tube for T04251 Order no. ZB9425SR1

Ceramic protective tube for FT04252 Order no. ZB9425SR2

**Options**

ALMEMO® connector with assembly Order no. OT9020AS

### Technical data

| | |
|---|---|
| Measuring element | Thermowire PtRh-Pt (S) see under variants |
| Measuring tip | Ceramic tube see under variants |
| Operative range | see under variants |
| Insert length | 500 mm |
| Protective tube | Ceramic, replaceable, 7 x 1 mm |
| Cable | 2-meter compensation line silicone insulation, free ends |

| **Variants** | **Order no.** |
|---|---|
| (including 2-meter compensation line) | |
| PtRh-Pt(S), $T_{max}$ = 1400°C, element-Ø = 0.35 mm, ceramic 610 | **FT04251** |
| PtRh-Pt(S), $T_{max}$ = 1600°C, element-Ø = 0.5 mm, ceramic 710 | **FT04252** |

* For general technical data, see page 07.03

DAkkS or factory calibration KT90xx temperature for sensor or measuring chain (sensor + device) (see chapter Calibration certificates)
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

# Infrared measuring technology

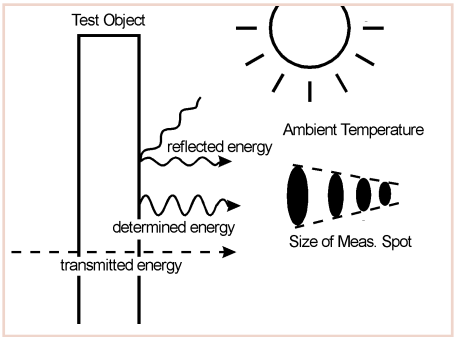

## Why Infrared Measurements?

Infrared measuring instruments provide large advantages with regard to measuring tasks that cannot be solved with conventional contact thermometers. Examples:

- Measurements of very high temperatures not allowing the use of thermocouples.
- Measurements at surfaces with low thermal conduction and bodies with low thermal capacity.
- Measurements at moving, inaccessible or live parts with a high rate of response (<1s).
- Measurements at objects, which must not be influenced by contact measurements.

## What is Infrared Radiation?

Every substance with a temperature above absolute zero emits an infrared radiation (spectral range of wavelengths from 0.7 to 1000µm) that corresponds to its temperature. This range is located below the longer red wavelength range and is not visible to the human eye. For measurements the most interesting range is located between 0.7 and 20µm.
The infrared radiation emitted by the test object follows the known optical rules and, therefore, can be deviated, bundled with lenses or reflected from catoptric elements.
**The emissivity** of a test object indicates how much infrared energy has been absorbed or released by radiation. The value can be between 0 and 1.0. The fact that the emissivity depends on the wavelength is relevant for measurements. With increasing object temperature the radiation maximum shifts to the short wave range. Therefore, IR thermometers are equipped with filters, which allow only one particular wavelength to pass through for the measurement. The spectral range for specific materials must be considered for the application.




## How Infrared Thermometers Operate

The optical system of an infrared thermometer captures the energy emitted from a circular measuring spot and focuses it onto a detector. A material with a high transmission factor is used for the lenses. The energy captured by the detector is electronically amplified and converted into an electrical signal. The optical resolution results from the ratio of the measuring distance to the size of the measuring spot. The measuring spot must always be smaller than the test object or the measuring point of interest. The higher the optical resolution the smaller the measuring spots can be measured at further distances.

## What is Intermittent Photometry?

Using intermittent photometry eliminates the thermal drift and immunes devices against thermal shock. The stability resulting from this, combined with noise-optimised signal processing, leads to an excellent temperature resolution and allows the measurement of smallest test objects and fast response times.

## Special Infrared Pyrometers

**Ratio Pyrometers** determine the temperature from the ratio of the energy radiated in each of two wavelength ranges. This method allows for exact measuring results, even in case of a limited view to the test object due to vapour, steam, dust, dirty windows or lenses (up to 95% reduction of meas. signal). Furthermore, test objects, which are smaller than the measuring spot (e.g. measurement at wires), or low or varying emissivities at fast moving objects, do not affect the measuring result.

**Line Scanners** measure the object temperature along a line. Fixed installed line scanners provide coloured heat flow charts from a product passing under the measuring head (e.g. conveyors, rotary furnaces), but can also be moved to pass above objects (e.g. heat flow chart of a house wall). The infrared scanner measuring head AMiR 7880 scans up to 256 dots over an angle of 90°. 20 lines can be scanned within one second. One measuring tape can be divided into 3 sectors, side by side or overlapping.

## What You Should Consider For Infrared Measurements

**What to do in case of dust, vapour and aerosols at the measuring point?**
If the atmosphere at the measuring point is contaminated with dust, vapour and aerosols, the radiation energy impinging on the sensor can be influenced by contaminated lenses. This can be avoided by using an air blow attachment that keeps the lens clean.

**What to do in case of high ambient temperatures?**
If the ambient temperature exceeds the temperature specified for the measuring head of the IR sensor, the measuring head must be protected by mounting an air or water cooling system along with an air blow attachment (to avoid water condensing on the lens). Furthermore, cables and cable routings with high temperature stability must be used.

**What to do in case of heat sources located next to the measuring object?**
If heat sources are located next to the test object, these can transmit or reflect additional energy. Such ambience radiations occur, for example, at measurements in industrial furnaces where the wall temperature is often higher than the temperature of the test object. Many infrared instruments allow for a compensation of the ambient temperature.

**What to do in case of measurements in a vacuum?**
In case of vacuum furnaces and similar applications it is necessary to mount the measuring head outside of the vacuum area and to perform the measurement through a window. When selecting the measuring window the transmission values of the window must match the spectral sensitivity of the sensor. Quartz glass or quartz are typically used for high temperatures. In case of low temperatures within the 8 to 14µm band the use of a special material, which is translucent for IR, is necessary, e.g. germanium, amtir, zinc selenide or sapphire. When selecting the window the temperature requirements, window thickness and pressure difference, as well as the possibility of keeping the window on both sides clean, must be considered. It might be advisable to consider an additional antireflective coating an the window on the window to increase the transmission capacity. Furthermore, it must be considered that not all window materials are translucent in the visible range.

**Why is the emissivity so important?**
In case of ideal radiators the reflected and transmitted energy equals zero and the emitted energy corresponds 100% to the characteristic temperature. However, many bodies emit less radiation at the same temperature (non-selective radiator). The ratio of real radiation value and that of the ideal radiator is defined as the emissivity ε. For example, a mirror has an emissivity of 0.1 while a so-called ´black body´ has an emissivity of 1.0. Many non-metals such as wood, rubber, stone, and organic materials have only low reflecting surfaces and, as a result, high emissivities between 0.8 and 0.95. However, metals, especially if they have glossy surfaces, can have ε = 0.1. Therefore, IR thermometers provide an option for setting the emissivity. The emissivity should be known as exact as possible. If a too high emissivity has been set, the indicated temperature is lower than the actual temperature, given that the temperature of the test object is higher than the ambient temperature. For example, if 0.95 has been set, while the emissivity is actually only 0.9, a temperature that is lower than the actual temperature will be indicated.

