



**Anton Paar**

Measure  
what is measurable  
and make measurable  
that which is not.

Galileo Galilei (1564-1642)

## **Sensors for MKT 50**

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## Further information

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# 1. Sensors for MKT 50

You can connect to MKT 50 any platinum resistance thermometer that meets the requirements of DIN IEC 60751 and has a nominal value of  $100\ \Omega$  ( $R_0$ ).

DIN IEC 60751 specifies tolerances for the temperature range from  $-200\ ^\circ\text{C}$  to  $+850\ ^\circ\text{C}$ . These tolerances, in turn, range from several tenths to several  $^\circ\text{C}$ , dependent on the temperature value. MKT 50 allows to determine the resistance of a sensor with a measuring uncertainty of 1 ppm. To make full use of MKT 50's accuracy, you should definitely use a sensor that is delivered with a calibration certificate. This enables you to measure temperatures across a wide range with very low measuring uncertainty. System measuring uncertainties below 10 mK are possible. The contribution of MKT 50 to this measuring uncertainty is usually negligible.

It is also possible to use ITS-90 for Pt 100 thermometers. But the spectral purity of the platinum and sufficient stability are essential requirements for this.

Find more information in the sensor producer's statements and/or the sensor manual.

**TIP** – *The instrument and sensor have been carefully calibrated and adjusted before shipment. Since thermal stress on the sensor and/or the minor drift of MKT 50's reference resistor cause changes to your measuring system, be absolutely sure to check the temperature measuring device before each major measurement. In most cases a test using freezing point calibrators or water triple point cells is sufficient.*

## 2. Sensors in Stainless Steel Tube

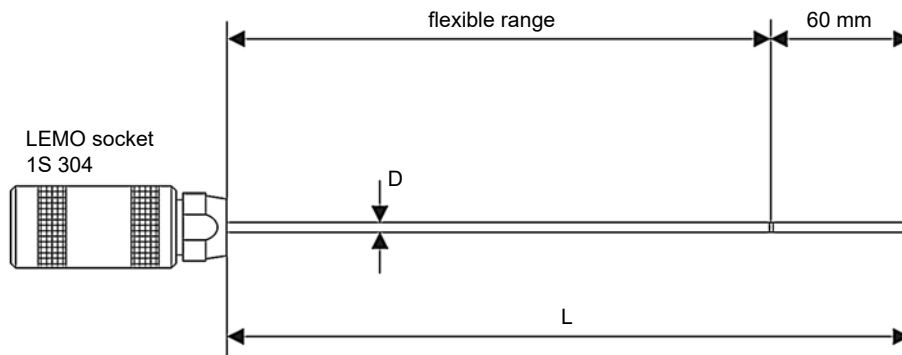


Fig. 1: MPMI sensor

### 2.1 Technical Data

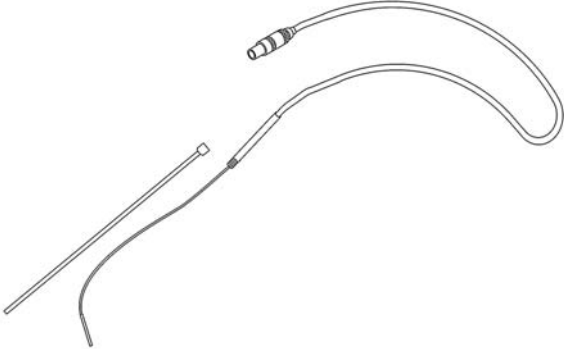
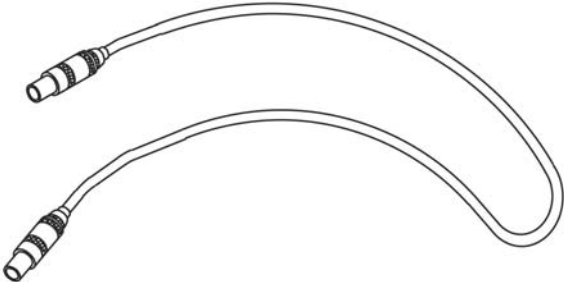
<b>Protective cover:</b>	stainless steel 1.4571
<b>Connection wires:</b>	4 wires insulated with aluminum oxide
<b>Sensor:</b>	Pt 100, pre-aged, stabilized
<b>Connection:</b>	LEMO socket 1S 304

### 2.2 Calibration Certificate

The sensors are available with diverse calibration certificates, which certify a variety of values measured or calculated during the calibration procedure. See the examples below.