**How can the emissivity be determined?**
Several methods can be used to determine the emissivity. As a first starting point, the following emissivity table can be consulted. The table data only represents average values, as the emissivity of a material is influenced by various factors. These include: temperature, angle of measurement, surface geometry (plane, concave, convex), thickness, surface quality (polished, rough, oxidised, sand-blasted), spectral range of the measurement and transmission capacity (e.g. in case of thin plastic foils)

## Application Examples for Infrared Thermometers

| Temperature Range | Spectral Sensitivity | Application Examples |
|---|---|---|
| appr. 0 … 800°C | 8 to 14 µm<br>3 to 5 µm<br>7 to 15 µm<br>7 to 18 µm | All non-metals, wood, paper, textiles, floor coverings, asphalt, lime floor, edibles, pharmaceuticals, as well as use with print, coating, laminating, drying/hardening, wave soldering and reflow soldering, for indoor installations, fire control, dust tips etc. |
| appr. 10 … 360°C | nominal 7.9 µm | Fabrication and processing of polyester foil, fluoroplastics, fluoropolymer, acrylate, nylon (polyamide), acetylene cellulose, polyamides, polyurethanes, PVC, polycarbonates. |
| appr. 260 … 1650°C | nominal 5.0/5.2 µm | Surface measurement on glass for heating up, forming, sealing, laminating, bending. |
| appr. 200 … 1200°C | 3.9 µm | Metal finishing, furnaces, melting furnaces, blast furnaces, measurements on thick glass. Measurements slightly influenced by $CO_2$ atmosphere (combustion gases). |
| appr. 30 … 340°C | nominal 3.43 µm | Fabrication and processing of polyethylene, polypropylene, polystyrene and other foils. |
| appr. 400 … 3000°C | 2 to 2.7 µm | Processing of ferrous and nonferrous metals, induction furnaces, glass production, melting furnaces, lab research. |
| appr. 200 … 1800°C | 1.6 µm | Heat treatment of steel, bending, hardening, warming up. |
| appr. 500 … 3000°C | 1 µm | Steel production, molten baths, for highest precision with shaping, casting and processing of metals, as well as the processing of glass, ceramics, semiconductors and chemicals. |

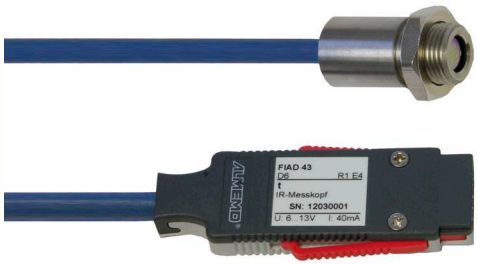
## Compact Glossary of Important Terms

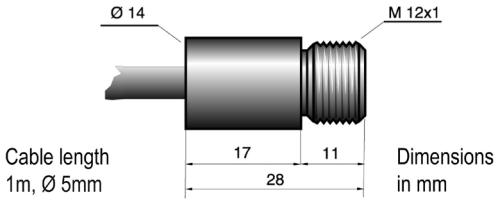
| | |
|---|---|
| Atmospheric Windows: | The wavelength ranges within the infrared spectrum, in which the atmospheric radiation energy is transmitted and the atmospheric absorption is minimal, approximately 3 … 5µm and 8 … 14µm. |
| Focal Point, Focal Distance: | Measuring distance where the maximum optical resolution is reached. |
| Far Field: | Measured distance, which is significantly larger than the focal length of a device, in most cases is larger than ten times the focal length. |
| Field of View: | The test object area, which is measured by the infrared thermometer; the diameter of the measuring spot is proportioned to the distance from the test object; often also specified as an angular variable at the focal point. Also see optical resolution. |
| Non-Selective Radiator: | Radiating body with an emissivity that, for all wavelengths, bears the same constant ratio to the emissivity of a full radiator at the same temperature, which is opaque to radiation of infrared energy. |
| Background Temperature: | From the view of the measuring instrument the ambient temperature or the temperature behind the test object. |
| Measuring Spot: | Diameter of the test object area, which is subject to a temperature measurement; the measuring spot is defined by the circular area, which typically allows to capture 90% of the infrared energy radiating from the test object to the optical receiving aperture of the measuring instrument. |
| Optical Resolution: | Also called the distance ratio: The ´measuring distance/measuring spot size´ ratio (distance ratio E:M) of an IR measuring spot. The measuring distance is typically defined as the distance from the focal point and the measuring spot size as the diameter of the IR measuring spot measured at the focal point (typically the 90% energy measuring spot diameter). The optical resolution can be also defined for the far field, by using the values for the measuring distance and measuring spot size within the far field. |
| Degree of Reflection: | Ratio of the radiation energy reflected from a surface to the incident radiation of the same surface; for a perfect mirror the value is approximately 1, for a full radiator the reflection is zero. |
| Full Radiator: | Also: black body; ideal radiator. Body, which absorbs the whole impinging radiation energy of all wavelengths and which does not reflect nor transmit any radiation. The surface of a full radiator has a uniform emissivity of 1. |
| Spectral Sensitivity: | Wavelength range for which an infrared thermometer is sensitive. |

## Emissivities of Various Materials Depending on the Spectral Range

| **Metals** | | **1 µm** | **2.2 µm** | **5.1 µm** | **8–14 µm** |
|---|---|---|---|---|---|
| Aluminium | non-oxidised | 0.1–0.2 | 0.02–0.2 | 0.02–0.2 | 0.02–0.1 |
| | oxidised | 0.4 | 0.2–0.4 | 0.2–0.4 | 0.2–0.4 |
| Alloy A3003, | oxidised | – | 0.4 | 0.4 | 0.3 |
| | etched | 0.2–0.8 | 0.2–0.6 | 0.1–0.4 | 0.1–0.3 |
| | polished | 0.1–0.2 | 0.02–0.1 | 0.02–0.1 | 0.02–0.1 |
| Lead | polished | 0.35 | 0.05–0.2 | 0.05–0.2 | 0.05–0.1 |
| | etched | 0.65 | 0.5 | 0.4 | 0.4 |
| | oxidised | – | 0.3–0.7 | 0.2–0.7 | 0.2–0.6 |
| Chromium | | 0.4 | 0.05–0.3 | 0.03–0.3 | 0.02–0.2 |
| Iron | oxidised | 0.4–0.8 | 0.7–0.9 | 0.6–0.9 | 0.5–0.9 |
| | non-oxidised | 0.35 | 0.1–0.3 | 0.05–0.25 | 0.05–0.2 |
| | rusty | – | 0.6–0.9 | 0.5–0.8 | 0.5–0.7 |
| | molten | 0.35 | 0.4–0.6 | – | – |
| Iron, cast | oxidised | 0.7–0.9 | 0.7–0.95 | 0.65–0.95 | 0.6–0.95 |
| | non-oxidised | 0.35 | 0.3 | 0.25 | 0.2 |
| | molten | 0.35 | 0.3–0.4 | 0.2–0.3 | 0.2–0.3 |
| Iron, wrought | dull | 0.9 | 0.95 | 0.9 | 0.9 |
| Gold | | 0.3 | 0.01–0.1 | 0.01–0.1 | 0.01–0.1 |
| Haynes | alloy | 0.5–0.9 | 0.6–0.9 | 0.3–0.8 | 0.3–0.8 |
| Inconel | oxidised | 0.4–0.9 | 0.6–0.9 | 0.6–0.9 | 0.7–0.95 |
| | sand-blasted | 0.3–0.4 | 0.3–0.6 | 0.3–0.6 | 0.3–0.6 |
| | electropolished | 0.2–0.5 | 0.25 | 0.15 | 0.15 |
| Copper | polished | 0.05 | 0.03 | 0.03 | 0.03 |
| | etched | 0.05–0.2 | 0.05–0.2 | 0.05–0.15 | 0.05–0.1 |
| | oxidised | 0.2–0.8 | 0.7–0.9 | 0.5–0.8 | 0.4–0.8 |
| Magnesium | | 0.3–0.8 | 0.05–0.2 | 0.03–0.15 | 0.02–0.1 |
| Brass | polished | 0.8–0.95 | 0.01–0.05 | 0.01–0.05 | 0.01–0.05 |
| | high polished | – | 0.4 | 0.3 | 0.3 |
| | oxidised | 0.6 | 0.6 | 0.5 | 0.5 |
| Molybdenum | oxidised | 0.5–0.9 | 0.4–0.9 | 0.3–0.7 | 0.2–0.6 |
| | non-oxidised | 0.25–0.35 | 0.1–0.3 | 0.1–0.15 | 0.1 |
| Monel (Ni–Cu) | | 0.3 | 0.2–0.6 | 0.1–0.5 | 0.1–0.14 |
| Nickel | oxidised | 0.8–0.9 | 0.4–0.7 | 0.3–0.6 | 0.2–0.5 |
| | electrolytic | 0.2–0.4 | 0.1–0.2 | 0.1–0.15 | 0.05–0.15 |
| Platinum | black | – | 0.95 | 0.9 | 0.9 |
| Mercury | | – | 0.05–0.15 | 0.05–0.15 | 0.05–0.15 |
| Silver | | 0.04 | 0.02 | 0.02 | 0.02 |
| Steel | cold-rolled | 0.8–0.9 | – | 0.8–0.9 | 0.7–0.9 |
| | heavy plate | – | 0.6–0.7 | 0.5–0.7 | 0.4–0.6 |
| | polished sheet metal | 0.35 | 0.2 | 0.1 | 0.1 |
| | melt steel | 0.35 | 0.25–0.4 | 0.1–0.2 | – |
| | oxidised | 0.8–0.9 | 0.8–0.9 | 0.7–0.9 | 0.7–0.9 |
| | stainless | 0.35 | 0.2–0.9 | 0.15–0.8 | 0.1–0.8 |
| Titanium | polished | 0.5–0.75 | 0.2–0.5 | 0.1–0.3 | 0.05–0.2 |
| | oxidised | – | 0.6–0.8 | 0.5–0.7 | 0.5–0.6 |
| Tungsten | polished | 0.35–0.4 | 0.1–0.3 | 0.05–0.25 | 0.03–0.1 |
| Zinc | oxidised | 0.6 | 0.15 | 0.1 | 0.1 |
| | polished | 0.5 | 0.05 | 0.03 | 0.02 |
| Tin | (non-oxidised) | 0.25 | 0.1–0.3 | 0.05 | 0.05 |
| **Nonmetals** | | 1 µm | 2.2 µm | 5.1 µm | 8–14 µm |
| Asbestos | | 0.9 | 0.8 | 0.9 | 0.95 |
| Asphalt | | – | – | 0.95 | 0.95 |
| Basalt | | – | – | 0.7 | 0.7 |
| Concrete | | 0.65 | 0.9 | 0.9 | 0.95 |
| Ice | | – | – | – | 0.98 |
| Soil | | – | – | – | 0.9–0.98 |
| Paint | (non alkaline) | | – | – | 0.9–0.95 |
| Gypsum | | – | – | 0.4–0.97 | 0.8–0.95 |
| Glass | pane | – | 0.2 | 0.98 | 0.85 |
| | molten mass | – | 0.4–0.9 | 0.9 | – |
| Rubber | | – | – | 0.9 | 0.95 |
| Wood, natural | | – | – | 0.9–0.95 | 0.9–0.95 |
| Limestone | | – | – | 0.4–0.98 | 0.98 |
| Carborundum | | – | 0.95 | 0.9 | 0.9 |
| Ceramics | | 0.4 | 0.8–0.95 | 0.85–0.95 | 0.95 |
| Pebble stones | | – | – | 0.95 | 0.95 |
| Carbon | non-oxidised | 0.8–0.95 | 0.8–0.9 | 0.8–0.9 | 0.8–0.9 |
| | graphite | 0.8–0.9 | 0.8–0.9 | 0.7–0.9 | 0.7–0.8 |
| Paper | (any colour) | – | – | 0.95 | 0.95 |
| Plastic | (translucent, over 0.5mm) | – | – | 0.95 | 0.95 |
| Fabric | (cloth) | – | – | 0.95 | 0.95 |
| Sand | | – | – | 0.9 | 0.9 |
| Snow | | – | – | – | 0.9 |
| Argil | | – | 0.8–0.95 | 0.85–0.95 | 0.95 |
| Water | | – | – | – | 0.93 |

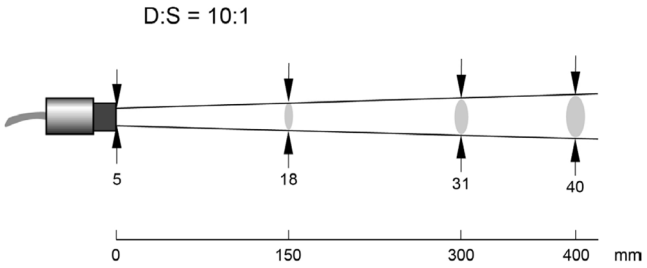
## Digital infra-red sensor for measuring surface temperature FIAD43
## Miniature probe head, integrated electronics, ALMEMO® D6 plug




- Digital infra-red probe head with integrated signal processor
- All sensor characteristics and adjustment data are stored in the probe head itself.
- Digital transmission ensures that measured values are not affected by the sensor cable being moved, bent, or twisted.
- Surface temperature is measured over a wide range up to 600°C.
- Robust stainless steel housing, protection class IP65
- The probe head, thanks to its small dimensions, can be installed in cramped and restricted conditions.
- The probe head is threaded for quick and easy installation.
- The sensor cable in polyurethane (PUR) is suitable for industrial use and is resistant to oily, acidic, basic environments.
- The sensor can be connected directly via the cable's ALMEMO® D6 plug to any ALMEMO® device.
- One measuring channel is preprogrammed on leaving our factory - surface temperature (°C).
- Emissivity 0.95 are preprogrammed (on leaving our factory).
- This can be programmed from 0.1 to 1.0 at the current ALMEMO® V6 devices via the device or via interface (some only via interface).
- Transmittance 1.0 is preprogrammed (on leaving our factory). Transmittance can be modified directly on the PC using USB adapter cable ZA1919AKUV. (see "General accessories for ALMEMO® D6 sensors" page 04.05).

## Measuring Field

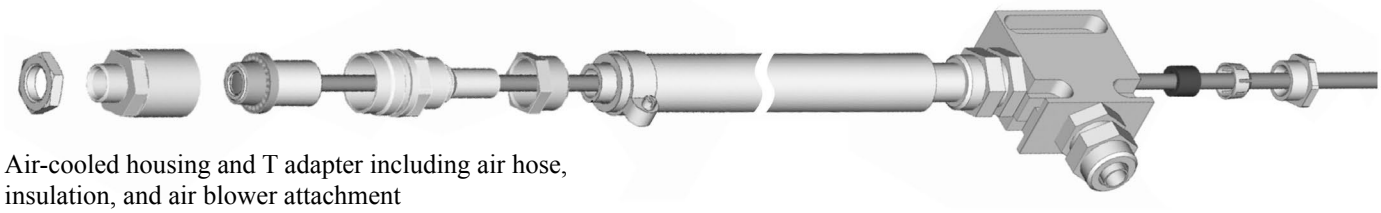



**General features and accessories, ALMEMO® D6 sensors**
see page 01.08

## Options fitted at our factory

Air blower attachment OR7843LB

Deflecting mirror with integrated air blower attachment OR7843US1



Air-cooled housing and T adapter including air hose, insulation, and air blower attachment
Length of air hose 0.8 meters OR7843KL1
Length of air hose 2.8 meters OR7843KL2