- Sensors calibrated according to ISO 17025 are traceable to the International System of Units (SI). An ISO 17025 calibration ensures international comparability and absolute accuracy of the device.
- The sensor is measured at 0 °C (or 0.0100 °C) and two or more additional temperatures within the calibration range of interest. The resulting three or more temperature/resistance data pairs are specified with their respective measuring uncertainties.
- The measuring data are used to calculate the coefficients  $R_0$ , A, and B according to DIN IEC 60751.
- Plausibility check: The sensor is tested at yet another temperature. The difference between the value measured at this temperature and the value calculated from the previously determined coefficients has to lie within the stated measuring uncertainty.
- For temperatures below 0 °C, the sensor is additionally measured at the triple point of mercury (approximately -38 °C). This gives a third coefficient C. Sensors calibrated in this way can be used for temperatures down to -50 °C.

### 3. Sensors, Cables, Calibrations

Mat. no.	Item
<b>Pt 100 sensor for temperature calibration of, e.g., DMA, SVM, MCP, LOVIS</b>	
74557	PT 100 TEMPERATURE SENSOR for temperature calibration DMA/SVM diameter 1.8 mm, total length 1500 mm incl. sensor cable and factory certificate 0 °C to 100 °C, uncertainty: 10 mK
	
<i>Possible calibrations: 219434, 219436, 187504, 47838</i>	
<b>Pt 100 sensors MPMI, minerally insulated, stainless steel sheath, L=300 mm</b>	
69281	RESISTANCE THERMOMETER D=2 mm, L=300 mm, uncalibrated, pre-aged temperature range: –100 °C to 220 °C / LEMO socket, 4 contacts, without sensor cable
69279	RESISTANCE THERMOMETER D=4 mm, L=300 mm, uncalibrated, pre-aged temperature range: –100 °C to 220 °C / LEMO socket, 4 contacts, without sensor cable
<i>Possible calibrations: 219434, 219436, 219437, 135254</i>	
<b>Pt 100 sensors MPMI, minerally insulated, stainless steel sheath, L=500 mm</b>	
69280	RESISTANCE THERMOMETER D=2 mm, L=500 mm, uncalibrated, pre-aged temperature range: –100 °C to 450 °C / LEMO socket, 4 contacts, without sensor cable
69278	RESISTANCE THERMOMETER D=4 mm, L=500 mm, uncalibrated, pre-aged temperature range: –100 °C to 450 °C / LEMO socket, 4 contacts, without sensor cable
<i>Possible calibrations: 219434, 219436, 219437, 135254, 135255, 135256</i>	
<b>Sensor cables for MPMI sensors</b>	
Sensor cable for all types of MPMI, PTFE-insulated leads, maximum temperature 250 °C, 2 plugs type LEMO size 1S	
	
69276	SENSOR CABLE MPMI 4-wire 1.5 m PTFE
95464	SENSOR CABLE MPMI 4-wire 3 m PTFE
95468	SENSOR CABLE MPMI 4-wire 5 m PTFE

Mat. no.	Item
	<b>ISO 17025 calibrations</b> (R <sub>0</sub> , A, B, and C of DIN IEC 60751 are provided)
	<i>If MKT 50 and sensor shall be calibrated together as a measuring chain, indicate this on your product order: "MKT + Sensor as measuring chain." Then you will receive only one certificate valid for exactly this MKT 50 and this sensor.</i>
219434	ISO 17025 CALIBRATION 0 °C to 100 °C for MKT 10, MKT 50; measurement uncertainty: 10 mK Included services: as found calibration, calculation of temperature coefficients, as left calibration
219436	ISO 17025 CALIBRATION 0 °C to 150 °C for MKT 50; measurement uncertainty: 10 mK Included services: as found calibration, calculation of temperature coefficients, as left calibration
219437	ISO 17025 CALIBRATION 0 °C to 200 °C for MKT 50; measurement uncertainty: 10 mK Included services: as found calibration, calculation of temperature coefficients, as left calibration
135254	DAkKS CALIBRATION -50 °C to 200 °C; measurement uncertainty: -50 – 0 °C: 25 mK, 0 – 200 °C: 10 mK
135255	DAkKS CALIBRATION 0 °C to 420 °C; measurement uncertainty 0–200 °C: 15 mK, 200–420 °C: 25 mK
135256	DAkKS CALIBRATION -50 °C to 420 °C; measurement uncertainty -50 – 0 °C: 25 mK, 0 – 200 °C: 15 mK, 200–420 °C: 25 mK
187504	DAkKS CALIBRATION -50 °C to 180 °C Pt 100 for DMA 4200 M, SVM, Lovis; tolerance: 10 mK
	<b>Factory recalibration</b>
47838	FACTORY CALIBRATION for sensor 74557, CKT 100, or MKT 10; tolerance: 10 mK