Deflecting mirror for air-cooled housing OR7843US

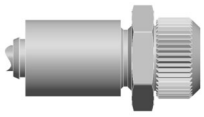
| **Standard delivery** | **Order no.** |
|---|---|
| Infra-red probe head with cable and ALMEMO® D6 plug and 1 mounting nut | |
| Cable length = 1 meter | **FIAD4332** |
| Cable length = 3 meters | **FIAD4332L3** |

DAkkS or factory calibration KI9xxx temperature for digital sensor (see chapter Calibration certificates).
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Technical data

| Digital infra-red probe head (including A/D converter) | |
|---|---|
| Temperature measuring range | -40 to +600 °C |
| Spectral sensitivity | 8 to 14 µm |
| Optical resolution (90 % energy) | 10:1<br>with focal point lens attachment 1 mm at distance of 10 mm<br>Transmittance can be programmed to 0.75. (see below) |
| Accuracy | ±1 % of meas. value or ±1 K (whichever value is higher) ±2 K for meas. values <20 °C |
| Reproducibility | ±0.5 % of measured value or ±0.5 K (whichever value is higher) |
| Nominal conditions | 23 °C ±5 K, emissivity 1.0 |
| Temperature coefficient | ±0.05 K / K or ±0.05 % of measured value / K (whichever value is higher) |
| Temperature resolution | 0.1 K |
| Response time | 130 ms (90 %) |
| Emissivity | 0.95 (preprogrammed on leaving our factory) This can be programmed from 0.1 to 1.0 at the current ALMEMO® V6 devices via the device (some only via interface). |
| Transmittance | 1.0 (preprogrammed on leaving our factory) This can be programmed from 0.1 to 1.0 directly on the PC using USB adapter cable ZA1919AKUV. (please place a special order) (see "General accessories for ALMEMO® D6 sensors") |
| Protection class | IP65 (NEMA 4) (National Electric Manufacturers Association) |
| Ambient temperature | -10 to +120 °C with air-cooled housing -10 to +200 °C |
| Storage temperature | -20 to +120 °C |
| Relative atmospheric humidity | 10 to 95 % non-condensing |
| Housing | Stainless steel |
| Dimensions | Probe head Length 28 mm x Ø 14 mm Thread M12 x 1 |
| Weight | Probe head 50 grams with 1-meter cable |
| Connecting cable(s) | permanently fitted Polyurethane (PUR) For available lengths see variants.<br>with ALMEMO® D6 plug |
| ALMEMO® D6 plug | Refresh time 0.25 seconds for all channels<br>Supply voltage 6 to 13 VDC<br>Current consumption 4 mA |

## Accessories

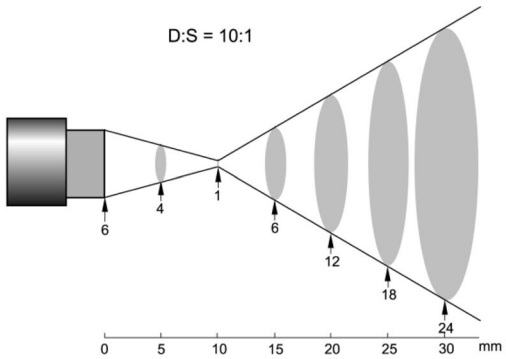


Focal point lens attachment (cannot be used together with air blower attachment or air-cooled housing)
Transmittance 0.75 ZR7843CFL

Protective window (cannot be used together with air blower attachment or air-cooled housing)
Transmittance 0.75 ZR7843PW

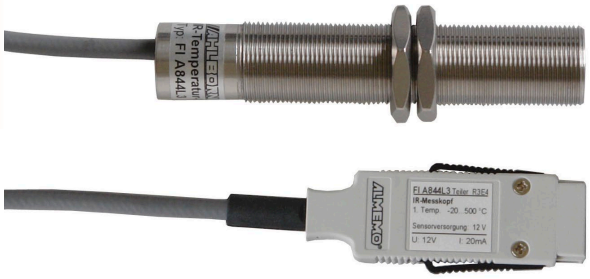
Mounting bracket, rigid ZR7842H

Measuring field with focal point lens attachment

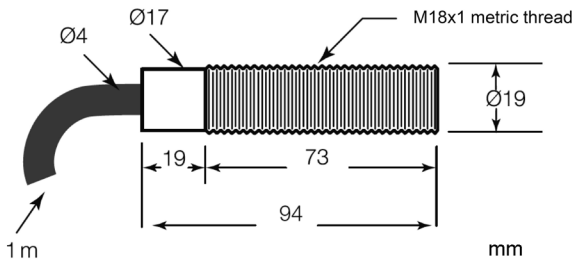


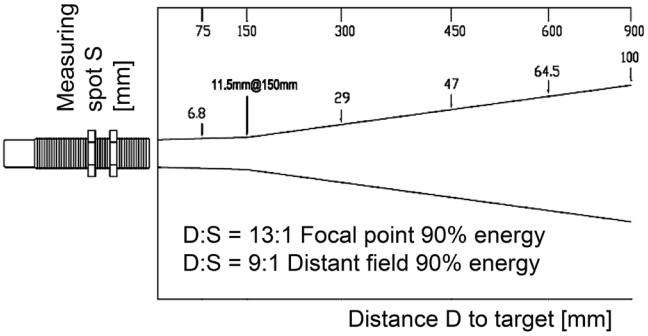

Mounting bracket, adjustable ZR7842JH

## Compact infra-red probe head AMiR FIA 844 suitable for all ALMEMO® devices



- Compact inexpensive infra-red probe head for measuring surface temperature
- Other measuring ranges -20 to +500 °C
- High optical resolution Measuring spot 11.5 mm at distance 150 mm, in distant field 9:1
- Sturdy stainless steel housing Protection IP65
- Quick and easy to install thanks to screw-fit housing
- Integrated electronics, cable permanently fitted
- Can be connected directly to the ALMEMO® device using an ALMEMO® connector.




| Accessories | Order no. |
|---|---|
| Mounting bracket, rigid | ZR7844FB |
| Mounting bracket, adjustable | ZR7844JB |
| Air blower attachment Thread M18x1 | ZR7844APM |

**Variants** (including 2 mounting nuts)**:**

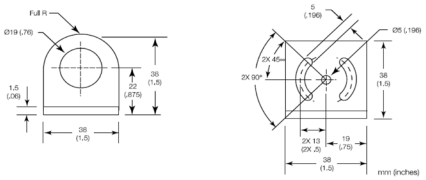
| | |
|---|---|
| ALMEMO® infra-red probe head Measuring range -20 to +500 °C with permanently fitted cable and ALMEMO® connector, Cable length = 1 meter | **FIA844** |
| Same as above Cable length = 3 meters | **FIA844L3** |

Factory calibration KI9xxx temperature for sensor (see chapter Calibration certificates)

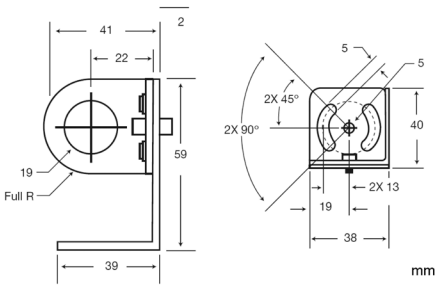
## Technical data

| | |
|---|---|
| Temperature range | -20 to +500 °C |
| Spectral sensitivity | 8 to 14 µm |
| Optical resolution (90 % energy) | 13:1 (11.5 mm at 150 mm distance), distant field 9:1 |
| Accuracy | ±1.5 % of measured value or ±2 K (whichever value is higher)<br>±3.5 K for measured values <0 °C |
| Reproducibility | ±0.5 % of measured value or ±1 K (whichever value is higher) |
| Nominal conditions | 23 °C ±5 K, Emissivity 0.95 |
| Temperature resolution | 0.1 K |
| Response time | 150 ms (95 %) |
| Emissivity | 0.95, fixed setting |
| Voltage supply | via ALMEMO® connector (12 VDC) |
| Protection | IP65 |
| Ambient temperature | 0 to +70 °C |
| Storage temperature | -20 to +85 °C |
| Relative atmospheric humidity | 10 to 95 % non-condensing |
| Housing | Stainless steel |
| Dimensions | Length 94 mm Thread M18x1 |
| Connecting cable | permanently fitted, 1 or 3 meters, -30 to +105 °C<br>including ALMEMO® connector, programmed |
| Weight | approx. 160 g (1-meter cable) |

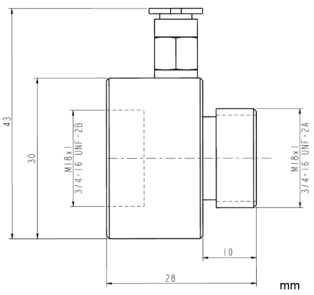
Mounting bracket
Order no. ZR7844FB



Mounting bracket, adjustable
Order no. ZR7844JB




Air blower attachment
Thread M18x1
Order no. ZR7844APM



## Infra-red transmitter for measuring surface temperature AMiR 7843
## Miniature probe head, transmitter box with display / operating controls, with analog output


- Surface temperature is measured over a wide range up to 600 / 1000 °C.
- The probe head, thanks to its small dimensions, can be installed in cramped and restricted conditions.
- Robust stainless-steel housing, protective class IP65
- The probe head is threaded for quick and easy installation.
- The sensor cable is suitable for industrial use and is resistant to oily, acidic, and alkaline environments.
- Transmitter box with display and operating controls
- Analog output 10 V / 20 mA, freely selectable and scalable.

! Infra-red sensor suitable for direct connection to ALMEMO® measuring instruments see Digital sensor FIAD43x with ALMEMO® D6 plug (see page 01.08)

### Accessories MR7843 series

| | Order no. | | Order no. |
|---|---|---|---|
| Mounting bracket, rigid | ZR7842H | Focal point lens attachment (cannot be used together with air blower attachment or air-cooled housing) | ZR7843CFL |
| Mounting bracket, adjustable | ZR7842JH | 10:1 optics Measuring spot diameter 1 mm at distance of 10 mm | |
| Protective window (cannot be used together with air blower attachment or air-cooled housing) | ZR7843PW | 22:1 optics Measuring spot diameter 0.5 mm at distance of 10 mm. | |

### Accessories for MR7843-12 / -32 / -42

| | Order no. | | Order no. |
|---|---|---|---|
| Air blower attachment | ZR7842LB | 90° deflecting mirror (only for air-cooled housing and air blower attachment) | ZR7842US |
| Air-cooled housing and T branch, including 0.8-meter air hose, insulation, and air blower attachment | ZR7842KL1 | 90° deflecting mirror with integrated air blower attachment | ZR7842US1 |
| Same as above but with 2.8-meter air hose | ZR7842KL2 | | |

### Options for MR7843-12 / -32 / -42

| | Order no. | | Order no. |
|---|---|---|---|
| Factory test certificate (only with delivery of new devices) | OR7843KZ1 | DAkkSDKD or factory calibration KI9xxx, temperature, for sensors (see chapter „Calibration certificates“). DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025. | |

### Standard delivery

Probe head (including mounting nut) with cable, PUR, mounted on transmitter box

| Temperature range | Optical resolution | Ambient temperature, probe head | Order no. Probe head cable, 1 m | Order no. Probe head cable, 3 m* |
|---|---|---|---|---|
| -40 to 600°C | 2:1 | -10 to 120°C | **MR784312** | **MR784312L03** |
| -40 to 600°C | 10:1 | -10 to 120°C | **MR784332** | **MR784332L03** |
| 0 to 1000°C | 22:1 | -10 to 120°C | **MR784342** | **MR784342L03** |

* Available on request longer probe head cable, 8 / 15 / 30 meters

### Options for MR7843-33 / -43

| | Order no. | | Order no. |
|---|---|---|---|
| Air blower attachment, only fitted at our factory | OR7843LB1 | Factory test certificate (only with delivery of new devices) | OR7843KZ1 |
| 90° deflecting mirror (only with air blower attachment OR7843LB1) | OR7843KZ1 | DAkkS or factory calibration KI9xxx, temperature, for sensors (see chapter „Calibration certificates“). DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025. | |

### Standard delivery

Probe head (including mounting nut) with cable, fluoropolymer, mounted on transmitter box

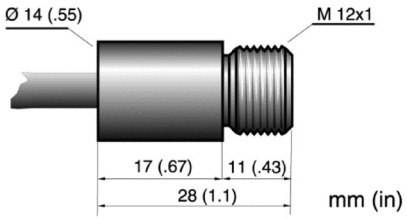
| Temperature range | Optical resolution | Ambient temperature, probe head | Order no. Probe head cable, 1 m | Order no. Probe head cable, 3 m* |
|---|---|---|---|---|
| -40 to 600°C | 10:1 | -10 to 180°C | **MR784333** | **MR784333L03** |
| 0 to 1000°C | 22:1 | -10 to 180°C | **MR784343** | **MR784343L03** |

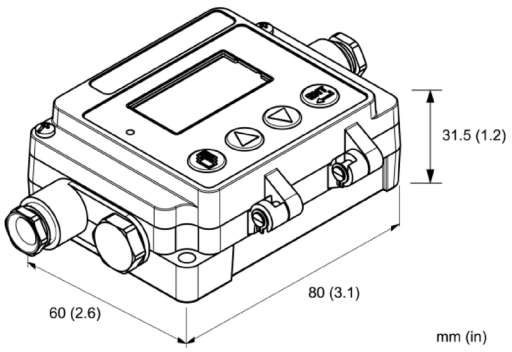
* Available on request longer probe head cable 8 / 15 / 30 meters