If the listed sensors do not meet your requirements, or if you have questions about measuring applications, please contact your Anton Paar representative.

## 4. SPRT Sensors for Highest Precision, e.g. for National Primary Calibration Labs

SPRTs like the Q100 or T100 are primary calibration lab standard thermometers, which need to be handled extremely careful. It is possible to calibrate an SPRT to extremely high accuracies (e.g. 2 mK at water triple point 0.01 °C), but in return the SPRT is much more fragile and vulnerable to mechanical shocks than our 10 mK working thermometers (MPMI). An SPRT for instance never must be dropped from even 1 cm height onto the top of the table. This would already damage its calibration. Normally SPRTs are only used for primary calibration using fixed point cells as a reference, not for secondary calibration like comparison calibration using liquid baths or dry block calibrators. For secondary calibrations, we recommend to use our MPMI sensors.


The sensors are delivered ready-made with cable and connector in a carrying case. The sensors can be connected directly to the MKT 50.

### 4.1 Technical Data

<b>Measuring range:</b>	<i>T100</i> : -200 °C to +165 °C <i>Q100</i> : -200 °C to +550 °C
<b>Nominal sensitivity:</b>	0.4 Ω / °C
<b>Recommended max. current:</b>	0.5 mA
<b>Resistance ratio:</b>	$W_{ga} > 1.11807$ as required by ITS-90
<b>Self-heating:</b>	1 mK / 25 μW
<b>Calibration certificate:</b>	included, giving $R_{TPW}$ and $W_{ga}$ option: UKAS calibration certificate
<b>Sensor:</b>	Pt 100, pre-aged, stabilized, sealed with dry oxygen/argon mix
<b>Sheath:</b>	<i>T100</i> : metal <i>Q100</i> : quartz
<b>Internal leads:</b>	4-wire platinum
<b>External leads:</b>	silver plated multi-strand wires in a low-loss insulation cable (2 m) ending in a LEMO 1S 304 plug
<b>Connection:</b>	LEMO 1S 304 plug



## 4.2 Ordering Information

Mat. no.	Item
<b>SPRT quartz glass sensor for highest precision measurement</b>	
95469	ANTON PAAR Q100, SPRT 100 Ohm, uncalibrated quartz sheath, D=7.5 mm, L=480 mm, -200 °C to 550 °C incl. traceable certificate at $R_{TPW}$ and $W_{ga}$ , carrying case, and sensor cable <i>Possible UKAS calibrations: 95471, 95472, 95473</i>
<b>SPRT metal sensor for highest precision measurement</b>	
95470	ANTON PAAR T100, SPRT 100 Ohm, uncalibrated metal sheath, D=6 mm, L=480 mm, -200 °C to 165 °C incl. traceable certificate at $R_{TPW}$ and $W_{ga}$ , carrying case, and sensor cable Optimized for low temperatures / less stem conduction due to internal construction <i>Possible UKAS calibration: 95471</i>
	
<b>UKAS calibrations for SPRT sensors</b>	
95471	UKAS CALIBRATION -38 °C to 156 °C; meas. uncertainty: -38 °C: 2 mK   0.01 °C: 1 mK   156 °C: 3 mK <i>For T100 and Q100</i>
95472	UKAS CALIBRATION -38 °C to 420 °C; meas. uncertainty: -38 °C: 2 mK   0.01 °C: 2 mK   232 °C: 3.5 mK   420 °C: 3.5 mK <i>For Q100</i>
95473	UKAS CALIBRATION -38 °C to 550 °C; meas. uncertainty: -38 °C: 5 mK   0.01 °C: 5 mK   232 °C: 5 mK   420 °C: 5 mK   550 °C: comparison calibration 40 mK <i>For Q100</i>