## Technical data

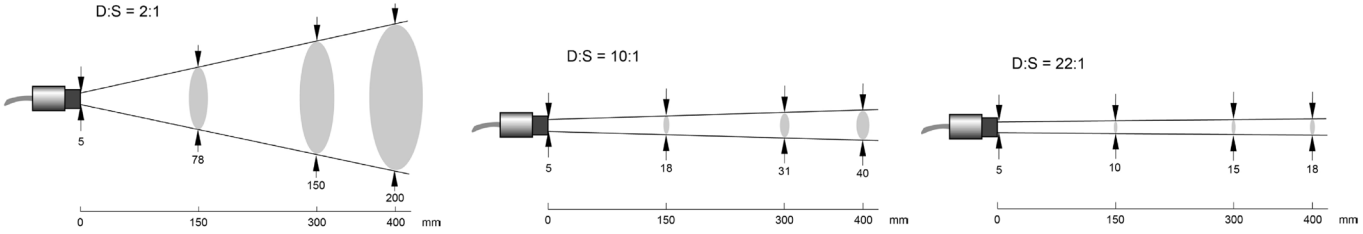
| **Probe head** | |
|---|---|
| Temperature measuring range | depending on type -40 to +600 °C or 0 to +1000 °C |
| Spectral sensitivity | 8 to 14 µm |
| Optical resolution (90 % energy) | depending on type 2:1 / 10:1 / 22:1, typical (21:1 guaranteed) |
| Response time (90%) | 130 ms |
| Accuracy | ±1 % of measured value or ±1 K (whichever value is higher) ±2 K for measured values <20 °C |
| Reproducibility | ±0.5 % of measured value or ±0.5 K (whichever value is higher) |
| Nominal conditions | at ambient temperature +23 °C ±5 K, Emissivity factor 1.0 and calibration geometry |
| Temperature coefficient | ±0.05 K / K or ±0.05 % of measured value / K (whichever value is higher) |
| Ambient temperature | depending on type -10 to +120 °C (with air cooling up to +200 °C) or -10 to +180 °C |
| Protective class | IP65 (NEMA-4) / IEC 60529 |
| Relative humidity | 10 to 95 % non-condensing |
| Housing | Stainless steel |
| Dimensions | L = 28 mm, Ø = 14 mm, Thread M12x1 |
| Probe head cable | depending on type polyurethane (PUR) or fluoropolymer |
| Weight | 50 g (with 1-meter cable) |
| **Transmitter box** | |
| Output (selectable) | 0 to 5 V / 0 to 10 V; 0 to 20 mA / 4 to 20 mA (Temperature range can be programmed in each case.) Thermocouple, type J, K, R, S Not electrically isolated from supply voltage |
| Temperature resolution | ±0.1 K for temperature range < 500 °C |
| Accuracy | ±1 K for output mA / V ±1.5 K for output, thermocouple |
| Temperature coefficient | ±0.02 K / K for output mA / V, ±0.05 K / K for output, thermocouple |
| Emissivity | 0.100 to 1.100 |
| Transmittance | 0.100 to 1.000 |
| Signal processing | Saving of maximum / minimum / average value retention period up to 998 seconds |
| Alarm output | zero-potential contact (semiconductor relays) 48 V / 300 mA |
| Power supply | 8 to 32 VDC, maximum 6 W |
| Ambient temperature | -10 to +65 °C |
| Protective class | IP65 (NEMA-4) / IEC 60529 |
| Relative humidity | 10 to 95 % non-condensing |
| Housing | Zinc die casting |
| Dimensions | 80 x 60 x 31.5 mm (LxWxH) |
| Weight | 370 g |

## Dimensions




## Measuring field ( 90% energy )



## Infrared Measuring Heads in Two-Wire Design AMiR 7838

- Compact, robust and precise infrared measuring heads.
- Wide range of versions for applications in intelligent process control and monitoring systems, as well as in production and test lab.
- Low cost standard version with fixed set temperature and output current range and emissivity can be manually set at the measuring head.
- The standard version without programming functions is ideally suitable for connecting to ALMEMO® devices.
- Measuring heads also available as addressable and remotely programmable versions.

### Accessories

| | Order no. |
|---|---|
| ALMEMO® connecting cable, 2 meters, ALMEMO® connector, programmed for the probe head's temperature range, Sensor supply via ALMEMO® device (use of the device mains unit is recommended) (cable not suitable for ALMEMO® 4490-2, available here on request) for programmable measuring heads MR7838xP | ZA7838AK |
| Protective window, snap-on, according to above lens detail | ZR7838SF |
| Remote control set incl. HART adapter and software | OR7838SH |
| Industrial mains adapter 110/220V – 24VDC | ZR7838NT |

### Options

| | |
|---|---|
| Other focus point optics (also see page 07.44 / 07.45) | |
| Water/air cooling housing including air blow attachment, factory mounted | OR7838KL |
| Inherent safety (Ex in IIC T4), only available with programmable meas. heads without cooling jacket | OR7838IS4 |
| Factory test certificate, based on DAkkS/NIST certified sensors (only with delivery of new devices) | OR7800KZ1 |

### Types (incl. rigid mounting angle and fastening screw)

| | Order no. |
|---|---|
| For universal applications, standard optics OR7838OS1 (Fresnel Lens) Meas. range –18 to 500°C, spectral range 8 to 14 µm, response time 165ms, optical resolution 15:1 | **MR783810(P)** |
| For universal applications, standard optics OR7838OS3 (Amtir Lens) Meas. range –18 to 500°C, spectral range 8 to 14 µm, response time 165ms, optical resolution 33:1 | **MR783811(P)** |
| For high temperature measurements in metal finishing and in rotary tubular kilns, standard optics OR7838OS3 (Sapphire Lens) Meas. range 200 to 1000°C, spectral range 3.9 µm, response time 165ms, optical resolution 33:1 | **MR783821(P)** |
| For maximum temperature measurements in metal finishing, standard optics OR7838OS6 (Float Glass Lens) Meas. range 500 to 2000°C, spectral range 2.2 µm, response time 100ms, optical resolution 60:1 | **MR783851(P)** |
| For high temperature measurements in glass production and at heating up and hardening, standard optics OR7838OS3 (Calcium Fluoride Lens) Meas. range 250 to 1650°C, spectral range 5.0 µm, response time 165ms, optical resolution 33:1 | **MR783831(P)** |
| For low temperature measurements in the production of plastic foils and normal foils, standard optics OR7838OS3 (Calcium Fluoride Lens) Meas. range 10 to 360°C, spectral range 7.9 µm, response time 165ms, optical resolution 33:1 | **MR783841(P)** |

**(P)** Measuring heads remotely programmable

DAkkS- oder Factory calibration KI9xxx temperature for sensor (see chapter Calibration certificates).
DAkkS calibration meets all the requirements regarding test resources laid down in DIN EN ISO/IEC 17025.

## Device Functions

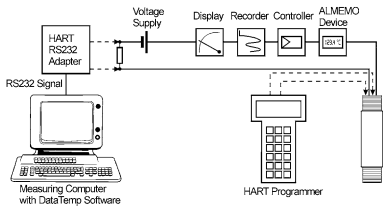
| only AMiR 7838-xxP (programmable AMiR Heads) | |
|---|---|
| Programming: | through PC via HART® adapter (OR7838SH) |
| Emissivity: | 0.10 to 1.00 programmable |
| Data functions: | max, min, average value hold, compensation of ambience radiation |
| Limit value programming: | 1 limit value incl. hysteresis, also usable for monitoring the temperature of the measuring head |
| ALMEMO® application: | To acquire and save measured values using those measuring head variants which cannot be addressed and remotely programmed we recommend our ALMEMO® 4390-2 panel meters. For other ALMEMO® devices please see Chapter 01.Mesuring instruments |

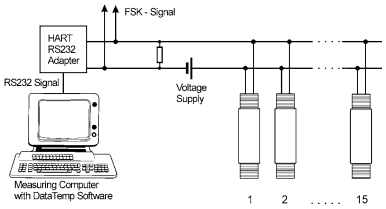
## Technical Data

| | |
|---|---|
| Accuracy: | ±1% of meas. value or ±1.4°C, the higher value of either is always valid |
| Reproducibility: | ±0.5% of meas. value or ±0.7°C, the higher value of either is always valid |
| Response time: | 165ms, at 7838 - 51(P) 100ms |
| Nominal temperature: | +23°C, ±5°C |
| Temperature resolution: | AMiR 7838 -10, -11: 0.125°C, AMiR 7838 -21, -31, -41, -51: 1°C |
| Relative humidity: | 10 to 95%, non-condensing, at 30°C max. |
| Power supply: | 12–24VDC, for AMiR 7838xxP: 24VDC |
| Output signal: | 4 … 20mA linear, two-wire technology |
| Emissivity: | 0.10 to 1.00 manually adjustable at measuring head (only noprogrammable heads) |
| Operating temperature: | without cooling: 0 to 70°C, with air cooling: 0 to 120°C<br>with water cooling: 0 to 175°C, with protective housing: 0 to 315°C |
| Protection system: | IP 65, (IEC 529) |
| Shock: | IEC 68-2-27 (MIL STD 810D), 50G, each axis, 11ms |
| Vibration: | IEC 68-2-6 (MIL STD 810D), 3G, each axis, 11 to 200Hz |
| Dimensions: | without water cooling housing: 187mm long, Ø 42mm<br>with water cooling housing: 187mm long, Ø 60mm |
| Weight: | without water cooling housing: 330 g<br>with water cooling housing: 595 g |

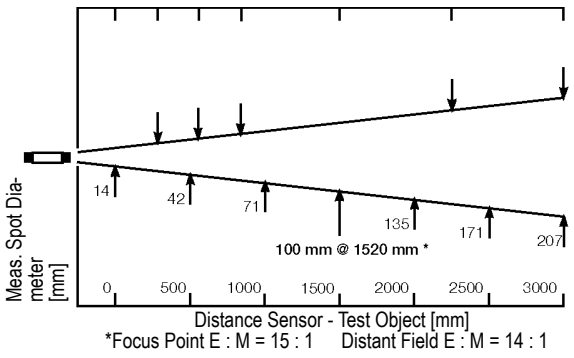
## Digital Signal Processing and Configuration

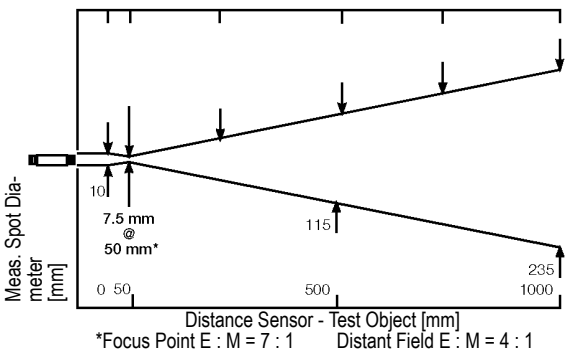
| | |
|---|---|
| HART® protocol: | The Hart® protocol (´Highway Accessible Remote Transducer Protocol´) is one of the most popular intelligent field bus protocols. It is more often used in industry than any other protocol and is supported by a large number of products and software of other manufacturers. The Hart® signal combines the standard output of 4 to 20mA with a simultaneously running digital remote data transmission. As a result, the measuring heads can, additionally, digitally communicate through the 2-conductor current loop (4 to 20mA) with the measuring computer. |
| Single installation: | The most frequently used installation method is the single current loop. Analog displays and controls, recorders or measuring equipment within the current loop will not be influenced by digital signals in the current loop. |
| Parallel working: | Up to 15 measuring heads can be switched in parallel and the measured values can be digitally further processed. For evaluation a powerful software with a menu-driven and user-friendly interface is available. It allows a graphical display of the ONLINE data including storing the measured values as an ASCII file for data export to other applications. |
| Configuration examples: | Single installation Parallel working. |




## Measuring Field Diagrams: AMiR 7838-10(P)

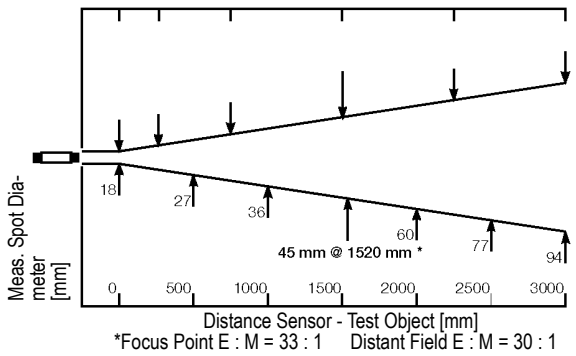


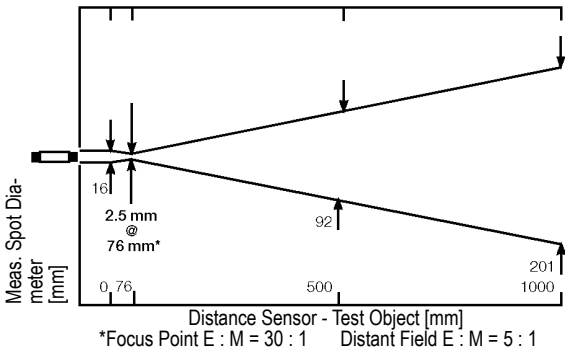

Standard Optics OS1

Focal Point Optics OS2 **Order no. OR7838OS2**

## Measuring Field Diagrams: AMiR 7838-11(P)/-21(P)/-31(P)/-41(P)

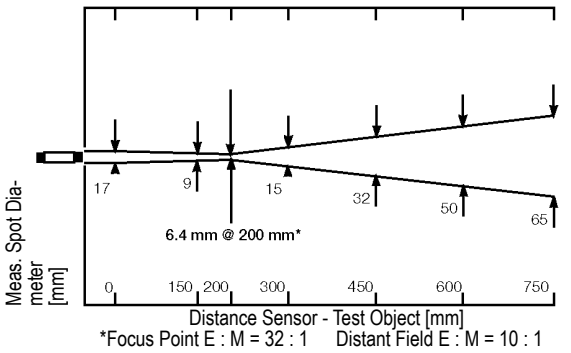



Standard Optics OS3



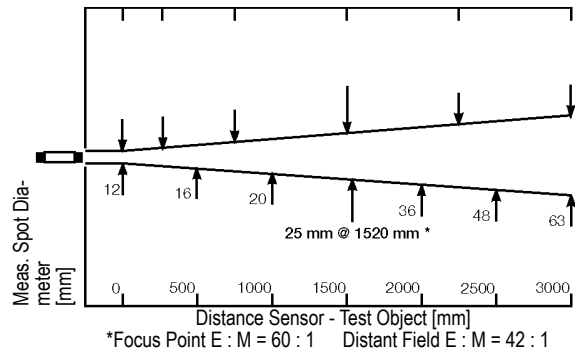

Focal Point Optics OS4 **Order no. OR7838OS4**

! The devices AMiR 7838-31(P) and AMiR 7838-41(P) are only available with standard optics OS3.

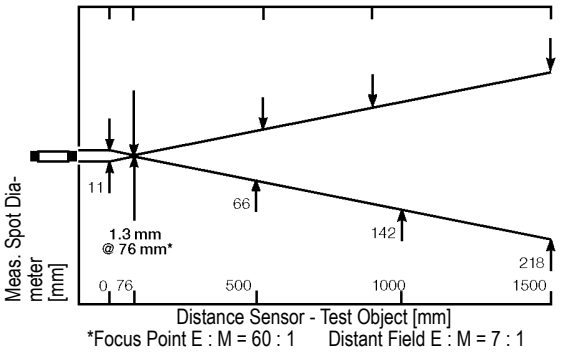



Focal Point Optics OS5 **Order no. OR7838OS5**

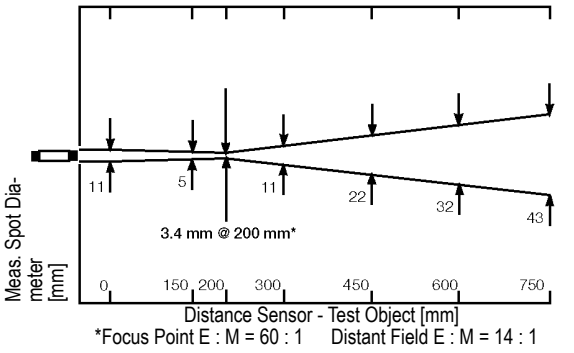
## Measuring Field Diagrams: AMiR 7838-51(P)




Standard Optics OS6

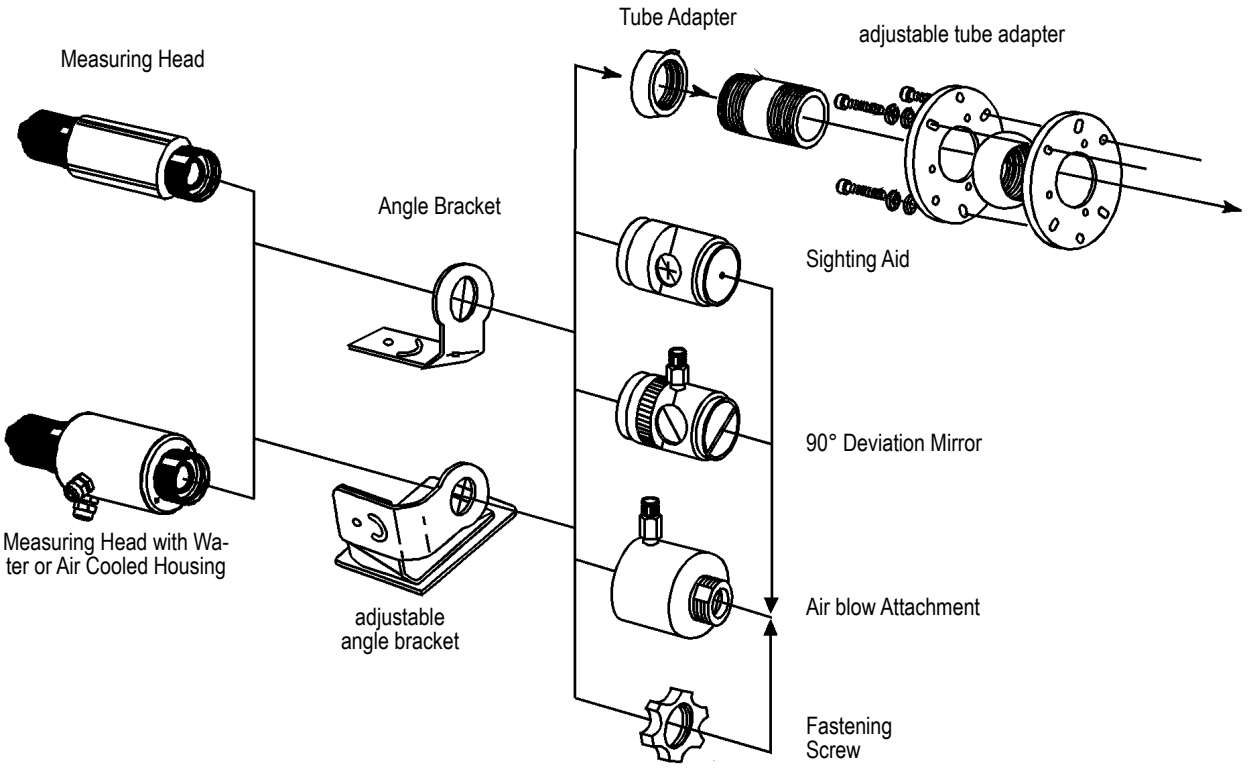



Focal Point Optics OS7 **Order no. OR7838OS7**



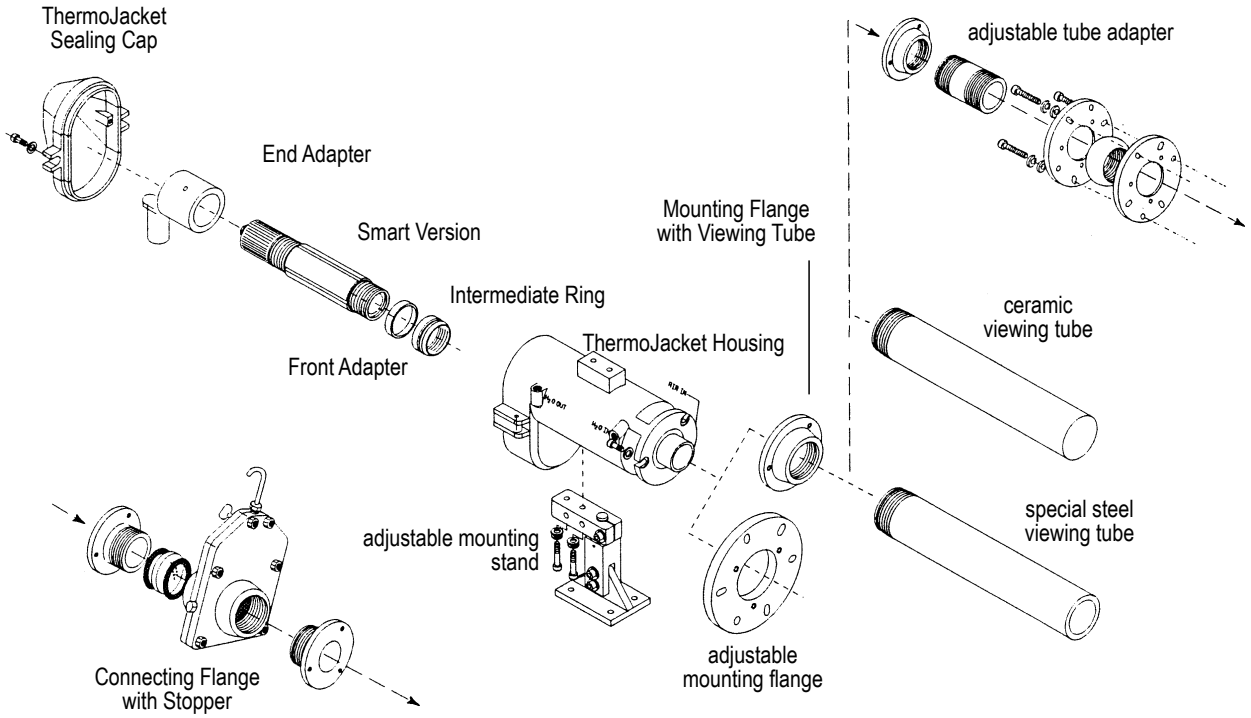

Focal Point Optics OS8 **Order no. OR7838OS8**

## Accessories for All Measuring Heads AMiR 7838, 7845, 7850 Without Use of the Thermojacket Protective Housing




| Accessories | Order no. |
|---|---|
| Rigid mounting angle (spare) | ZR7838H |
| Adjustable mounting angle | ZR7838JH |
| Fastening screw (spare) | ZR7838BM |
| Sighting aid, screw-on | ZR7838VS |
| 90° deviation mirror | ZR7838US |
| Air blow attachment | ZR7838LB |
| Tube adapter onto 11/2” NPT | ZR7838RA |

## Accessories for All Measuring Heads AMiR 7838, 7845, 7850 With Use of the Thermojacket Protective Housing




| Accessories | Order no. |
|---|---|
| Thermojacket protective housing (3.26kg) | ZR7838SH |
| Adjustable mounting stand | ZR7838MF |
| Adjustable mounting flange | ZR7838JM |
| Mounting flange for anti-reflective tube | ZR7838FR |
| 30cm anti-reflective tube, special steel | ZR7838RE |
| 30cm anti-reflective tube, ceramics | ZR7838RK |
| Adjustable tube adapter | ZR7838JR |
| Connecting flange with stopper and Amtir window (from 3.9 to 14 mm) | ZR7838SA |
| Connecting flange with stopper and quartz window (from 1 to 2.2 mm) | ZR7838SQ |
| Water quantity regulator | ZR7838WR |
| Air quantity/pressure regulator | ZR7838LR |